John Shaw Billings
(1838-1913)
EULOGY OF DR. JOHN SHAW BILLINGS
READ BY DR. ABRAHAM JACOBI AT THE MEMORIAL MEETING OF THE NEW YORK ACADEMY OF MEDICINE, 1913

The death of Dr. John Shaw Billings has robbed America of one of its greatest men. This New York Academy of Medicine, the representative and headquarters of medical endeavor in New York, is anxious and eager to honor itself by extolling a man who was so prominent in many fields of knowledge, research, and activities that each of them would have secured his immortality both in medical and general history. Indeed it is mostly to mere specialistic learning and labor that many of our famous men owe their deserved renown.

Dr. Billings began his life as a demonstrator of anatomy in a western college. In the Civil War he served the country as a surgeon, and finally as a medical inspector of the Army of the Potomac. He then set out to develop the scanty library of the Surgeon General's Office established by Wm. A. Hammond. A few years of hard work on the part of Billings and the liberality of Congress made the library grow so that in 1876 the plan of publishing the Index Catalogue was matured and in 1880 the first volume was printed. Of this monumental work which amazed the world there are now thirty-five volumes. The same fertile genius created the Index Medicus, which was continued by Fletcher.

His military labors developed in him an inexhaustible interest in public health and in hospital organization. He was the adviser and builder of the Johns Hopkins and other hospitals. He delivered courses on the history of medicine in Johns Hopkins University, was professor of hygiene in the University of Pennsylvania and director of its new laboratory of hygiene. In 1896 he became the director of the New York Public Library. Some weeks ago he left behind him two millions of books and fifty branch libraries. For two editions of the U. S. Cen-

1 The completion of the second series makes the total now thirty-seven volumes.
sus he was the statistician. Of the Carnegie Institution of Washington he was the chairman.

His erudition was stupendous, not only in medicine, but in history and the literatures of the world. His vast reading and retentive memory carried him into all continents and zones, into sciences and trades, into chemistry, physics and meteorology.

Such was the commanding genius with the measured tones, the pleasant voice, the humorous remarks, the interest in all that is human, in social problems, and economic and political questions. Withal he was governed by unfailing modesty and a cheerful readiness for self extinction. In his disinterestedness he did not so much as think of complaining, when the inauguration, two years ago, of his very creation, the Library, was not even to be graced by his ever thoughtful and forceful eloquence.

The multiplicity of his virtues, aims and results cannot be expressed in a few sentences. We trust, however, that it is not probable that the light-heartedness and forgetfulness of an ungrateful republic will deal with his memory as with that of lesser men. It is in him that the combination of American idealism and creative constructiveness is best represented, an example to be emulated by all men, both great and small, in all countries. Though Billings was rarely active in this hall, his perfections are known to us and will be appreciated forever. His very life, ever vigorous, ever modest, ever bountiful, is his eulogy. There is nobody here who is not impoverished by the loss of his efficiency and influence. To those who were personally near to him, to the members of his immediate family, it is for us a sad and honorable duty to express our mournful sympathy.

Τρωθί Σεαυτόν

What am I? How produced? And for what end? Whence drew I being? To what period tend? Am I th' abandoned orphan of blind chance, Dropt by wild atoms in disordered dance? Or from an endless chain of causes wrought? And of unthinking substance Born with thought. The purple stream, that through my vessels glides, Dull and unconscious Flows like common tides. The pipes through which the circling juices stray Are not that thinking I, no more than they. This Frame compacted with transcendent skill Of moving joys obedient to my will, Nurs'd from the fruitful Glebe, like yonder Tree, Waxes and wastes, 'tis mine but 'tis not me. New matter still my mouldering Mass sustains The Fabrick chang'd, the Tenant still remains.

John Arbuthnot (1675-1743-5).
OLD familiar childhood recollections and beautifully contrived poetic fantasies of ancient and modern impress flatter us with the notion that, at least in the field of hygiene (as was seriously taught, centuries ago, of many phases of human knowledge), the acme of enlightenment and achievement was already attained in man's earliest infancy; that, in this science, at least, the beginning of wisdom was synchronous with the genesis of things in general.

Such teachings haunted the science of chemistry for the longest period. As late as the seventeenth century, it was assumed that Tubal-Cain was her greatest master, and that wise Solomon, while building his temple, knew more of the mysteries of chemistry than possibly the great Geber, Paracelsus, Basiliius-Thölde and Andreas Libavius together.

This false idea, as being self-contradictory, eventually annihilated itself. But numberless ages ago, our ancestors along the Baltic Sea and the Bay of Biscay, or on the Highlands of Pamir, the residents along the Euphrates or the Nile, are still supposed to have imparted the most important lessons in hygiene, in healthy living and immunity from disease. Even today, some assume that this is incontrovertible and self-evident. A well informed man will hardly venture to offer valid objection to that old and oft-quoted catch-phrase anent the "life comformable to nature." In fact, it would be possible to devote a whole volume to an account of the many times that the cry "Back to Nature" has resounded in its innumerable variations; well nigh every possible view of the universe and a stately array of marvelous philosophizing would necessarily be presented; a lengthy jeweled chain of brilliant names in the history of human thought would pass in review.

I shall not commit the heresy of denying each and every justification of this cry, even though there is more beating of the air on this point than is commonly surmised. I shall be content with demonstrating that the paradisiacal condition of a long life, free from care, with a late unencumbered old age, was by no means the rule in prehistoric and ancient times. It is true that, as compared with the present, those times could boast of superiority in some, but by no means in all respects. Upon inspecting the many early Egyptian and Nubian crania, for instance, we are astounded at the perfect preservation of the teeth, although the extensive abrasion of the masticatory surfaces is rather startling, suggesting simple, suitable fare, but mainly of vegetable character, rich in cellulose and with a generous adulteration of sand particles. We become rather thoughtful, however, on finding in the majority of adult skeletons from Upper Egypt and Nubia of five to seven thousand years ago,
signs of a disease which to-day appears only under the most unhygienic conditions, and then hardly to such degree as it formerly affected a tremendous majority, even in the third decade of life, causing ankylosis of the joints and spine with almost absolute immobility, so that at an early age these unfortunate people became helpless dependents. Osteoarthritis deforms in that “Golden Age” afflicted humanity of both sexes with such frequency and severity as to stagger all power of imagination in this our own period, so corrupt with “refined culture” on the one hand and misery on the other. Even then, constant sojourn along, upon and in the waters, even more perhaps the dwelling and sleeping upon the damp ground, in wet pits and caves, was a fruitful source of disease.

I have purposely begun with an account of conditions in the tropics, where for a long time the cradle of mankind lay beneath the palm trees. Yet, the hygienic coefficient of life among the early inhabitants of Northern Europe, derived from a study of osseous remains, differs but slightly from the results of investigation along the Nile. Less attention has been paid to pathological findings in the archaeological researches north of the Alps, thus restricting the material to more modest proportions; but such osseous remains as have been carefully studied exhibit exactly the same tendency. Rudolph Virchow’s “cave gout” in man and beast has long since been incorporated in historic pathology; the primitive Germans, who interred their heroes in the long stone passages of the “giant chambers,” suffered to an appalling degree (almost ninety per cent of adults) from gouty diseases of the bones and joints. Dietetic customs along the Nile and the Baltic Sea were certainly the most diverse, but, in the manner of abode, perfect parallelism existed in one respect, namely that of dampness: whether the habitation were a lake dwelling over the placid water, or a rustic hovel, depressed below the surface of the ground to the depth of a meter, only gradually (at least in the case of sleeping quarters), emerging from the pits which from the Stone Age to La-Tène constantly became more and more shallow. A moderate advance, perhaps, but highly important!

Although climate may exert only a minor influence upon the character of habitation, this is not true in the matter of clothing. Enthusiastic as we may be about the light, hygienic clothing of the Egyptians, Babylonians, or even of the Greeks, we must nevertheless properly evaluate the wisdom of the North Alpine people, whose men were clothed in warm trousers and waist-coat, their women in long skirt and jacket. Perhaps the Greeks migrated from the North in similar garb, and, in a warmer climate and under altered conditions, learned to know and prize the light, convenient, Mediterranean or sub-tropic costume of cloth simply thrown about the body—a warning against premature generalizations about clothing problems for all climates, even when we exclude those of the polar regions!

Viewed in the light of hygiene alone, classical antiquity, Greece and Rome, represents a cultural pinnacle of almost incomparable height.

The Greeks, a master people (with a substratum of slaves), for the first time in history, and in a scope and degree never again approached, undertook universal training of boys (in some phratries, of girls also), with a view to the harmonious development of all the physical faculties and to the attainment of the greatest measure of strength, dexterity and self-confidence, of physical perfection and beauty. The system was founded upon daily exercise from earliest youth to ripe manhood, under the supervision of experienced and practised leaders, who not only strove to make it viable and successful, but were capable of intelligent specialization, ex-
acting from each physical entity the highest possible accomplishment, with constant reference to general vigor. The teacher of gymnastics became the professional "gymnast," who strove to comprehend the normal functions of the body, vying with the medical fraternity, who again studied the value of gymnastics for a healthy physique and took from its storehouse of anatomic-physiologic knowledge the plumb line for estimating the possibilities of each individual. With the aid of general dietetics, the physicians deduced the norms for the application of gymnastics to the prevention of bodily ills and as an auxiliary in the treatment of general or organic disorders. Under this beneficent rivalry between professional gymnast and physician, gymnastics itself became a scientific system of physical exercise and invigoration, of hygiene of movement and occupation, such as we to-day, with the aid of modern technique and instrumental precision, are intent upon creating anew.

With this central endeavor of Hellenism, physical invigoration by daily gymnastic exercise, the rest of personal hygiene was in great measure associated, viz., care of the skin by washing and bathing, by swimming and massage; physical cleanliness, including care of the hair and clothing; as well as regulation of diet, rest and sleep, and of the sexual life. The regulation of the latter function in the gymnastic exercises of girls was divorced from prudery and had a definite eugenic aim: vigorous offspring.

The public officers of Greece were engrossed with other questions of hygienic importance. Town planning, arrangement of streets, sunning of houses, sewage disposal and water supply were carefully considered and purposefully regulated, especially in the culminating cultural period of the Age of Tyrants. The Romans, among whom solicitude for the purity of grain and potable water was recognized almost as a religious and state duty, with their eminent talent for solving great questions, contributed much to public hygiene. In the days of their world empire, water supply, drainage, road-building, town-planning, food-control, heating, and baths were regulated with a thoroughness which evokes our respectful admiration even to-day. In the cult of Vesta and Juturna, the Roman early evinced an inherent sense of the fundamental necessity for purity of food, which can proudly take its place beside the justly extolled cult of food-hygiene of the Orient. We shall deal with the latter immediately; for Graeco-Roman antiquity, we must again repeat that, although hygienic requirements were partly based on cult-hygiene, these peoples soon outgrew this purposeless fancy and set themselves conscious hygienic goals, devoted themselves to their attainment in a large genial manner, and accomplished results which, in addition to constituting a scientific supervision of the life of the individual, will forever merit admiration as the first attempt (conceived and executed with genius) at personal and public hygiene with definite aims: indirect prophylaxis by increasing the vigor and resistance of two whole nations.

On the other hand, what is the significance of the extolled cult-hygiene of the Egyptians, Babylonians, and even of the Jews, who never conceived of hygiene directly and with intention, the subject appearing in pre-Hellenic times as something incidental or as an almost negligible side-issue? Modern historic research does not support the legend of a Moses leading his people with deepest wisdom and confident, purposeful clarity over the road of hygiene in religious garb, thousands of years ago; the theory is as far removed from truth, perhaps, as the assumption of a perfect natural hygienic condition of mankind at the start. The hygienic contributions of the Western Asiatics (especially of the Semites) to humanity are enormous, but
they lie in a totally different sphere, as we shall perceive.

A few preliminary words on the negative side. It is no longer correct to regard the ritual hygiene of Judaism as a singular phenomenon, as in former days, when it constituted the only remaining specimen of an entire cultural cycle, buried under the ruins of centuries, from which it has only just been unearthed with many elucidating disclosures. In the midst of the tides of racial intercourse flowing and ebbing from the Euphrates to the Nile, we can imagine the Jewish people exposed to cultural currents from which it adopted and adapted much. What are to-day considered fixtures of ancient Semitic cult-hygiene, originated almost exclusively after the exodus, partly, therefore, after the time during which the people of Israel had been exposed for decades to the influence of racially and intellectually kindred civilizations along the Euphrates and the Tigris. To trace externalities of custom to their origins is consequently difficult. In the period especially represented by the compilation of the Talmud, the Jews had for centuries been influenced in hygienic matters by Greek science, from which they assimilated and amplified whatever seemed suitable for adoption. In estimating and evaluating the hygiene of the Jews this fact should be borne in mind, without in the least detracting from their merits; claims to special originality alone are thereby given a new aspect.

Among all peoples of antiquity, meat diet was, so far as the domestic animals are concerned, a sacrificial cult in the first instance; everywhere, on the Jordan, Tiber and Cephissus a sacrificial inspection was combined with this, which exhausted itself mostly in sophisms, but also (particularly in Mesopotamia) contributed a fund of experience which prepared the way for a sanitary meat-inspection, and imparted a viable, interpretative basis to future hygienic knowledge. The same is true of cult cleanliness which, as has already been shown, was not less developed among the Greeks than among the Orientals along the Euphrates, Jordan and Nile, upon whom (including the Jews), the Grecian amplification of an intentional personal hygiene exerted undoubted influence. Even ritual uncleanness of woman under special circumstances, is ancient property of Greece. Pope Gregory the Great, in eliminating this Jewish atavism from Christian custom, performed a liberal and noble service to womanhood, by leaving the question of church attendance during menstruation and puerperium to the free decision of the individual, thereby effectively removing the whole matter from "cult-hygiene"—a landmark in the emancipation of woman from unwarranted guardianship, which cannot be commended too highly. But to return from this digression!

There is no longer any doubt that the Jews borrowed circumcision of males from Egypt, while the origin of the custom for both sexes is traceable to Central Africa. The fact that the custom bears no subjective hygienic impress does not deprive it of objective hygienic value, any more than in the case of other customs originating in entirely different spheres of thought. But the hygienic importance of circumcision of males is minimized by the proof of the non-existence of syphilis in the Old World in pre-Columbian times, as is to-day generally assumed. To cite congenital anomalies (e.g., phimosis) as an argument for general circumcision removes the whole question to another sphere. Clitorotomy, of identical religious origin, has to date not been proclaimed a hygienic measure. That Judaism did not adopt this ritual custom of the Egyptians is explained by the fact that, in the temple cult of the Jews, women originally played no role, in fact, were forbidden entry to the temple. The question here arises, whether at some period in the his-
The Hygienic Idea and its Manifestations in World History

Tory of Israel, only the priestly tribe was circumcised, or whether from the beginning, circumcision characterized the whole people as sacerdotal.

But let me not be misunderstood! In the history of hygiene, as well as in the history of general culture, these questions of cult-hygiene are of transcendent interest. None, however, is to be considered a landmark equivalent to the gymnastics of the Greeks, the hygienic vision of Hellenism and the achievements in public sanitation of the Romans. Two of the greatest hygienic thoughts of mankind owe their origin to Semitism, especially to her intellectual prime (Judaism being the bearer, intermediary and perfecter): the weekly day of rest and the direct prophylaxis of disease.

The first will be immediately evident to all, even though it has not yet been clearly recognized and proclaimed as a hygienic manifestation of prime importance. Babylonian civilization probably had a precursor of the Jewish Sabbath. In Babylonian astrology, the 7th, 14th, 21st, and 28th days were ill-starred; to these was added the 49th (7 x 7), counted from the beginning of the preceding month. No foods could be baked or roasted (nor those prepared in this manner ingested); change of clothing, sacrifices, public acts, and medical treatment were interdicted; in fact these days were inauspicious for the execution of any project. Through these numerous inhibitions, the "unlucky" day became, in part, a public day of rest—in part only—and it might seem that from this emanated the suggestion of the Jewish Sabbath. But nevertheless, what a wealth of physical and spiritual blessing was poured upon the Jews by this, their holy day, their day of rest! More than any other factor, it gave them strength to assert themselves among other races; and by contributing this hallowed day to Christianity and Islam, they thus imparted its hygienic blessing upon the greater part of the world.

Had Judaism given nothing more to mankind than the establishment of a weekly day of rest, we should still be forced to proclaim her one of the greatest benefactors of humanity.

What can be said as to the second thought, direct prophylaxis?

Although Greek medicine became of incomparable importance in general human progress and bases its title to fame chiefly upon the substitution of the investigation of natural etiology for the supernatural demonic medicine, which ruled the whole of pre-Hippocratic Orient and Occident (Mediterranean and North Alpine) and still enslaves part of the world, it is a most interesting fact that, despite its theory of natural causation, Greek medicine was blind to the fact of contagion, of direct transmission of disease. Whence so glaring a defect in the face of such keen perception of the processes of nature? Thucydides' history of the Athenian plague shows that these facts had not entirely escaped the Greeks, but Greek medicine passed them by, perhaps, because a natural explanation seemed impossible, since the populace so readily satisfied itself with the "Evil Eye" and similar imaginations.

Along the Euphrates, however, we come early upon the concept of a chronic, rarely curable disease, characterized by cutaneous changes and capable of transmission to others. Babylonian culture in fact readily drew the proper conclusion and translated knowledge into action: Those affected with this disease must be debarred from intercourse with the healthy. Whoever was defiled by iššubbu (leprosy) was banished to the wilderness. Details regarding these matters are still wanting in original sources, no matter how often the facts transpire through the Assyro-Babylonian tradition. But in the Old Testament, we have a methodic inspection of a leper by the priest, who, according to the diagnosis, isolated the patient temporarily or per-
manently, and admitted him again to free intercourse only after indubitable convalescence or cure. To be sure, it has never been determined (because indeterminate), whether the *zaraath* of the third book of Moses represents leprosy exclusively; to see in it a harmless disease, however, degrades a serious, austere procedure of one of the most outstanding legal codes in history to a silly farce. Any competent, unprejudiced investigation must lead to one conclusion, viz., that the majority of those suffering from the symptoms enumerated in Leviticus xiii were lepers; the most important point historically is the fact that the Mosaic Law gave to mankind the idea of the imperative necessity of isolating those afflicted with a chronic contagious disease; in addition, the purification measures recommended in Leviticus for infected houses constitute the armament of modern prevention of epidemic diseases. In this connection, it makes little difference to me if the so-called *zaraath* of houses had no relation to leprosy, and that modern prophylaxis is not derived directly from Leviticus. (It is neither evident nor probable that the place of refuge of the leper King Azariah-Uzziah represents a leprosorium in the mediaeval sense.) The fact remains, however, that the whole concept of the transmission of serious disease by social intercourse with the afflicted, and of the consequent isolation of the diseased became property of the West by religious route.

When leprosy fell upon the ancient world from the East, and came to the cognizance of Greek physicians, especially of Alexandria, these met its appearance with an admirable establishment of the semeiology, without penetrating deeper into epidemiological questions or recording prophylactic segregation measures. Egypt, where in Hellenic times leprosy spread and became established, was then its principal sally-port in the West and is, even to-day, one of its most intensive fields of activity. From Egypt, the disease in sluggish epidemic form traversed North Africa, crossed the straits of Gibraltar with the continuous stream of travelers, and spread over Moorish Spain; at the same time the germs were carried by the constant migrations across the Mediterranean to Italy and Southern France, across Byzantium to the Balkan and Danube states. The network became especially close over Southern Gaul, and even further into Celtic domain, over which a Germanic stratum had been deposited; here, authentically in the sixth century, the thought of rending or cutting the threads of the epidemic which coursed over the lands was initially entertained. Enlightened princes of the Church, moved by the increasing misery of the people, on the strength of the sacerdotal code of the Old Testament, undertook the task of interfering; the shepherdess of the mediaeval peoples knew her duty. The Council of Lyons (583) attempted to restrict the free migration of lepers! The edict of Rotharus, King of the Lombards, demonstrates what advances this idea made in sixty years; the acts of Charlemagne, one and a half centuries later, show the same trend; the leprosy decretals of the third Lateran Council (1179) represent, in a measure, the last word of the Church. Apprehension of lepers became general routine in the territories of the ecclesiastical and secular princes of France and Germany; isolation camps were established everywhere, gradually increasing to thousands. Thither the lepers and suspects were taken, the former civilly dead for the rest of life. This system was mercilessly enforced for centuries with perfect success. In this tenacious fight of centuries, the methods of which were borrowed from the Mosaic Code, the Occident triumphed over leprosy. Guided by this intellectual torch, it accomplished the first great feat in direct prophylaxis: methodical eradication of leprosy by consistently making the affected individuals harmless.
as carriers of the virus. Light from the East is transformed to pulsating energy by the European peoples, while the disease swings its lash unchecked in the Orient.

The same light, rising for Occidental and Mohammedan physicians alike, spent its luminosity over a second great battle, which constitutes an additional title to fame for the Middle Ages: the campaign against an acute infectious disease, which, like the destroying angel, again coursed over the Mediterranean from the Orient, the plague. Stirred by the "Black Death," which arose about the middle of the fourteenth century, the public officials of Italy and Southern France, during successive decades into the next century, with Venice and Marseilles as pioneers, created the whole system of sanitary control of incoming vessels, of observation stations, isolation hospitals and disinfection procedures. All this was adopted by the Renaissance and is still practiced by modern hygiene, in more definite and rigorous form with relatively few changes. An energetic attempt to establish order in the infected cities was made, without, however, the consistency and purposefulness of the prevention of importation. Three dates may be cited in this connection: 1374, Venice, being again threatened by importation of the plague, denied entry to the city of all infected or suspected ships, travelers and freight; 1377, Ragusa, in Dalmatia, rejected all travelers from plague districts, who had not sojourned for a month at one of two designated points, without developing the disease; 1383, Marseilles erected her first quarantine station, at which, after rigid inspection of the vessels, all travelers and cargoes from stricken or suspicious ships were detained for forty days, exposed to air and sunshine. These are the principles of preventive medicine in the Middle Ages, created by physicians and authorities in common endeavor, in amplification of an idea called into being by the campaign against leprosy.

Finally, another idea which can be counted among the great hygienic thoughts and contributions of the past, the spirit of Christian mercy, expressed in form of hospitals for the poor, aged, infirm, and sick; a noble social blossom of young Christianity, which sprouted on the Jewish tree, but developed in self-directed manner from the time of Basil the Great of Cæsarea. An idea which, in the early days of Byzantium, was in intimate sympathy with Greek medical science, as is evident from regulations governing medical service in the hospitals, preserved from the period of the Comnenes, while in Western Europe it was not until a much later date that healing the sick by actual treatment became the chief task of hospitals. Nevertheless, their hygienic importance was tremendous, since hospitals formed only a fraction of Christian eleemosynary institutions of mediæval and modern times, and served definitely as a pattern for the wonderfully developed system of socially benevolent institutions which constitutes one of the greatest claims of modern times to recognition in the field of applied hygiene. It holds its own with the scientific contributions of modern biologic medicine to hygiene, contributions which are the result of original thought and independent development, no matter how much is unconsciously related to the personal hygiene of the ancient Greeks; while the biologic concept of the theory of infection itself must be characterized as purely modern, since, after all, it owes the first clear conception to Girolamo Fracastoro (1546) finding in Ignatius Philip Semmelweis and Joseph Lister its great, genially intuitive, practical interpreters, while Louis Pasteur and Robert Koch were its master investigators along purely scientific lines and thus the best equipped to redeem its riddles.

3 Referring to the Byzantine family which occupied the throne of Constantinople during 1057–1059 and 1081–1185.
A YEARLY festival in honour of a medical worthy is certainly an occasion of note, especially if it has been held annually for one hundred and eighty three years, and is still observed in England, in spite of the War. Last fall, news came to Oxford, England, from the little village of Fenny Stratford, Buckinghamshire, that the exercises in it to St. Martin. It was so dedicated because Thomas Willis had lived in St. Martin's Lane, London, had died on St. Martin's Day and had acquired his wealth and fame as a seventeenth century practitioner in the Royal Parish of St. Martin's-in-the-Fields. The fortune fell to his grandson. During the life of Browne Willis, a festival was held annually in honor of his grandfather. When he died he left the following note:

"... and I do make it my request ... that they will with all due solemnity ever keep up and see to the annual celebration of S. Martin's Festival ... in the Church of Fenny Stratford, in the manner as I have solemnized it annually ... for 26 years, in all which time I have been constantly present and heard a sermon."

He also left for an endowment fund two old houses near the church. The cottages were pulled down a few years ago, being no longer fit for occupancy, and the money was invested in a war loan.

The festival itself, as celebrated last year, has some interesting features, not the least of which are the "Fenny Poppers." The poppers consist of six small iron mugs which are filled with powder, placed in a field and fired off, like a cannon, by a fuse. The original poppers of Browne Willis's time have been broken, but some thirty years ago six...
new ones were made, modeled after the old ones and these are fired off yearly by the church wardens in strict accordance with Browne Willis’s wishes. Another feature is the church service which this year was held in the little brick church late in the afternoon of November 14, 1916.

The church stands on high ground at the cross roads of the town, one of which is Watling Street, the old Roman road. The north side is the oldest part, built in 1726. Just inside the door, the Fenny Pop­pers are kept. Inside the chapel, most of the inter­est falls on the north aisle. The ceiling is ex­ceptionally fine, being decorated in colors with forty armorial shields, with a “cave” around it of twenty-six more, the crests of all the donors of ten pounds or more to the original building fund. These are beauti­fully executed and have recently been retouched under the skillful direc­tion of Dr. William Brad­brook, a local antiquarian with the best interests of medical history at heart. The ceiling to-day is one of the best preserved armorial ceilings in England. The tomb of Browne Willis stands at the further end of the north aisle. In a small room beside the altar is hung an engraving of Doctor Thomas Willis, dated 1742, under which Browne Willis has writ­tten—

In Honour to thy memory, blessed shade,
Was the foundation of this Chapell laid,
Purchased by thee, thy son and I, their heir
Owe these three manours to thy art and care.
For this, may all thy race, thanks ever pay,
And yearly celebrate St. Martin’s Day.

The Bishop of Buckingham preached a short sermon. Some sixty good church mem­bers were there with twenty medical men from Fenny Stratford and the surrounding country. It was an impressive service. The bishop had an appropriate text, “The old is good,” and one felt that under the guidance of the Church, such an annual festival spirit would never relinquish.

After the service, we wandered across the street to a comfortable old English tavern and about thirty sat down to a jolly dinner. Later, in the town hall, coffee was served by the ladies of the parish. There was an exhibition of a number of old engravings of the church, some old books and other objects of in­terest.

When Sir William Osler was called upon to speak the hall was crowded with the villagers from miles around. His presence in Fenny Stratford was a red letter day for this little country town. Sir William Osler was at his best in his talk on “Willis the Anatomist,” not a bit of which was lost on these simple country folks and honest prac­tioners. The spirit of medical history is dear to the heart of many English physi­cians and most of them pride themselves on being antiquarians. As Sir William Os­ler’s talk was not written, I can only give it as it appeared in the local paper.

**Remarks of Sir William Osler**

“As Fenny Stratfordians, you do well to cherish the memory of the distinguished family to which the parish is so much be-
I holden. It is not always easy to find enthusiasm for an annual festival, but St. Martin of Tours is a jovial host whose name is associated with all sorts of good living and better company. That the annual dinner preceded and did not follow the oration suggests a wise provision on the part of the Saint to whom a personal reference stirs my blood when I think of some far-away ancestor whose hostelrie was so good and whose hospitality, I hope, was so free that his guests, in gratitude, called him by the name of his house; the name from which my own name is obviously derived. It is fitting that the Regius Professor of Medicine at Oxford should come here to honour a family to which Thomas Willis, the anatomist, grandfather of their founder, belonged. This is the first time, I believe, in the many years you have held the festival, that my chair, the University and the College to which Willis belonged, have been honoured in this way. Another reason for my presence is that I happened to be curator of the Bodleian Library to which Browne Willis was a very generous donor. Then, I have the great pleasure to be the friend of Dr. Bradbrook, your townsman, who has done so much to keep alive the memory of Browne Willis. This evening I wish to speak of Willis, senior, the physician, whom you all know in the profession, and of his circle at Oxford. Thomas Willis took his M.B. in 1646, and began his practice in a house, still existing, known as Beam Hall. He had a special interest in the Church of England, and during the Cromwellian occupation of the city, the services of the Church were held twice a day in his house. One of the most famous pictures hanging in the hall in Christ Church shows John Fell, John Dolben and Richard Allestree with a copy of the Liturgy open before them. That picture may have been taken in Willis's house opposite Merton, where these three men, all great friends, were in the habit of attending the service of the Church of England twice daily. Willis married for his first wife a sister of John Fell, the Dean of Christ Church. Browne Willis's devotion to the Church was natural—his grandfather had it before him. To Willis's special circle in Oxford belonged a most interesting group in the history of science in England.

The awakening of science in England had begun in the early part of the 17th century, and perhaps the first scientific work of first rank to be published in Great Britain, was Gilbert's De Magneto (1600). Harvey's memorable work on the 'Circulation of the Blood' appeared in 1628. Harvey was himself at Oxford during the period in which Willis was an undergraduate. Whether they ever met or not is not known, but whilst there he met a group of men whose lives and works as the founders of the Royal Society have had the greatest influence of any single group of men on the development of science in this country. Wallis himself told the story of the Society's meetings, first in London and then in Oxford. Most of the scientific subjects they discussed had been set on foot really within the previous thirty years, chiefly by the remarkable observations of Galileo. These men, who had an important influence on the subsequent development of science in this country, deserve to be held in remembrance. Seth Ward, who was subsequently Bishop of Exeter and of Salisbury, was the centre around whom the majority of these scientific men revolved. He was 'a profound statesman, but a very indifferent clergyman.' Wallis, who was also a Cambridge man, was, more than any single man, the living spirit in the formation of the Royal Society. He was a great mathematician, and, in a most astonishing mathematical dream, extracted the figure root from
eight groups of figures—and it was correct. He became Professor of Geometry at Oxford, and his reputation as a mathematician extended throughout Europe. and became so much interested in the studies that were in progress with Willis, Boyle and others that at first he studied medicine; and it is a remarkable fact

Another man who had quite a great influence was Wilkins, Warden of Wadham, a very ingenious man with a good mechanical head, who was afterwards Bishop of Chester. In Wadham College is still shown the early meeting room of the Royal Society in Oxford. Perhaps the best remembered genius of the group is Christopher Wren, who was an undergraduate at Wadham College in 1649, that the distinguished architect was the first in England, probably in Europe, to invent a method for the transfusion of blood from one human being to another, or from one animal to another. He is also remembered as the first man who made drawings from the microscope. He also did many of the drawings for Willis's works. Another remarkable member of the group was the Hon. Robert Boyle,
son of the Earl of Cork. He was a great exponent of the experimental method, and every elementary student of physics still knows him through Boyle's law. It is astonishing when one thinks how much Boyle did, how little was the impression he made. It was probably due to the fact that he was rather a rough experimenter; he had a better mind than hands. Coordination of head and hand are necessary for a great experimenter. But he did a great work in stimulating research and a good deal of the reputation of English science on the continent was due to him. Another extraordinary character in the group was that genius, Sir William Petty, who made the Down Survey in Ireland, and was the founder of the science of political economy. He went to sea at eight or nine years of age, and while being nursed in France for a broken leg he began a career of making. He went to Paris with no other capital than his native wit, became a doctor, and came to Oxford at the time one of my predecessors had the fortunate habit of fainting whenever he saw a dead body, so it was impossible for him to do dissection. Petty was made Professor of Anatomy, and joined this circle of Boyle's, and was a most invaluable member of it. He became well-known throughout the country as the resuscitator of Ann Green, a young woman who was 'hanged by the neck until she was dead,' and then handed over as a perquisite to the Professor of Anatomy, who claimed the bodies of all criminals for dissection. In spite of the fact that the relatives had tugged at the rope, before the body was cut down and had jumped on her to make sure she was dead, Petty resuscitated her, and she lived for many years and became a very respectable member of the community. It was a great loss to Oxford when Petty went to Ireland; he is of interest to the present generation as the founder of the Lansdowne family. Other remarkable men of the circle were Sydenham and John Locke, the author of the 'Essay on the Human Understanding,' which even an ordinary woman can read. There is no one in the room who would not be improved by a careful study of this book over a period of several years. The last man of the circle is Lower, who did a good deal of work for Willis, whose name is remembered by the smallest single fragment in the human body. It is astonishing on how small a cork a man will float down the ages. He did, however, a great deal of good work, especially in the dissection of the brain. These were Willis's friends during the years he was a practitioner in Oxford.

Willis did two things; he made himself a good scientific man as far as the science of that day went, and he made himself a first class practitioner, and those two sides of the man are presented in his works. It is not possible in a mixed audience to go into the character of his work, but there are one or two things that will interest you. The first of his collected works was a 'Study of Fermentation.' From time immemorial, it had been one of the great mysteries how certain bodies undergo the extraordinary change known as fermentation, and why at the end of the fermentation there was such a good change in the liquid. Willis studied this mystery and made it still greater in the pages he devoted to it. But he grasped one very important thing, the analogy between a fever and fermentation. He made the very interesting observation that there is no difference between the vintner and the physician; when the vat becomes too full in fermentation the vintner draws off some of the liquid, and he said: 'What is that but what we do with blood fermenting in a fever?' That was a good reason for phlebotomy. It was not until 1857 that the problem of fermenta-
tion was solved by Louis Pasteur, who showed that fermentation is not a pure chemical process, but due to changes owing to the growth of living bodies in the fluid. That is the greatest single discovery as far as the welfare of humanity is concerned, and it has had the farthest reaching influence of any single discovery of the century. It revived the parallel which had been drawn 300 years before between fermentation and fever. Fracastorius had called attention to it in the 16th century, and Boyle had said that the man who would solve the problem of fermentation would solve the problem of infectious fevers. Pasteur solved both. He showed that if one took the tiniest little drop on the point of a needle from a fermenting fluid and put it into a sugary solution it would create fermentation; and, in just the same way, the tiniest drop of blood from an animal suffering from anthrax would cause identical changes to occur in the blood of another animal; there would be a multiplication of the germs, a change in the fluid, and at the end of the fever produced by the anthrax one could not induce the fever again by inoculation. That was the foundation of our modern treatment of infectious disease and the antiseptic treatment of wounds.

Besides this subject of fermentation,
Willis also dealt with intermittent fevers and enteric or typhoid fever. He was one of the first to describe an epidemic in 1643 in the army of Essex besieging Reading. He reported also on an epidemic in 1661. It is interesting to see what he prescribed for typhoid. One would not care to have typhoid fever and to be treated by Willis. The patient would be lucky if he were not bled, dosed with all the available purges in the Pharmacopoeia, sweated, given two or three active vomits and blistered on the calves of the legs, the abdomen, and probably the back. These were five articles of the treatment of fever that the public at present is spared. Willis was one of the first to describe typhoid fever in epidemic form, and one of the first to give an accurate description of child-bed fever. He was the first to give an accurate account of the disease known as diabetes, and he recognised the saccharine or sugar variety from the ordinary form. He is better remembered to-day by his big work on the brain. He did a really fine piece of study on the human brain, and it was the best book of its date on the nervous system, not only in the description of the anatomy of the brain, but of the anatomy of the nerves, in which he was greatly helped by Lower's sections and Wren's drawings. His classification of the nerves of the brain remained in England until my own generation. Willis is remembered particularly by the description of certain blood vessels at the base of the brain known as the circle of Willis. A great part of Willis's book is taken up with a 'Pharmaceutica rationale.' It is as dead as Willis. It gives me a shudder to think of the constitutions our ancestors had, and of how they withstood the assaults of the apothecary.

It is really a wonderful age to live in, more for what the human body misses than for what we have. When I look through the list of drugs that were given and the prescriptions that were then followed, I feel that the public has to thank the profession for having got rid of so many nauseous and horrid drugs. We still have a fair number, not that the profession likes to give, but the public will have them. In some of Willis' prescriptions, there were ten to fifteen different ingredients—each worse than the other—besides vomits, purges, sweatings, diuretics, cordials and opiates. Sydenham and Willis probably owed much of their reputation to their knowledge of how to use opium. Willis wrote, amongst other things, two discourses on the soul of brutes, which would be a very good exercise for any medical student or doctor. Altogether, Willis is an interesting character to contemplate. I have known him for a good while and I have known him far better since I had your kind invitation and have had to read Willis's large book through, from which I got a great deal of information I did not want, and have refrained from giving to you. I have only picked out a few parts here and there, but it has been a pleasant task, and I feel a good deal better for it. Willis was a great and a good man, and the 15th Psalm the Chairman has read at the service is most appropriate. It just suited him. There are many good descriptions of the upright, righteous man, but none better than that in the 15th Psalm, which fits Willis to a 't.'
MEDICINE AND MATHEMATICS IN THE SIXTEENTH CENTURY

By DAVID EUGENE SMITH, LL.D.

NEW YORK CITY

No one who gives serious attention either to the history of medicine or to the history of mathematics can fail to be struck by the number of physicians who have excelled in mathematics and astronomy, and by the number of mathematicians who have been skilled in the healing art. The cases are so numerous as to surprise even those who would naturally be familiar with the connection between the two sciences, and they are by no means confined to any single race or to any particular period. To enter into an exhaustive study of the matter would be impossible within the limits of a paper of this character, such a study of the Arab civilization alone being enough to fill a printed volume. All that can be attempted under the present circumstances is to consider some of the causes of the phenomenon and to speak of its development in the century of its greatest prominence, namely, the period from 1500 to 1600.

When we seek for the cause of any occurrence whatever, as of some disease or of some event in the domain of astronomy or history, we always find that it is by no means unique. Various contributing influences enter into the situation, and so it is with the close relationship between the medical and mathematical sciences.

One of the most potent causes in this case was the general belief, both in ancient times and in the Middle Ages, in the influence of the stars upon human life. Astrology therefore became the handmaid of medicine and was looked upon by the intellectual world as part of the equipment of the man who aspired to highest rank in the medical profession. Great stimulus was given to this idea through a translation of a passage in Hippocrates in which the master speaks of τι θεῖον in disease, a term which the early translators rendered by coeleste instead of divinum and which was thus thought to refer to the influence of the heavenly bodies. Moreover, there was much to encourage the belief because of the manifest curative powers of the sun, of the influence of the moon upon human emotions, and of the force of tradition derived from the religious beliefs of the ancients in the power of the stars. To our somewhat more scientific minds a little of this belief seems warranted; but we of the present fail to comprehend the further belief in horoscopes or to recognize that the best scientific minds of a few centuries ago failed as completely to take our own point of view. That a man like Caspar Bartholinus (1585-1629), father of the mathematico-medical scholar Erasmus Bartholinus (1625-1698) and professor of medicine at the University of Copenhagen, should have seriously advocated the claims of astrology only three centuries ago seems to us quite beyond reason, but such cases were by no means infrequent.

1 For example, in Wüstenfeld's list of 300 Arabian physicians ("Geschichte der arabischen Aerzte und Naturforscher," Göttingen, 1840) there are the names of 38 prominent mathematicians, while many of the others were doubtless interested in the subjects of astronomy or mathematics. In Suter's list of 528 Arabian mathematicians ("Die Mathematiker und Astronomen der Araber und ihre Werke," in Abhandlungen zur Geschichte der math. Wiss., Leipzig, 1900), at least 83 are known to have been physicians.


3 "Astrologia, seu, de stellarum naturâ," Wittenburg (?), 1612, and his "De astrologia," Rostochii, 1616.
means rare at that time or even up to the close of the eighteenth century.

To this belief in the power of the stars is partly due the development of the Greek-Alexandrian sect of iatromathematicians, a sect that has its origin in the superstitions of the ancients long before the period of Hermes Trismegistos. The beliefs of these iatromathematicians, relating chiefly to the application of astrology in the domain of medicine, have been clearly set forth by Sudhoff, particularly as they showed themselves in the fifteenth and sixteenth centuries. These beliefs are to be found in the writings of some of the best scholars of earlier times, such as the Rabbi ben Esra of Browning’s poem, who asserts that a lunar eclipse at the beginning of an illness has a baneful influence, that a solar eclipse prolongs the period of sickness, and that a conjunction of planets or of the sun and moon is a very dangerous sign. Another such writer was the Arab scholar Alcabitius (fl. c. 965), whose work on astrology was translated by Johannes Hispalensis and commented upon by Johannes de Saxonia.

Still another example, and this from the thirteenth century, is seen in the case of Roger Bacon. This remarkable man touched all branches of science then known, and in particular he wrote upon medicine as set forth by the school of Galen and by the Arab writer Avicenna. Just as he antagonized the mathematicians of the day, so he asserted that contemporary medicine abounded in error. He stated it to be his belief that the antiqui had a sort of primitive medical revelation which endured through the periods of Chaldean, Greek, and Arab ascendancy, although dimmed by the errors and defects of the Latin rustici.

Once the belief is established that astrology has value in the equipment of the physician, it is evident that a certain degree of proficiency in mathematics will be looked upon as necessary in his education. He must know something of angle measure, must be able to use astronomical tables, and must be fairly well equipped as a computer. This explains in part the relation of mathematics to medicine in that period in which printing first made learning really popular, namely, the sixteenth century.

There was also another potent influence leading to the development of the iatromathematicians, namely, the universal ancient belief in number mysticism, a belief which had not died out in the seventeenth century and which is not unknown even to-day. Deus imparibus numeris gaudet is a phrase as old as the period of the Pythagoreans, and even to-day the belief that “there is luck in odd numbers” is very general. The recognition of the influence of the number seven in medical literature, until recently almost universal, a recognition due in large part to a work long attributed to Hippocrates himself but probably spurious, is an illustration of this belief. The superstitions relating to numbers like three

---

1 Ἰατρομαθηματικός
2 See his Ἰατρομαθηματικά in Patricius, “Nova de Universis Philosophia” (1593). On his general beliefs in the subject, see “Die Lehren des Hermes Trismegistos” by Josef Kroll in the Beiträge zur Geschichte der Philosophie des Mittelalters, Bd. XII. Heft 2–4, Münster i. W., 1914, pp. 266 seq. and 367 seq.
3 “Iatromathematiker, vornehmlich im 15. und 16. Jahrhund.” in the Abhandlungen zur Geschichte der Medizin, Breslau, 1902, Bd. II. The term has also been applied to those interested in the general use of mathematics in medicine.

7 ‘Abd el ‘aziz ibn ‘Otmân ibn ‘Ali, Abû-l-Šaghr, el-Qabîšî. The transliteration of Arabic names follows the Suter list.
8 This commentary was printed in Venice in 1485 and again in 1521.
9 A. G. Little, “Roger Bacon Essays,” Oxford, 1914. See the article by the present writer, on “The Place of Roger Bacon in the History of Mathematics,” page 153, and the one by E. Withington, “Roger Bacon and Medicine,” page 337, from each of which extracts have been freely made.
and seven, with their squares, have all the appearance of being transmitted from the East, possibly through Pythagoras himself; but at any rate they were powerful enough to interest the medical profession for many generations in the mysticism of number.

This number mysticism naturally led to the use of amulets such as the Thibetans and others of the East wear to-day,—plates on which magic squares, the mystic trigrams of the Chinese, and the signs of the zodiac are engraved. These are closely related to various instruments of divination in which number played a leading part. This subject is so extensive as to permit only of brief mention at this time, and a single illustration will serve to show its importance. Tradition relates that the astrologer Petosiris dedicated to King Nechepso, of the seventh century B.C., a sphere of wondrous power. To foretell the outcome of the sickness of a patient it was only necessary to add the numbers corresponding to the Greek letters of the name of the disease, to add to this sum the number corresponding to the day of the month on which the invalid took to his bed, to divide the result by 29 (approximately the number of days in the lunar month), to note the remainder, and then to consult the magic sphere. This sphere was divided into six cells, the upper three being the cells of life and the lower three those of death. Whether the patient would live or die was determined by the group of cells in which the remainder was found, and whether the recovery would be speedy or slow was determined by the particular cell in the group. It will at once be seen that there is a connection between this superstition and that of gematria, the theory of finding the attributes of a person from the numerical value of his name obtained by adding the numerical values of the letters, a subject too extensive to admit of discussion at this time.

A fourth reason why the medical class in the Middle Ages was led to a study of mathematics is found in the imagined need for the compounding of drugs in such proportions as to bring out their dynamidiae. This need led the physician to the study of alligation, as the alchemist and the mint master were also led, and it is, of course, even more potent in carrying out the scientific work of to-day. It was very likely this influence that led a man like Arnaldo de Villanova (1235-c.1313), or Arnaldo Bachuone, to study mathematics. Teaching medicine in Barcelona and Paris, physician to Frederick of Sicily, a prominent practitioner in Rome, Bologna, and other great centers, known chiefly for his writings on alchemy, Arnaldo was the type of man who would naturally be led to imagine a close connection between medicine and number, and between alchemy and astrology. So whether the aspiring physician, when Salerno began to encounter serious rivalry, went to Padua, which leaned to the astrological doctrines of Pietro di Abano (c. 1250-1316), or to Montpellier, which favored the alchemy of Arnaldo, he was sure to come in contact with some form of mathematics.

A fifth influence to be noted, even though this is not the place to discuss it historically, is that of the study of optics, especially on the part of the physician who specialized in the treatment of the eye. Upon this topic there is a large literature, beginning promi-

11 For further discussion, see Wickersheimer, “Figures Medico-Astrologiques des IXe, Xe, et XIe Siècles,” in Janus, 1914, Vol. XIX, pp. 157-177.
12 This sphere seems, however, not to be older than the second century B.C. For discussion, see Sudhoff, loc. cit.
nently with the Arab scholars and spreading thence to the West, particularly in the thirteenth century, one of the most remarkable periods in the world’s intellectual progress.

A sixth reason why physicians were so commonly led to the study of mathematics is to be found in the general belief in the influence of comets upon human health. This is quite independent of the belief in astrology, and it proved to be so strong as to attract the attention of a considerable number of physicians in the sixteenth century, and to lead them to a sufficient study of mathematics to make use of armillary spheres and astrolabes for locating the comets in the heavens. An example of this is found in the case of Fernández Raxo y Gómez (d. 1695), a graduate in medicine at Valencia, physician to Philip II, and the author of a well-known work on the influence of comets.¹⁵

It is especially appropriate in this connection to mention one more influence leading the physician to the study of mathematics, since this makes the mystic number seven, and so I refer to the fact that medicine was a very natural gateway to mathematics in the early universities. A young scholar was offered four great possibilities in the medieval period, namely, theology, philosophy, law, and medicine. Of course he might follow out his mental bent without taking any of these paths, but these were the enticing ones. If his taste was for science in any of its branches, the path of medicine was the natural one to follow, since, as we have seen, medicine had as auxiliary sciences astronomy (which was mathematics par excellence in those days) and alchemy, and made not a little use of physics. Scientific training, therefore, found its path of least resistance through medicine.

¹⁵ “De Cometis, et prodigiosis eorum portentis libri quatuor,” Madrid, 1578. A Spanish bibliographer remarks that “era más bien filósofo que astronómo.”

An illustration of this general combination of all the sciences under the guidance of medicine is seen in one of the sumptuous volumes that came from the Aldine press at the opening of the sixteenth century, written by Georgius Valla, the elaborate title beginning: “Georgii Vallae Placentini viri clariss. de expetendis, et fugiendis rebus opvs, in qvo hac continentvr.” Valla was born at Piacenza in 1430 and died at Venice in 1499. He lectured on physics and medicine at Pavia and also at Venice, and translated various writings of the Greeks, both medical and mathematical. His *magnum opus*, above mentioned, treated of Boethian arithmetic and music, of Euclidean geometry, of medicine and optics, of astrology and the astrolabe, of rhetoric, poetry, and law, and of most of the other great branches of human knowledge. Much of the work is devoted to medicine. Thus he has “De Physiologia libri .iii. . . . De Medicina libri .vii. . . . De Corporis commodis, & incommodis libri .iii. quorum primus totus de anima, Secundus de corpore, Tertius uero de urinis ex Hippocrates, ac Paulo aeginita, déq; Galeni questionibus in Hippocratem.” Like all such works, this was merely a compendium, but it established Valla’s reputation as a physician of great scientific learning, and it serves to illustrate the point in question.

There is much more to say if one desires to enter fully into the relations between mathematics and medicine. The story is one of interesting mysticism, of the Greek, Roman, and medieval symbols of drugs and numbers, of tetragrams, of exorcisms, of skryers, and of all that borderland between the region of superstition and that of science. The story is therefore a long one, and lest it might prove unprofitable it is better to leave it untouched and to mention a few of the great names in the fields of medicine and mathematics in the sixteenth century.

This century has been selected because
it combines the seven influences above mentioned more completely than was the case before the year 1500 or has been since the year 1600. Before the sixteenth century printing had not been sufficiently developed to make it possible to freely disseminate thought, while after the close of that century superstition began to give way more rapidly than ever before to scientific inquiry.

Before considering the list of sixteenth century mathematico-medical scholars, many of whom were slavish followers of tradition, one name should be mentioned as standing in a class by itself. No list of medico-mathematical writers would be complete without reference to this remarkable genius who was neither a medical man nor a mathematical professor, but who knew more of anatomy and of mathematics than most of his contemporaries who were working in these fields. The works of Leonardo da Vinci (1452-1519) in mechanics, in astronomy, in the study of the infinitely great and the infinitely small, and his familiarity with the writings of the scholars who had made mathematical physics, all show the same remarkable acumen that he revealed in connection with the study of the heart and the circulation of the blood. Had Leonardo not been one of the world's greatest artists he would have been known as one of the world's greatest anatomists; had not the other phases of his genius overshadowed his work in mathematical physics, he would have been known as one of the world's greatest scholars in this important field. The contributions of Dr. Arnold C. Klebs to our knowledge of his work on the circulation of the blood were a revelation to most of us who thought that we knew something of Leonardo's scientific attainments, while even a brief consideration of his fragmentary work in mathematics will convince anyone of his real ability in this field as well.

I now propose to mention a few of the other leading names among those whose tastes led to the study of mathematics as well as medicine, and to speak very briefly of their labors. After that it will be quite enough to enumerate, for purposes of reference, the names of others who, in that century, cultivated more or less impartially the two sciences under discussion.

It usually happens that a really great man attains his dominant position in one line, his other lines of interest being so completely overshadowed as to be forgotten. Of course there are exceptions to this rule, as in the cases of Descartes, Pascal, Leibnitz, and particularly Leonardo da Vinci; but in general it is a law that is almost axiomatic. For this reason few in the medical profession will recall the fact that Galileo (1564-1642) was at least a novice in their guild. This, however, is the case, for his father withdrew him from the monastery of Vallombrosa, where he had decided to take orders, and sent him to Pisa to study medicine. His observation of the swinging lamp led not only to his study of the law of the pendulum but to his use of this device for measuring the frequency of the pulse.16 His tastes, however, were toward applied mathematics, and so he secured his father's consent to give up the study of medicine and to endeavor to make a name for himself in his chosen field.17

As in the case of Galileo, so with Copernicus (1473-1543); it is not generally recalled that he was a physician, as also Canon of the Cathedral at Frauenburg in East Prussia. His mathematical and astronomical studies under Peurbach, Regiomontanus, Domenico Maria, and Brudzewski led him to devote his energies to the mathematical side of astronomy with an intelligence that made for the success which the world has long since recognized.

17 "Le Opere di Galileo," Firenze, 1856, tomo xv, p. 334.
Of all those who achieved a reputation in the fields of mathematics and medicine in the sixteenth century, none was more notorious, to say the least, than Girolamo Cardano who was born at Pavia in 1501. He was the illegitimate son of a jurist, Facio Cardano, a man who had also taken a degree in medicine, had given some attention to mathematics, and had edited Archbishop Peckham’s “Perspectiva Communis,” and of a mother who had a reputation that was none too good. Students of heredity may find here a fertile field for speculation, for Girolamo certainly combined in his nature some of the highest and some of the lowest elements. He was at once an astrologer (not a great reproach at that time, however) and a serious student of philosophy; a gambler and a first-class algebraist; defender and father of a murderer and at the same time a physicist of high ability; a liar and at the same time a physician of repute; an inmate of a poor-house and a professor in the University of Bologna; a victim of blind superstition and rector of the College of Physicians at Milan; a heretic who ventured to publish the horoscope of Christ and a recipient of a pension from the Pope. While only twenty-one years of age he taught mathematics at Pavia; at the age of twenty-five he took his degree in medicine at Padua, practicing for seven years at Sacco. In 1534 he became professor of mathematics at Milan, at the same time practicing and teaching medicine. He died in Rome in 1576.

Cardano’s greatest mathematical work is the “Ars Magna” (1545), a work in which the solution of the cubic equation first appeared in print, although apparently secured under the pledge of secrecy from Tartaglia. He wrote, however, numerous other works on mathematics, physics, philosophy, and astronomy, and a number of “oposcoli” on medicine, published and unpublished. Among the medical writings given by him in his own list, are the following: “Delle cause, dei segni e dei luoghi delle malattie,” “Picciola terapeutica,” “Degli abusi dei medici,” “Delle orine, libro quattro,” and “Sulla medicina di Galeno,” but a careful modern edition of his works has not appeared, and a systematic search for his unpublished manuscripts has probably not been made. Among his works was also a commentary on the anatomy of Mundinus.

Cardano’s own opinion of a medical career is familiar to all who have looked into the history of medicine, but it may be interesting for others to read. He says, in his garulous autobiography: “If I had money to earn, I could earn it as a doctor, and in no other way. But that calling of all others (except the glory that attends it) is completely servile (tota servilis est), full of toil, and (to confess the truth) unworthy of a high-spirited man (ingenuo viro indigna), so that I do not at all marvel that the art used to be peculiar to slaves.”

The most popular writer on arithmetic in the Latin language in the sixteenth century was Gemma Regnier or Rainer (1508-1555). Having been born at Dockum, in East Friesland, he was known as the Frisian, or commonly as Gemma Frisius. He was only thirty-two years old when his “Arithmeticæ Practicæ Methodus Facilis” was published at Antwerp (1540), and so favorably did this work strike the popular taste that it went through at least fifty-nine editions in the sixteenth century, not to speak of many later ones. He also wrote on astronomy and geometry, acquiring a high reputation as an author if not as a mathematician. Soon after publishing his arithmetic he took the degree of doctor of medicine and then gave up his mathematical studies. While nothing was published upon medicine under his name during his lifetime, there is, in a work printed at Frank-
fort in 1592, a "Consilia quaedam de arthritide" attributed to him.

Among French physicians of the sixteenth century there stood out prominently one whom his admirers called the modern Galen, Jean Fernel (1497-1558), who received his doctorate from the Faculté of Paris in 1530. Four years after receiving his degree he became a professor in Paris, and soon rose to a position of leadership in the medical profession. His "Universa Medicina" (1567) went through more than thirty editions. In the field of mathematics he published two works, "De proportionibus" (1528) and also two in the field of astronomy, the "Monalospherium" and the "Cosmotheoria." His work in geodesy was also noteworthy, his computation of the length of a degree of the meridian being 56,746 toises, although it is really 57,024 toises,—a good approximation for the time.

Of the English scholars who cultivated both mathematics and medicine in the sixteenth century, Robert Recorde was the most prominent. Born at Tenby, Pembroke, c. 1510, he studied at Oxford and Cambridge, and received his degree in medicine at the latter university in 1545. He taught mathematics at Oxford and very likely at Cambridge, became royal physician, and wrote on medicine as well as mathematics. It was in the latter field, however, that he attained his chief prominence. His arithmetic, "The Ground of Artes," appeared between 1540 and 1542 and went through at least thirty editions, being the most popular work that appeared in England upon the subject in the first two centuries of printing. He wrote also "The Castle of Knowledge" (1551), a work on astronomy; "The Whetstone of Witte" (1557), a work chiefly on algebra, and the one in which the present sign of equality (=) first appeared in print; and "The Pathway to Knowledge" (1551), a work on geometry, written, like the others mentioned, in catechism form.

His medical work, "The Urinal of Phy-
Interested in the same line of mathematical study was his contemporary Adriaen Metius (1571–1635), or Adriaen Adriaenszoon, who was a professor of mathematics and medicine in the university at Franeker, but whose writings were all in the line of mathematics and astronomy. He also is well known for his approximation to the value of $\pi$.\(^{22}\)

Among those of less importance in the combined fields of medicine and mathematics in the sixteenth century was Jacques Peletier (1517–1582). He was a man of some ability in mathematics,\(^{23}\) but he was too ready with his pen, and this in too many lines of work, to attain a high standing. Interested in law, a voluminous writer in general literature, principal of the Collège de Bayeux, physician at Bordeaux, Poitiers, and Lyons, teacher of arithmetic at Annecy, author of various textbooks on mathematics—including algebra, geometry, and arithmetic—it will be seen that he had little time for serious work in any of his various fields of activity.

Perhaps the most all-round dilettante of the sixteenth century to come within our field is Henricus Cornelius Agrippa (1486–1535). He posed as physician, lawyer, soldier, philosopher, astrologer, and alchemist in various centers of learning, including Cologne, Pavia, Freiburg, Brussels, Bonn, and Grenoble. His “De Incertitudine & Vanitate Scientiarum” went through various editions\(^{24}\) and shows at least a superficial knowledge of substantially every science, mathematics ranking equally with medicine in his general condemnation.\(^{25}\)

Such were a few of those who added to mathematical knowledge, who were held in high esteem as healers of the body, or who made some name in literary productions which touched upon both of the sciences. It will, however, be more helpful to those who care to study the intimate connection between mathematics and medicine if a list of some of the others who helped to establish this connection is made accessible to them, and such a list, necessarily much abridged, is given as a supplement to this fragmentary sketch.

Although it has been said above that the sixteenth century was par excellence the century of the iatromathematicians, it must not be thought that later centuries failed to find this same intimate relationship between the two sciences. Thus in the century following we find the great Boerhaave (1668–1738), whose reputation as one of the greatest physicians of his time obscured what would otherwise have been an enviable reputation in the field of applied mathematics. So his contemporaries Eisen schmid (1656–1712) and Guglielmini (1655–1710) represent the union of the two subjects, since it was the “Diatribe de figura telluris elliptico-sphæroide (1691)” of the former that gave rise to the dispute as to the elongation of the earth, and the latter was a recognized authority on mathematics as applied to hydraulics. These facts are apt to be forgotten both by the historian of mathematics and by the recorder of medical progress, just as when we see the beautiful colonnade of the Louvre, we forget that Claude Perrault (1613–1688) was not merely an architect but was also a physician and a mathematician. Not many, too, recall the fact that the famous Johann (I) Bernoulli (1667–1748), one of the two broth-

\(^{22}\) His works include “Doctrinæ sphæricæ libri V,” Francofurti, 1591, and Franeker, 1598; “Geometrices per usum circini nova praxis,” Amstelodami, 1623; “Opera arithmetica et geometrica,” Lugduni Batavorum, 1625.

\(^{23}\) Among his works are “L’Algèbre, départie en deux livres,” Lyon, 1554; “L’Arithmétique, départie en quatre livres,” ib., 1554; “Demonstrationum in Euclidis elementa geometrica libri sex,” Lugduni, 1557.

\(^{24}\) A copy in the writer’s library has the double date, Lugduni Batavorum, 1643 and 1644.

\(^{25}\) His “De occulta Philosophia libri III” appeared at Cologne in 1510 and again in 1533.
ers who founded the celebrated family of
mathematicians bearing his name, held a
degree in medicine. His dissertation “De
effervescentia et fermentatione” (Basileae,
1690) gave little suggestion that he would
become one of the greatest leaders in spread­
ing the knowledge of the new mathemati­
cal discipline of the calculus throughout
continental Europe; yet such was the case,
and his productions in mathematics were
of highest scientific value.

Thus it has been through all the centu­
ries, particularly from the ninth to the twen­
tieth, that mathematics and medicine have
found much in common, although the two
periods in which this has been the most
noticeable are the era of the Arab ascend­
cy and that of the sixteenth century, to
the latter of which this brief summary chief­
ly refers.

A PARTIAL LIST OF THOSE WHO, IN THE SIX­
TEENTH CENTURY, WERE DISTINGUISHED
IN MATHEMATICS AND IN MEDICINE 26

Bernard Abatia (1540-c.1590), physi­
cian, mathematician, astronomer, jurist,
and linguist.

Alessandro Achillini (1463–1512 or
1518) was professor of medicine and of
philosophy in Bologna and in Padua. His
“Opera Omnia” (Venetiis, 1508) contains
numerous contributions to medicine, and
he wrote also on astronomy and physics,
subjects so closely connected with mathe­
matics as to show the trend of his interests.

Johann Acronius, or Atroci anus (1520–
1564), not only practiced medicine at Basle
but was also professor of mathematics and
of logic in the university of that city. His
writings were in the line of mathematical
astronomy. His skill as a physician could
not save him from death as a result of the
plague.

Adriaen Adriaenszoon. See the article.

Agrippa. See the article.

Juan Aguilera, who flourished in Salam­
anca in the middle of the sixteenth cen­
tury, was well known as a mathematician,
physician, philosopher, and theologian.27

Juan Alemán practiced medicine in
Spain in the second half of the sixteenth
century and wrote on astronomy and astro­
logy.28

Juan Almenar, born in Valencia in the
latter part of the fifteenth century, took
his degree in medicine and is described as
“el primer español que escribió sobre el
mal venéreo” (1502). He was much interested
in astrology, however, “en la cual llegó á
adquirir gran fama,” and he seems to have
written a work on astronomy which was
never printed.

Johann Asverus Ampsing (c. 1559 –
1642), one of the chief authorities on the
iatromathematics in the seventeenth cen­
tury, a native of the province of Upper Yssel. He was a physician of prominence and
wrote a dissertation on iatromathematics.29

Melchior Ayrer (1520–1579), a physi­
cian of Nürnberg, well known in his day as
a chemist and mathematician, was skillful
in the making of mathematical instruments.

Bernardino Baldini (1515–1600), pro­
fessor of medicine in Pavia and of mathe­
matics in Milan. His writings were chiefly
on astronomy and physics.

Pierre Beausard (d. 1577), a physician
of Louvain, and in later life a professor of
mathematics in the university. While not

26 The list is arranged alphabetically either by the
family name or by the name by which the person is
commonly known. It includes the names of many
prominent medico-mathematicians who were living
between 1500 and 1600, but the reader is referred to
Sudhoff’s list for a considerable number of minor
names.

27 His “Canones astrolabii universalis” appeared
in its second edition at Salamanca in 1554.

28 The first edition of his work appeared at Bar­
celona in 1580, under the title “Lunari ó repertori
del temps compost per Io molt abil astrolog Joan
Alemany.”

29 “Diss. iatromathica in qua de medicinæ et as­
tronomiae præstantia indissolubili cōjugio dissertur,”
Rostochii, 1629.
an original genius, he is known for two works of some merit.\textsuperscript{30}

Isaac Beeckman (1570–1637), a physician, director of the Latin school at Dordrecht, wrote "Mathematico-physicarum meditationum," Traject. ad Rhen., 1644.

Lattanzio Benacci (1499–1572), physician and professor of astronomy in Bologna, and an astrologer of some repute.

Michael Beuther (1522–1587), doctor of law and also of medicine, professor of poetry and also of mathematics in Greifswald, and finally professor of history at Strasburg. He contributed slightly to the literature of the circle and the calendar.

Heinrich Brue\textsuperscript{e}us (c. 1531–1593), was professor of mathematics in Rome, and afterwards practicing physician as well as professor of medicine and of mathematics in Greifswald, and finally professor of history at Strasburg. He contributed slightly to the literature of the circle and the calendar.

Olaus Engelberti Bure, or Bur\textsuperscript{e}us (1578–1655), was a physician at the court of Gustavus Adolphus, but he was also much interested in mathematics and was one of the pioneers in mechanical computation.\textsuperscript{31}

Baldassare Capra (d. 1626) was a practicing physician at Milan, but his interests were rather in mathematical astronomy.\textsuperscript{32} He was a bitter antagonist of Galileo.\textsuperscript{33}

Facio Cardano (1444–1524), professor of medicine and jurisprudence in Milan, edited Bishop Peckham’s "Perspectiva communis." He was the father of Cardano the algebraist.

girolamo Cardano. See the article.

Johann Chesnecopherus (1581–1635), professor of medicine and anatomy at Upsala, gave much attention to astronomy and physics, and incidentally to mathematics.\textsuperscript{34}

Federigo Commandino (1509–1575), a physician, became mathematician to Duke Guido Ubaldi of Urbino and to Cardinal Ranuccio in Rome, but his greatest contributions were in his editions of the mathematical works of Ptolemy, Archimedes, Apollonius, Aristarchus, Euclid, Pappus, and Heron. These were published in Venice, Rome, Bologna, Pisa, and Urbino between 1558 and 1592. His edition of Euclid is particularly well known.

Copernicus. See the article.

Juan Baptista Cursa, born in Valencia in the second half of the sixteenth century, a doctor of medicine, wrote one work on mathematical astronomy.\textsuperscript{35}

Joachim Curtius (1583–1742), a practicing physician in Hamburg, edited Tycho Brahe’s "Oratio de disciplinis mathematicis" (Hamb., 1621) and wrote "De certitudine matheseos et astronomiae" (ib., 1616).


Federigo Delfino (1477–1547), a physician in Venice, became professor of astronomy in the University of Padua, his native town. His mathematical work is seen in his "Annotationes in Tabulas Alphonsinas."

Joseph Solomon Delmedigo (1591–1655), a native of Candia, a graduate of Padua, a student under Galileo, a cabalist in Constantinople, physician to Prince Radu...
ziwill at Vilna, a Rabbi at Hamburg, a physician in Amsterdam, and a prolific writer on medicine and mathematics.36

JOHANN DRYANDER, or EICHMANN (1500–1560), was professor of medicine and mathematics at the University of Marburg (1535). He wrote several works on mathematical astronomy.

THADDÆUS DUNUS, or TADEO DUNO (1523–1613), was a Zürich physician, born in Locarno, but he is known only for his two rather obscure mathematical works.37

LORENZ EICHSITTDT (1596–1660), professor of medicine and mathematics in the Gymnasium at Danzig, published several works on mathematical astronomy.

SAMUEL EISENMENGER, known also as Siderokrates (1534–1585), a practicing physician, was professor of mathematics at the University of Tübingen.38

PAUL FABRICIUS (1529 or 1519–1588), a physician of high standing, a professor in the University of Vienna, was known chiefly for his mathematical tables for use in astronomy.39

JEAN FERNEL. See the article.

AUGER FERRIER (1513–1588), physician to Catharine de Medici, queen of Henri II of France, was quite as much interested in mathematics and astrology as in medicine.40

FIENUS, or FYENS (1567–1631), professor of medicine at Louvain, writer upon medical matters, was also known as an astronomer.41

For example, the “Refuath Tealah” (Healing medicine); “Or Shibat Ha-yamim” (the Light of the Seven Days) including some discussion of optics; “Bosmat Bat Schelomoh” (Bosmat, daughter of Solomon), on mathematics and related subjects; and “Elim” (Amsterdam, 1629), a work containing answers to various scientific questions propounded by Zerakh ben Nathan and seventy mathematical paradoxes.

37 “Arithmetices, practices methodus,” Basileae, 1546; “De nonis, idibus et calendis,” ib., 1546.

38 “De usu partium coeli in commendationem astronomiae,” Argentorati, 1567.

THOMAS FINKE, or FINCK (1561–1566), was court physician to the Duke of Schleswig-Holstein, and afterward professor of medicine (1591), of mathematics (1602), and of rhetoric in the University of Copenhagen. His mathematical work also led him into the field of astronomy.42

JACOB FLACH (1537–1611) was professor of medicine and of mathematics at the University of Jena, but he seems to have contributed nothing to the literature of either science.

ERASMUS FLOCK (1514–1568), a physician of Nürnberg, was for a short time (1543–1545) professor of philosophy and mathematics in the University of Wittenberg. Among his other activities he edited Ptolemy’s “Almagest” (Norimb., 1550).

SIMON FORMAN (1552–1611), a physician and an astrologer in London and the author of various works on alchemy, magic, and astrology.

GERONIMO or GIROLAMO FRACASTORO (1483–1553), a physician in Verona, was afterwards Papal physician. He wrote on medicine, but also was interested in the mathematics of optics and seems to have had some idea of the telescope.43

JEAN FRANCO (c. 1550–1610), a physician of Brussels, wrote an ephemeris of astrological character, in Flemish, and this was published at Antwerp in 1594.

LORENZ FRIES (c. 1485–1531), a prominent iatromathematician, author of the “Spiegel der Arznei” (1518) and of a work on the astrolabe. He remarks that “medi-
cus sine astrorum cognitione perfectus esse non potest.”

Galileo. See the article.

Gemma Frisius. See the article.

Cornelis Gemma Frisius (1535–1577), son of the better known Gemma Rainer (Gemma Frisius), was professor of medicine and also of astronomy at Louvain. His “De arte cyclognomica tomi III, philosophiam Hippocratis, Galeni, Platonis et Aristotelis in unam methodi speciem referentes” (Antv., 1569) is well known, and he also wrote two astronomical works.

Simon Gryneus the Younger (1539–1582) was professor of medicine and of mathematics at Heidelberg. His father published the first Greek edition of Ptolemy’s “Almagest” (Basil., 1538), and was a friend of Luther and Melanchthon. Simon the Younger wrote a work on astronomy, published in Basle in 1580.

Isaak Habrecht (d. 1633) was a doctor of philosophy and of medicine. In his later years he became an assistant in mathematics in the University of Strasburg. He published various works of an astronomical nature.

Thaddäus Hagek (1525–1600), also known as Hajek, or Hagecius ab Hayck, and as Thaddeus Nemicus, was for a long time professor of mathematics in the Carolinum at Prague, but later was physician to Maximilian II and to Rudolph II. He wrote several works on geometry and astronomy.

Muḥammed ibn Ibrāḥīm ibn Jūṣuf, Raḍī ed-dīn Abū ʿAbdallāh (d. 1563), known as Ibn el-Ḥanbalt, a native of Aleppo, a man well versed in medicine, law, and mathematics, wrote various works on geometry and arithmetic.

Johann Hartmann (1568–1631) was professor of mathematics in the University of Marburg (1592) and later took his degree there in medicine (1606), then becoming professor of chemistry (of “Chymiatrie”). He was physician at the court of the Kurfürst of Hesse.

Sixtus ab Hemminga (1533–1581) was a physician and mathematician of some prominence in Belgium. He studied in Gröningen, Cöln, Louvain, and Paris.

Georg Henisch (1549–1618), of Hungarian birth, was a physician and afterwards taught logic and mathematics at Augsburg. He wrote numerous works on mathematics, philology, and medicine.

David Herlicius (1537–1636), also known as Herlick and Herlitz, a physician, was professor of mathematics in the University of Greifswald from 1585 to 1598. He wrote upwards of fifty works, chiefly on astronomy.

Joachim Jung (1587–1657), professor of mathematics at Giessen (1609–1614), of medicine at Padua (1618), of mathematics at Rostock (1624–1625), of medicine at Helmstädt (a few months), and again of mathematics at Rostock, alternated as few men do between his two favorite sciences. His writings cover a wide range, including mathematics, astronomy, physics, and botany.

Lilio. See the article.

Johann Marcus Marci de Kronland (1595–1667), for more than forty years professor of medicine at Prag, physician to Emperor Ferdinand III, wrote quite as much,
in a somewhat heterodoxical fashion, on mathematics as on medicine.\footnote{For example, “De proportione motus,” Pragae, 1639; “De proportione motus figurarum rectilinearum et circuli quadratura ex motu,” ib., 1648; “De longitutudine s. differentia inter duos meridianos; una cum motu vero luna inveniendo ad tempus data observationis,” ib., 1650; “Labyrinthus in quo via ad circuli quadraturam pluribus modis exhibetur,” ib., 1654.}

**Philips van Lansberg (1561–1652),** a physician and priest at Antwerp and elsewhere, devoted his energies chiefly to mathematics\footnote{Among other works he wrote a “Breviarium geometricum et geodaeticum.”} and astronomy. His “Opera omnia” appeared at Middelburg in 1663.

**Wilhelm Lauremberg (1547–1612)** was professor of mathematics and medicine at Rostock and wrote on both sciences.\footnote{“Logarithmus,” Lugduni Batav., 1628; “Lusus et recreationes ex fundamentis arithmeticis,” Havnn., 1634; “Arithmetic et algebra,” Soroe, 1643; “Instrumentum proportionum,” etc. Rostochii.}

**Peter Lauremberg (1585–1639),** son of Wilhelm, was even more versatile than his father, for he studied medicine in Leyden, was professor of philosophy in Montauban, of medicine in Montpellier, of physics and mathematics in Hamburg, and of poetry at Rostock. He wrote on astronomy, mathematics, physics, and various other disciplines, and his influence was what would be expected from one who scattered his energies so recklessly.

**Johann Wilhelm Lauremberg (1590–1658),** a younger brother of Peter, divided his interests almost as disastrously. He received his doctor’s degree in medicine at Rheims in 1616, was professor of poetry and mathematics at Rostock (1618) and of mathematics in the Ritteracademie at So-rore (1623). His writings were chiefly if not wholly mathematical, but not of a high character.\footnote{Among his works were “Die ersten sex Bucher elementorum Euclidis,” Nürnberg, 1610; “Hypotheses de systemate mundi,” 1596.}

**Heinrich Lavater (1560–1623),** a physician, was professor of physics and mathematics in Zurich, the city of his birth. His writings were chiefly on physics and astronomy and were of no particular merit.\footnote{He wrote “Analysis arithmetica et geometriae tabulis succinctis,” Lipsia, 1607, and edited the arithmetic of Psellus and the optics and catoptrics of Euclid.}

**Leonardo da Vinci.** See the article.\footnote{He wrote “Annulli cum spheric, tam mathematici usus et structura,” Marp., 1536; “Stereometria,” Francof., 1544.}

**Adam Lonicerus, or Lonitzer (1528–1586),** was professor of mathematics at Nürnberg in 1553 and the following year he received his doctor’s degree in medicine at Mainz. He wrote on botany, medicine, and mathematics.\footnote{He wrote “Analysis arithmetica et geometriae tabulis succinctis,” Lipsia, 1607, and edited the arithmetic of Psellus and the optics and catoptrics of Euclid.}

**Mangin.** See Cyriaque de Mangin.

**Simon Marius, or Mayer (1570–1624),** studied astronomy under Tycho Brahe and Kepler and then took a course in medicine at Padua. His contributions were all in the line of mathematics, including astronomy.\footnote{Among his works were “Die ersten sex Bucher elementorum Euclidis,” Nürnberg, 1610; “Hypotheses de systemate mundi,” 1596.}

**Mayer.** See Marius.

**Metius.** See the article.

**Christoph Meurer (1558–1616),** a member of the medical faculty and professor of mathematics at the University of Leipzig.\footnote{He wrote “Analysis arithmetica et geometriae tabulis succinctis,” Lipsia, 1607, and edited the arithmetic of Psellus and the optics and catoptrics of Euclid.}

**Jacob Milich (1501–1559),** or Milichius, professor of medicine in the University of Wittenberg, also taught mathematics there. His commentary on Pliny contains more or less of astronomy.

**Burckhard Mithob (1504–1565)** was professor of mathematics and of medicine in the University of Marburg.\footnote{He wrote “Analysis arithmetica et geometriae tabulis succinctis,” Lipsia, 1607, and edited the arithmetic of Psellus and the optics and catoptrics of Euclid.}

**Antoine Mizauld (c. 1520–1578),** a practicing physician in Paris, wrote a number of works on mathematical astronomy.

**Henry de Monantheuil, or Monanthe­lius (1536–1606),** professor of medicine (1574) and later (1585) of mathematics in the Collège royal of France, at Paris. He was a...
pupil of Ramus’s. He wrote various works on mathematics and iatromathematics.58

Jean Baptiste Morin (1583–1656), physician to the Bishop of Boulogne and other notables, became professor of mathematics at the Collège royal in Paris in 1630. He was a voluminous writer, his interests including geology, astronomy, theology, astronomy, and mathematics.59

Joannes Morisotus, a physician of about the middle of the sixteenth century, wrote among other works four books on arithmetic.60

Jacob Müller (1594–1637) was professor of mathematics (1618) and of medicine (1620) in the University of Giessen, and later of both mathematics and medicine at Marburg. He wrote chiefly on mathematics.61

Müller. See also Mulerius.

Nicolaus Mulerius (1564–1630), also known as Mulierius, Mullers, and Müller, a Dutch physician, was professor of mathematics at the University of Gröningen (1614–1621). He wrote a number of works on mathematical astronomy.

Pieter Mulerius (1599–1647), son of the preceding, was a physician and became professor of physics and botany at Gröningen (1620). He wrote on mathematical astronomy, continuing the Ephemeris begun by his father.

Michael Neander (1529–1581) was professor of mathematics and Greek (1551) in the University of Jena, and later (1560) professor of medicine.62

Nemicus. See Hagek.

Gerard de Neufville (d. 1648), professor of mathematics and physics (1611) in the Gymnasium at Bremen, and later (1624) of medicine, wrote on mathematics, astronomy, and physics.

Augustinus Niphus (1473–1546), a physician and astrologer in Suessa, Calabria, published in 1504, in Venice, an astronomical work in which he endeavored to combine the observations of the physician with those of the astronomer.

Antonio Núñez de Zamora, a native of Salamanca or Zamora, born in the second half of the sixteenth century, lectured at the University in that city on medicine, mathematics, and astrology.63

Pedro Núñez Salaciense (1492–1577) studied medicine in Lisbon, but gave his attention thereafter entirely to mathematics. He became one of the leading Portuguese mathematicians of the sixteenth century, writing several treatises of considerable merit.64

Hermann Obermeyer (1588–1655), a Basle physician, became professor of mathematics in the University of Basle in 1630. His writings were astrological and astronomical and were of no value.

Peletier. See the article.

Kaspar Peucer (1525–1602) was professor of mathematics (1554) and then (1560) of medicine in the University of Wittenberg. His position as son-in-law of Meanchthon probably gave him more standing than would otherwise have been his.65

68 His “Synopsis mensurarum et ponderum ponderationisque mensurabilium secundum Romanos, Athenienses,” etc., was published at Basle in 1555. He also wrote “Elementa sphæricæ doctrinæ,” ib., 1561.

69 “Arithmetica theoretica et practica,” Bremse, 1624.

60 He published two works, the first being “Prognostico del eclipse del sol que se hizo en año de 1600,” Salamanca, 1600.

He was also physician at one of the small courts. He wrote various works on medicine and mathematical astronomy.66

Juan Martín Población, a native of Valencia, took high rank as a physician and astrologer in the sixteenth century. He wrote two works on the astrolabe, one of which exists only in manuscript.67

Cristóbal Ponce de León (d. 1598) was professor of medicine and also of mathematics in Alcalá.68

Rainer or Rainier. See Gemma Frisius in the article.

Recorde. See the article.

Regnier. See Gemma Frisius in the article.

Ambrosius Rhodius (1577–1633), professor of mathematics in the University of Wittenberg (1608) and author of various works on optics, astronomy, and geometry,69 gave also much attention to medicine. There seems to have been another of the same name, a contemporary, who was also interested in medicine and mathematics.

Giovanni Antonio Roffeni (d. 1643), a doctor of medicine, became professor of mathematics in Bologna, but his works were astronomical and astrological only.70

Adriaen van Roomen. See the article.

66 Among the latter, “Elementa doctrinae de circulis celestibus et primo motu,” Viteb., 1551, with various editions; “De dimensione terrae et geometrice numerandis locorum particularium intervallis ex doctrina triangulorum sphaericorum,” ib., 1554, with later editions.

67 The published work was entitled “De vsv astrolabi,” and appeared in Paris in 1526 and 1527, later editions in 1546, 1547, 1550, 1553, 1554, and 1556. The unpublished manuscript is a “Tratado y uso del astrolabio” and is in the Biblioteca Nacional at Madrid.

68 He wrote “Libro de la ciencia natural del cielo,” Alcalá, 1598.

69 “Euclidis elementorum libri XIII,” Viteb., 1609, 1634.


Peter Ryff (1552–1629) was a practicing physician in Basle and became professor of mathematics (1586) in the university. He wrote several works on mathematics.71

Francisco Sánchez (1550–1623), born at Tuy in the diocese of Braga, a Spanish physician, lived for some time in Montpellier where he was engaged in the practice of his profession, finally settling in Tolosa. He wrote one work on mathematics72 and one on astronomy. He should not be confused with the great humanist of the same name, who was born at Brozas in 1523.

Giuseppe Scala (1556–1585), a Sicilian physician, composed a set of astronomical tables which was published four years after his death.73

Victorin Schönfeld (1525–1591) received the degree of doctor of medicine at Marburg in 1557, became professor of mathematics in the same university in 1557, and in 1566 became professor of medicine. He wrote on medicine, mathematics, and astrology.74

Jacob Schönheinz, one of the earliest iatromathematicians of Germany, and the earliest in the sixteenth century, published his “Apologia astrologiae,” at Nürnberg, in 1502.

Johann Schröter (1513–1593), a Viennese practitioner, physician to the Imperial and Saxon courts, wrote various mathematical works.75

Miguel Serveto (c. 1511–1553), one of


72 “Objectiones & erotemata super Geometricas Euclidis demonstrationes ad Christopherum Claviurn.”

73 “Ephemerides ex tabulis Magini,” Venetiis, 1589.

74 Among his works are a treatise on epilepsy (Marburg, 1577) and the “Prognosticon astrologicum,” which appeared for various years.

75 Among them, “De arte numerandi.”
the best educated young men of Spain in the sixteenth century, well trained in Latin, Greek, Hebrew, philosophy, theology, mathematics, and medicine, fell under the ban of the authorities because of his opinions and was executed in his forty-fourth year. He wrote on geography and astrology.76

Olaus Martin Sten (1598-1650) was professor of astronomy, physics, and medicine at the University of Upsala.

Georg Tanstetter von Thannau (1482-1535) was physician to the Emperor Maximilian I, and became professor of astronomy in the University of Vienna. He edited Peurbach's "Tabulae eclipsium," Regimontanus's "Tabulae primi mobilis," Proclus's "Libellum de sphaera," and 76 "Apologetica disceptatio pro astrologia."

Galen De usu partium, 1, 3.
HISTORICAL DEVELOPMENT OF OUR KNOWLEDGE OF THE CIRCULATION AND ITS DISORDERS

By PHILIP S. ROY, M.D.

WASHINGTON, D. C.

The earliest account of the structure of the heart is that contained in the Hippocratic writings. It is probably pseudo-Hippocratic, but admittedly a work of great antiquity. The heart is described as a strong muscle; the pericardium as a smooth tunic, containing a little fluid resembling urine; the auricles, the ventricles, the sigmoid valves and the origin of the veins from the heart are mentioned. The heart is described as the fountain-head irrigating all parts of the body, and the left ventricle is held to be the seat of understanding.

The first great master dealing with the circulation of whom we have a record is Aristotle, and we constantly find Harvey referring to him in his great work. Indeed, Harvey's mind seems to have been so impressed by the great masters of antiquity that in his old age he bade a young student, "Go to the fountain-head and read Aristotle, Cicero and Avicenna."


"When an ancient observer looked with the naked eye at the very early embryo of the fowl, he distinguished at first only a blood-red point, which pulsated, or 'leapt.' This, Aristotle judged to be the heart containing blood, before any blood-vessel had shown itself and before blood was visible in any other part. Very soon, however, two vessels containing blood were seen, according to him, to extend from the rudimentary heart towards the periphery. From these and other considerations, Aristotle inferred that both the blood and all its containing vessels owe their first origin to the heart; and that throughout life the liquid made elsewhere from the food, enters the heart, there to be perfected into blood by the action of the vital innate heat, of which, as we have seen, he held the fiery central hearth to be within the heart. Naturally, therefore, he believed the blood not to be hot of itself, but to acquire its vivifying heat at the heart, the pulsation of which he held to be caused directly by the seething of the blood within. When thus perfected and charged with heat, the blood, according to him, is distributed from the heart through the vena cava as well as the aorta. These great vessels and their subdivisions, Aristotle distinguished anatomically, but he made no serious physiological distinction between what we call the veins and the arteries; and, himself, applied the word "artery" to the windpipe only. As to the cavities and contents of the heart, even as to the number of its cavities, he had obscure, complex, and erroneous ideas, and of the valves he knew nothing. He recognized no essential differences between the matters distributed by way of the vena cava and by way of the aorta, all being, alike, one thing,—blood; though the blood was hotter or cooler, thinner or thicker, purer or cruder, in different regions or parts of the body, in different sets of vessels, in different cavi-

1 Read to the Medical History Club of Washington, D. C., January 27, 1917.
ties of the heart, or at different times, in the same place.”

Aristotle, like Plato, knowing nothing of the nerves, judges the blood-vessels to be sensory paths; and blood-vessels connect, not only the sensitive flesh, but all the most special sense organs, with the heart. Such is an outline of the reasons why Aristotle held the heart to be the life-long seat, not only of the “nutritive soul” but of the “sensory soul” as well. During the Alexandrian period, Erasistratus (300 B.C.) recognized the valves, both arterial and auricular, and believed that they ventilated the heart. This was more than four centuries before Galen and more than nineteen centuries before Harvey.

Passing from Aristotle to the next great period of medicine, we learn from Curtis the views that Galen held about the heart, blood-vessels and the circulating blood.

“According to the more detailed views of Galen and his school, the blood was perfected and had its central source not in the heart but in the liver, to which the portal vein brought a crude liquid derived from the products of digestion. In the liver, the veins also originated, while the arteries originated at the heart. The blood left its source in the liver, by way of the roots of the venous system, that is, by the hepatic veins of modern anatomy. From these it entered the great venous trunk, the vena cava, a vessel which comprised the inferior vena cava, the right auricle, and the superior vena cava of our present nomenclature. Upon leaving the liver, the blood at once divided into two sharply diverging streams, one flowing directly downward through the vena cava, the belly, and the lower extremity; the other flowing directly upward through the vena cava to the chest, the upper extremities, and the head.

Therefore, that part of the vena cava which we call the right auricle simply formed a part of the upward pathway of the blood, at a place where some of the blood left its upward pathway and flowed through a side opening into the right ventricle. Of the fraction of the blood that entered the right ventricle, a part went to the lungs simply for their nutrition, by the “arterial vein”—the pulmonary artery of modern parlance—and a part percolated in a refined condition through the pores of the septum, from the right ventricle to the left, to be worked up there with the vital spirits and thus become the basis of the spirituous blood of the arteries. From the left ventricle, this spirituous blood went to the body at large by way of the arteries. There is no evidence that Galen believed any blood to pass from the right to the left ventricle otherwise than through the pores of the septum. As he says, however, the branches of the venous artery (our pulmonary vein) ‘transmit thin and pure and vaporous blood in abundance’ to the lungs for their nutrition, we may infer that he held this supply to be derived from the left ventricle, like that of the rest of the body.”

Galen seems to have been the first writer who positively proved that the blood-vessels, both veins and arteries, carry blood.

Galen had maintained that the blood passes from the right to the left ventricle by means of certain hypothetical, invisible “pores.” Vesalius, in 1543, treated this statement in a skeptical or half-credulous manner. Servetus, in 1553, reasoned that the blood is mixed with air from the lungs before passing into the heart. Columbus, in 1559, showed, in his vivisections of animals, that the pulmonary veins contain blood, denied the existence of Galen’s pores, and also held that the blood is cooled and


\[\text{\textsuperscript{3} Curtis: op. cit., 36-38.}\]
rendered spirituous by mixture with air in the lungs. Sir Michael Foster and others maintain that Columbus derived his knowledge from the works of Servetus, and that the honor of discovering the pulmonary circulation belongs to Servetus and not to Columbus.

The circulation was but dimly understood by physiologists until William Harvey on his fiftieth birthday, 1628, in a master-stroke, gave to the world a treatise which he entitled "An Anatomical Dissertation Upon the Movements of the Heart and Blood-vessels in Animals." We can not help regretting that Harvey did not dedicate this great work to a great man, but we find it dedicated to Charles I, and this dedication concluding with the following words:

"Accept, therefore, I most humbly beseech you, most serene King, with your wanton kindness and forbearance, this, my new treatise upon the heart—you who are yourself the new light of this age and indeed its true heart, a prince abounding with virtue and grace, to whom we will gladly refer all the blessings which England enjoys, all the pleasures in our lives."

Aristotle established what Curtis calls "The primacy of the heart," regarding it as the seat of life and the soul, the hearth of animal heat. Harvey gave this primacy to the blood and viewed the heart as only a force-pump to keep the blood in motion.

It would not be possible in the length of this paper to give all of Harvey's dissertation on the circulation of the blood, proving that it is "a movement, as it were, in a circle." Harvey said he became convinced that "the veins on the one hand would become drained, and the arteries on the other ruptured through excessive charge of blood unless the blood should somehow find its way from the arteries into the veins and so return to the right side of the heart." He continues,

"I finally saw that the blood, forced by the action of the left ventricle into the arteries, was distributed to the body at large and its several parts, in the same manner as it is sent through the lungs, impelled by the right ventricle into the pulmonary artery; and that it then passed through the veins and along the vena cava, and so round to the left ventricle in the manner already indicated. And similarly does it come to pass in the body, through the movement of the blood, that the various parts are nourished, cherished, quickened by the warmer, more perfect, vaporous, spirituous, and, I may say, alimentive blood; which, on the other hand, owing to its contact with these parts, becomes cooled, coagulated, and, so to speak, effete. It then returns to its sovereign, the heart, as if to its source, or to the inmost home of the body, there to recover its state of excellence or perfection. Here it renews its fluidity, natural heat, and becomes powerful, fervid, a kind of treasure of life, impregnated with spirits, it might be said with balsam."

Harvey then proceeds with mathematical precision to demonstrate his circulation theory. He says:

"Let us assume, either arbitrarily or from experiment, the quantity of blood which the left ventricle of the heart will contain when distended, to be, say two ounces, three ounces, or one ounce and a half—in the dead body I have found it to hold upwards of two ounces. Let us assume further, how much less the heart will hold in the contracted state than in the dilated state; and how much blood it will project into the aorta upon each contraction;—and all the world allows that with the systole something is always projected; a necessary consequence, and obvious from the structure of the valves; and let us suppose as approaching the truth, that the fourth or fifth or sixth, or even the eighth part of its charge is thrown into the artery at each contrac-
tion; this would give either half an ounce, or three drachms, or one drachm of blood, as propelled by the heart at each pulse into the aorta; which quantity, by reason of the valves at the root of the vessel, can by no means return to the ventricle. Now in the course of half an hour, the heart will have made more than one thousand beats, in some as many as two, three, or even four thousand. Multiplying the number of drachms propelled by the number of pulses, we shall have either one thousand half-ounces, or one thousand times three drachms, or a like proportional quantity of blood, according to the amount which we assume as propelled with each stroke of the heart, sent from this organ into the artery; a larger quantity in every case than is contained in the whole body! Upon this supposition, therefore, assumed merely as a ground for reasoning, we see the whole mass of blood passing through the heart from the veins to the arteries, and in like manner, through the lungs. But let it be said that this does not take place in half an hour, but in an hour, or even in a day; anyway it is still manifest that more blood passes through the heart in consequence of its action, than can either be supplied by the whole of the ingesta, or than can be contained in the veins at the same moment."

If Harvey had expressed these facts in terms of algebra, the scientific world would have soon come around to our own view that his experiments led him to a mathematical or quantitative demonstration of the circulation.4 But Smith shows that the plus and minus signs were first introduced in the arithmetic of the Bohemian physician Johann Widman (1489),5 and Cajori tells us 6 that these did not come into general use before the time of Vieta (1540-1603), who also popularized the use of letters to denote algebraic quantities. The sign of equality was devised by Robert Recorde in "The Whetstone of Witte" (1557), the first English treatise on algebra; the sign of division was not employed in England before 1668, and the sign of inequality much later.

In 1640, Harvey's discovery was given a hydrodynamic proof in the celebrated "experiment of Walseus," viz., that incision in a ligated femoral vein causes the blood to spurt in streams from the distal opening and to ooze in drops from the proximal opening.

In 1660, Malpighi demonstrated the capillary circulation. Of his discovery of the capillaries, Fraser Harris has well said, "Harvey made their existence a logical necessity, Malpighi made it a histological certainty."

ANATOMY AND PHYSIOLOGY

Leonardo da Vinci made the most accurate and beautiful drawings of cardiac structure of his time. As with Henle, many of his drawings are architectural in character, bringing out the idea of plan and elevation. The valves are drawn from many angles, from above downwards and otherwise, and their relations in three dimensions are clearly shown. In one drawing, the whole valve is dissected from the underlying muscle and unrolled in a single plane, showing its finer structure in a sort of Mercator's projection (Arnold Klebs).7 Leonardo understood clearly that "the heart is a muscle, the first in strength and the most potential among the other muscles." His drawings and physiological investigations of the heart were far superior to those of Vesalius. He was the first to delineate the muscular bands which pass from the ventricular walls to the septum, now

described as "moderator bands," structures which contain branches of the auriculo-ventricular bundle of His.

In 1733, Stephen Hales, an English clergyman, invented the first manometer or tonometer—a long glass tube fastened inside a horse's artery; and with this rude instrument made the first measurements of blood pressure in connection with the capacity of the heart and the velocity of the blood current.8 The next step was taken by Poiseuille, who in 1828 invented the hemodynamicometer, with which he showed the relation of blood pressure to respiration, and measured the degree of arterial dilatation at each heart beat. In 1847 Carl Ludwig connected Poiseuille's instrument with a revolving cylinder and thus invented the kymograph and introduced the graphic method into physiology. In 1840 Poiseuille stated the celebrated mathematical law or formula for estimating the viscosity of the blood and invented the viscosimeter for this purpose. The inhibitory power of the vagus nerve was discovered by the Weber brothers in 1845, but, in 1870-71, Ludwig and Schmiedeberg showed that the vagus contains accelerator as well as inhibitory fibers. Nearly all our recent knowledge of the physiology of the circulation came originally from the laboratory of Ludwig, who was once defined as "the only physiologist who ever did anything." He invented the graphic method, the kymograph, the blood pump and the Stromuhr or blood current clock, and devised the method of perfusion of excised organs, which has played such a prominent part in physiological experimentation up to the time of Carrel. In 1848, Ludwig discovered the ganglionic cells in the auricular septum. In 1850, with Noll, he showed that the lymph is produced by the diffusion of fluids from the blood through the walls of the capillary vessels into the surrounding tissues. In 1857-8, with Lothar Meyer, he investigated the gases of the blood. In 1866, with Cyon, he investigated the effect of temperature on the heart beat, discovered the depressor nerve of the heart and the erector nerves of the peripheral vessels. In 1867, with Dogiel, he measured the movement of blood passing in a unit of time, by means of the current-clock (Stromuhr). In 1869-70, he had Brunton and Schmiedeberg study the effects of drugs upon the circulation, which was the starting point of the pharmacological careers of these two distinguished men. In 1871, his pupil, Bowditch of Boston, deduced "the all or nothing law," viz., that the heart muscle will always give a maximal contraction, or none at all. In the same year Kronecker showed that the heart muscle can not be tetanized. In 1871-73, with Dittmar, Ludwig located the vasomotor center in the medulla. In 1875, with von Kries, he measured the blood pressure in the capillaries. In 1880, with Schmidt Mülheim, he inaugurated the study of the effect of the injection of peptones into the blood. In 1883, his pupil Wooldridge began the study of the chemistry of coagulation of the blood. In 1884, another pupil, Gompertz, studied the arrangement of the muscular fibers in the heart.9

The most important work of recent times on the physiology of the circulation is that of Gaskell, who, in 1882-85, investigated the vasomotor nerves of the blood vessels, in Ludwig's laboratory. This research was the starting point of Gaskell's great work on the vagus nerve, which he showed to be quiescent rather than inhibitory in its effects upon the heart. The researches of Gaskell and Engelmann brought out the important fact that the heart muscle is autonomous and automatic in its action, its contractions being regulated to some extent by the nerves but not caused by them. Gaskell invented the term heart-block, pro-

duced it experimentally and explained its causes. Around the name of Gaskell we naturally group Waller, Kent, Keith and Flack, His and Tawara. It was Gaskell who explained the significance of the celebrated "experiment of Stannius," viz., that a ligature at the junction of the auricle and the sinus venosus will stop the heart, while a second ligature applied to the auriculo-ventricular groove will cause the ventricle to beat again. By means of the polygraph and the string galvanometer Sir James Mackenzie, Thomas Lewis and other clinicians have made many obscure diseases of the heart stand out as individualities. Cushny used electrocardiograms in checking up the effects of digitalis, and it is now well recognized that this drug is a positive danger in certain conditions of the heart. Among these may be mentioned angina pectoris, due to changes in the coronary arteries, and heart-block, unless complete.

The elucidation of the vasomotor mechanism was one of the great triumphs of Claude Bernard (1851-3). The anatomical studies of the heart's innervation were made by Henle (1841), by Bidder who discovered the ganglionic cells at the auriculo-ventricular juncture (1852), and by Bezold who demonstrated the accelerator nerves and their origin in the spinal cord. The sphygmograph was invented by Marey (1860).

The first correct investigation of the true nature of coagulation of the blood was made by William Hewson in 1771. He showed that, when coagulation is delayed by chemical means, coagulable plasma can be separated from the corpuscles and skimmed off, and that this contains an insoluble "coagulable lymph," which is our present fibrinogen. This discovery was confirmed by Andrew Buchanan, who extracted fibrin ferment in 1845. This name was given to the substance by Alexander Schmidt, who supposed that coagulation was due to the combination of fibrinogen and serum globulin. This error was corrected by Hammaersten, who showed that coagulation is caused by the splitting up of the fibrinogen and other substances (1875). The rôle of the hormones, antithrombin and thromboplastin, in the coagulation of the blood, was investigated by Howell of Baltimore in 1911 and subsequently. Howell has also investigated the effect of increased venous pressure of the heart (1881), the life history of the blood corpuscles (1890), and other problems connected with the circulation. His teacher, Newell Martin, also specialized in the circulation, and studied the effect of variations of blood pressure and temperature upon the rate of heart beat. Two other American physiologists, Stewart of Cleveland, and Porter of Harvard, have also made extensive investigations in the circulation. In 1880, Sidney Ringer of Norwich, England, began to experiment with the effects of mixtures of the chlorids of sodium, potassium, calcium and magnesium in keeping the heart beating outside the body for a long period of time. These experiments evolved the ideal Ringer's "solution" for this purpose, and gave Carrel the means for his remarkable work in experimental surgery, in particular his investigations of the latent life of arteries (1910), the preservation of portions of blood-vessels in cold storage for long periods before using them in transplantation, and the vast improvements in the surgery of the vascular system which resulted from this technic.

HEART SOUNDS

Harvey thought that the ebullition of hot blood distends the auricle, and that the distention of the ventricle through con-

10 The history of the heart sounds has been investigated by G. Joseph in the older Janus (Gotha, 1853, II, 1; 345; 565) and latterly by Leonard Hill in Schäfer's "Text-Book of Physiology," Edinb. & Lond., 1900, II, 28-33.
traction of the auricle causes the heart-beat. He said further that, "When there is the delivery of a quantity of blood from the veins to the arteries, a pulse takes place and can be heard within the chest." He compared this sound to the noise made by a horse swallowing. This view was naturally opposed by all the opponents of Harvey's theory of the circulation, and one of these, Æmilius Parisanus, a Venetian physician, declared that the sound described could not be heard at all, or at least "only in London." Lancisi, Senac, Haller and others refer to a pulsus cardis, however, which could be heard as well as felt, but even Corvisart made no distinction whatever between the sound and the impulse, since he only approached his ear to the chest when he could not sufficiently distinguish the beats by laying his hand upon the thorax. Laënnec was the first to note that the heart sounds can be heard in the vicinity of the heart, that there are two successive sounds, the first dull and longer, the second shrill and shorter, separated by a momentary rest, in the musical sense of the term. He ascribed the first sound to the ventricular contraction, the second to the auricular contraction, and he compared the latter to the sound made by a dog in lapping up water. In 1829, A. Turner pointed out that the second sound occurred not at the end but at the beginning of the diastolic pause, and hence could not be derived from the auricular systole. From this date, a perfect flood of opinions and controversies arose as to the cause of the heart sounds. Corrigan, Burdach, Magendie, Piory, C. J. B. Williams, Bouillaud, Skoda, Cruveilhier, Barth, Roger, Purkinje, Valentin, Hamernik, Canstatt—to mention only a few outstanding names—all ventilated opinions more or less erroneous. Dunglison, in 1836, tabulated the views expressed up to his time in order to show what bewildering discordance of opinion existed. Sandborg, in 1881, tabulated no less than forty different theories. Before the time of Skoda, the French clinicians made no distinction whatever between heart sounds and heart murmurs, describing either indifferently as "bruit." Skoda cleared up much obscurity by making a clean-cut distinction between a "sound" and a "murmur." C. J. B. Williams, in 1836, showed that the first sound can be heard in the excised heart, even if the auriculoventricular valves be held open with the fingers. Ludwig and Dogiel, in 1868, found that the first sound continued, almost unaltered, after successive ligation of the venae caveae, the pulmonary artery and vein, and the aorta. This experiment entirely overthrew the view that the first sound was of simple valvular origin. Schaefer says that the valves can be held back by hooks or the finger, yet a systolic sound continues. A large number of physiological experiments of this kind produced the most conflicting views as to the origin of the first heart sound, but the difficulty was settled when Einthoven and Geluk, in 1894, registered the effect of the heart sounds on a microphone circuit, by means of a capillary electrometer; the movements of the electrometer being photographed on a moving sensitized plate. These photographs showed clearly that the sounds are compounded of several tones, each sound giving rise to a succession of vibrations of the mercury
meniscus. The same method has been applied to the second sound of the heart, and the conclusion is that neither sound is simple, but each is formed of many component tones caused by the sudden tension and vibration of the cardiac muscles of the auriculoventricular valves, and of the blood, augmented by the stroke of the heart beating against the chest wall. The constituent tones of the second sound of the heart arise from vibrations of the valves and of the blood columns and the arterial walls.

A third sound of the heart was noted by E. Barié in 1893, again by A. S. Hirschfelder (1907), and elucidated by Einthoven, A. J. Gibson and William S. Thayer in 1907.

CLINICAL AND PATHOLOGICAL INVESTIGATIONS 18

Up to the time of Hippocrates (460-377 B.C.) it was held that the heart could not be diseased. Herophilus and Erasistratus, of the Alexandrian school (300 B.C.), showed the synchronism of the pulse and the heart beat, and likened the heart to a pump. Galen (131-210 A.D.) expanded the pump analogy, showed that the arteries contained blood, not air, and made special experiments to demonstrate the motor power of the heart.

Aretaeus says: "If the heart suffers primarily, death is not far off." In Celsus appears, for the first time, a mysterious disorder called by the Greeks kardiakon, and by the Romans Cardiacus or Morbus Cardiacus. This consisted of an indefinable and incoordinated group of symptoms—profuse sweating, fever with thin, weak pulse and short, panting respiration, great bodily weakness with cold extremities—variously attributed to the heart or stomach. Aretaeus calls it "syncope" and regards it as a definite cardiac affection. Galen regards it as a general weakening disease affecting both heart and stomach. Alexander Trallianus and Aetius, the last to mention it, describe it as a gastric disorder. The treatment was roborant, and wine the universal remedy, in all the old authors. After Alexander Trallianus (6th century B.C.) all trace of it disappears for six centuries. Huxham thought it a nervous fever with colliquative sweating and chills. Bonet describes a case (from Zacutus Lusitanus) of syncope cardiaca from a worm or polyp in the heart. Hecker, in his treatise on the English sweating sickness (1834) regards it as an analogue of this disease (miliary fever). In 1835, Seidlitz, of St. Petersburg, identified it with "exudative pericarditis." Landsberg, in his study of 1847, regards it as a secondary anemia. The symptoms he enumerates also bear some resemblance to those of leukemia.19 At all events, it was not an idiopathic disease of the heart.

In 1555, Vesalius diagnosed aortic aneurism of the abdominal and thoracic aorta in the living, and proved by opening the chest of a strapped animal that a quiescent heart may be resuscitated by the use of bellows. In 1534 Massa described cardiac dilatation and hypertrophy as aneurism. In 1679, Bonet described fatty infiltration or degeneration of the heart muscle. In 1672, Vieuussens surmised that heart disease was the cause of most of the symptoms which the physicians of his day grouped as hydrothorax or otherwise described as asthma, palpitation, etc. In 1673 he noted dropsy of the pericardium, again in 1675 (with autopsies), and a little later, a case of pericarditis (with autopsy). In 1685, Vieuussens noted a case of stenosis of the left ostium with disease of the mitral valve, and hypertrophy of the heart. The quality of the pulse was "small, weak and entirely irregular." This description of the pulse of mitral stenosis is classic. These contributions are all con-

18 See the historical sketches in Ziemssen's Cyclopaedia of the Practice of Medicine, N. Y., 1876, VI, passim.

Historical Development of Our Knowledge of the Circulation

tained in his treatise of 1715. In 1695 he described a case of aortic regurgitation which remained unnoticed until the time of Hodgkin and Corrigan. Albertini was the first to employ palpitation in order to ascertain the cardiac impulse. In 1707, Lancisi associated asthma with cardiac disease, saw hypertrophy and dilatation as a common cause of sudden death, and described palpitation, difficult respiration and other symptoms of the disorder; also described aneurism due to syphilis. He indicated the turgescence of the veins of the neck as a characteristic symptom of hypertrophy of the left ventricle, which is not necessarily true. In 1761, Auenbrugger introduced percussion in diagnosis, which was taken up by Corvisart (1818) and extensively employed in the diagnosis of heart disease. Auenbrugger in his book on percussion pointed out the increased areas of dullness in pericardial effusion and cardiac hypertrophy (1761). Corvisart in his revival of Auenbrugger’s method diagnosed pericarditis and separated hypertrophies from dilatations by percussion.

The first definite treatise on disease of the heart was that of Senac (1749) which was followed by the splendid books of Corvisart (1818), Laennec (1819-26), James Hope (1832), Bouillaud (1835), and Stokes (1834). The invention of the stethoscope by Laennec in 1819 revolutionized the diagnosis of diseases of the chest, including cardiac disorders, as shown in the first edition of his work (1819). The second edition (1823) is not only the greatest work on thoracic diseases ever written, but also a wonderful collection of original descriptions of new diseases. Hypertrophy and dilatation of the heart were referred to in Senac’s treatise (1749). Endocarditis is mainly associated with the great name of Bouillaud, who introduced the term, and to whom we owe our fundamental knowledge of the condition. He showed the relation between endocarditis and acute articular rheumatism, sepsis and anemia; also its relation to valvular lesions and its occurrence after the development of such lesions; also the frequent complication of myocarditis with endocarditis and pericarditis. Virchow investigated the pathological histology of carditis (1856-62), and bacteriology made it possible to investigate the causes of the mycotic and malignant forms of the disease. Albertini (1661-1738) showed that the left ventricle is prone to hypertrophy, the right ventricle to dilatation. Auenbrugger, and after him Corvisart, applied the term aneurism to hypertrophy and dilatation. The two conditions were first distinguished by Laennec and Bertin. Bright first noted enlargement of the heart in renal disease (1827) and Traube (1856) investigated it in detail.

Atrophy of the heart was first described by Senac (1749). Laennec (1819) regarded it as a secondary disease. Bouillaud (1835) divided it into the simple, eccentric and concentric varieties.

Benivieni first noted induration of the heart (1529). Rota (1555), Massa (1559), and Fernelius (1656) described “ulcers of the heart.” In 1761 Morgagni gave detailed accounts of inflammation, induration, ulcers, and rupture. Senac (1749) pointed out the base of the heart as the frequent site of abscess and induration, and assigned adjacent disease (pericarditis) as the cause. Laennec (1819) studied myocarditis very closely, and first described true fatty degeneration, and external deposits of fat causing atrophy of the muscular substance.

21 J. J. Philipp: Janus, 1847, II, 582-598.
22 Ibid., 1848, III, 316-326.
by pressure. Bouillaud (1835) showed the independence of myocarditis from endocarditis and pericarditis. Hamernik (1844) and Dubini (1844) gave simultaneously the first microscopical reports on inflammation of the papillary muscles. Latham (1846) and Craigie (1848) described purulent myocarditis. Rokitansky pointed out the relation of myocarditis to aneurism of the heart, and Virchow described parenchymatous inflammation. Thomas Bevill Peacock, in his “Croonian Lectures” of 1851, described overstrain of the heart. J. M. Da Costa described “irritable heart” in soldiers of the Civil War (1862-71). Sir Clifford Allbutt elucidated the effects of overwork and overstrain of the heart in those engaged in occupations requiring great exertion (1869-71). Fragmentation of the heart fibers was first described by Renaut in 1877. Sir John and Sir William Henry Broadbent have devoted especial study to pericardial disease, particularly adherent pericardium (1895).

Rupture of the heart was first noted by Harvey in his second letter to Riolanus (1649). Morgagni (1761) said it can only occur when the muscular tissue is diseased. It is interesting to note that Morgagni himself died of this condition. Corvisart first described rupture of the chordae tendineae and “verrucose vegetations” of the valves, which he regarded as of venereal origin. This view was opposed by his pupil Laënnec.

The first great contribution to the heart’s pathology was made by Morgagni (1761), who, in his autopsies, found most of the valvular lesions, and connected them with the clinical manifestations. The mitral lesion is particularly associated with his name. Morgagni was also the first to describe heart-block (1761),24 which attained its present status through the classical papers of Robert Adams (1826)25 and William Stokes (1846),26 and the memoir of W. H. Gaskell (1881),27 who produced the condition experimentally. It was Huchard who called the affection “Stokes-Adams’ disease.” Laënnec fully described the sounds and murmurs of the heart in different diseases, and Skoda clearly differentiated the sounds from the murmurs. The second edition of Laënnec (1826) accounts for dilatation, hypertrophy, hardening, softening, atrophy, gangrene, displacement, abnormalities, intercommunication, rupture, fatty degeneration, ossification, tubercle, cancer, serous cysts, valvular lesions, polyps and neuralgia of the heart. The clinical minutiae, which now make up the pictures of these diseases in our textbooks, were added gradually through the labors of Stokes, Graves, Adams, Bouillaud, Hope, Corrigan, Sibson, Andral, Pierry, and many others, followed by the new era of Gaskell and Mackenzie. What we know of the earlier history of valvular disease is contained in Laënnec’s treatise on mediate auscultation (second edition, 1826). Aortic regurgitation was noted by Vieussens (1695), Cowper (1705);28 in more detail, by Hodgkin (1829),29 and in classical form by Corrigan (1832),30 with a superb plate showing the pathological appearances. John Mayow, in 1669, described mitral stenosis; Vieussens gave a good account in 1685; Morgagni, in 1761, gave several autopsies with clinical findings, and with the description of Senac, in 1749, this lesion became familiar to clinicians. King, in 1837,31 first individualized tricuspid insufficiency, which was first noted by Morgagni in his autopsies (1761).

George Whitley, in 1857, gave the earliest complete account of disease of the pulmonary valves. Laënnec said that Corvisart was the first to distinguish by percussion the purring or cat-like thrill (frémississement cataire) in valvular disease. Austin Flint, in 1862, showed that a presystolic murmur can be produced in cases of aortic insufficiency without mitral lesion. Laënnec, in spite of the stethoscope, did little to clarify the diagnosis of mitral disease, which began to assume accuracy in the treatise of James Hope (1832). The early history of pulse-counting (Cusanus, Kepler, Santorius, Sir John Floyer) has been given by Weir Mitchell in his "Early History of Instrumental Precision in Medicine" (1892). The use of the watch in timing the pulse was due to Louis, Graves and Stokes.

In 1632 the Earl of Clarendon in his Memoirs, described a case of angina pectoris in his own father. Morgagni again described it in 1761 and in 1772, William Herberden gave his classical account, which was followed by the investigations of Jenner and Parry. John Hunter suffered from the disease for twenty years (1773-93) and died from it. At the autopsy Edward Jenner found calcification of the coronary vessels. The use of amyl nitrite in the treatment of angina pectoris was introduced by Sir Lauder Brunton (1867).

In 1881 Gaskell first investigated the electrical condition of the heart with a galvanometer. In 1889, Augustus D. Waller first measured and figured the action currents of the heart by means of electrodes in contact with the wet skin and connected with a galvanometer or a Lippmann electrometer. This led to the invention of the ink-polygraph of Sir James Mackenzie, Jaquet's cardiosphygmograph and the string galvanometer of Einthoven (1903). With this instrument and the electrocardiograms obtained from it such conditions as heart-block, auricular fibrillation, paroxysmal tachycardia, pulsus alternans and pulsus bigeminus were closely analyzed and defined by Sir James Mackenzie, James Lewis, A. W. Hewlett and others. Mackenzie and Cushny, with its aid, elucidated the uses and limitations of digitalis. The English periodical Heart, founded in London in 1909, and edited by Thomas Lewis, contains most of these important investigations.

Before the latter half of the nineteenth century, patients with heart disease were usually required to rest and keep quiet. In his treatise of 1854, William Stokes pointed out that "the symptoms of debility of the heart are often removable by a regulated course of gymnastics, or by pedestrian exercise, even in mountainous countries, such as Switzerland or the Highlands of Scotland and Ireland." Gradually the Swedish movements of Ling and the mechanical contrivances of Zander were applied, to be followed by the slow "resistance gymnastics," breathing exercises and protein diet of M. J. Oertel (1884), and the combined exercises, rest and carbonated baths (Naum-heim treatment) of Schott (1880).

The modern doctrine of embolism is almost entirely the work of Rudolph Virchow (1846-56), which was followed by the later
researches of Cohnheim, Bernhard Cohn, Welch and others. Up to Virchow's time, John Hunter and Cruveilhier had firmly established the doctrine that phlebitis is the cause of thrombosis. In 1856 Virchow turned this about by showing that coagulation and other mechanical obstructions of the blood-current may initiate thrombosis with subsequent phlebitis. Bacteriology established the fact that pathogenic microorganisms may set up a phlebitis, in which case thrombosis is again secondary.

A case of malformation of the heart was reported to the Royal Society by Wilson in 1798. Meckel studied the resemblances between these congenital malformations and the hearts of reptiles, amphibians and crustaceans (1802). In 1858 Thomas Bevill Peacock published the first systematic treatise on the malformations of the human heart, an outstanding work which was reissued in 1866, followed by the great memoir of Rokitansky on defects of the cardiac septa (1875) and the fine study of Maude Abbott on “Congenital Cardiac Disease” (1908).

Aneurism was not known to Hippocrates, but Galen knew of aneurism from dilatation and traumatic aneurism, recognizing the thrill in the former. Galen recognized arteriovenous aneurism “as a sequel of careless vivisection and cured a case of it” (Osler). William Hunter described it in classic form in 1757. In 1555, Vesalius diagnosed aneurism of the thoracic and abdominal aorta (case of Leonard Velser) and confirmed his diagnosis at the post-mortem (1557). Fernelius, in his Pathologia (1592), first noted that “aneurism likewise happens sometimes in the internal arteries, especially under the breast, about the spleen and mesentery, where the venous pulsation is often observed” (Osler). Ambroise Paré recognized aneurism by anastomosis, erosion, rupture and injury. “He was the first to suggest the relation of aneurism to syphilis, and he described the noise or blowing sound associated with the tumor, and the frequency of thrombosis in the sac and the occasional calcification” (Osler). Modern pathologists, while recognizing mechanical disturbances of the circulation as an accessory factor in the production of stagnation thrombi, regard a phlebitis as beginning in the outer coat of the vein and proceeding inwardly until endophlebitis is established, so that thrombosis is usually secondary to lesions of the veins, the old Hunter-Cruveilhier view. The syphilitic causation of aneurism was later established by Lancisi (1728) and Morgagni (1761), who also gave Valsalva’s mode of treatment. William Hunter, in his account of arteriovenous aneurism (1775), first separated the true, spurious and mixed forms. The pathology of aneurism was later investigated by Scarpa (1804), Cruveilhier (1849-64), Rokitansky (1850), Hemstedter (1873), Köster (1875) and others. Dilation-aneurism of the aorta was clearly described in 1815 by Joseph Hodgson, who differentiated it from ordinary aneurism, observed its frequency in the arch, its misleading cardiac symptoms, and its association with aortic insufficiency. Trousseau called the latter variety “maladie d’Hodgson.” In 1507 Antonio Benivieni first noticed cardiac thrombi as “polyps” (fibrinous clots) in the heart (Welch). William Wood of Edinburgh described ball thrombi in the left auricle (1814). Recklinghausen, in 1893, described agglutinative (hyaline) thrombi. Trousseau

and Werner, in 1860, first pointed out the association of thrombosis with chlorosis in young women. A detailed history of embolism and thrombosis is given in the exhaustive memoirs of Professor William H. Welch (1909).  

Of diseases of the blood, chlorosis was described by Johann Lange, in one of his Consilia, as “morbus virgineus” (1520). Virchow described the form with aortic hypoplasia and contracted heart in girls (1870). Hemophilia was first described by John C. Otto, of New Jersey (1803), splenic anemia by Guido Banti (1882), aplastic anemia by Ehrlich, leukemia by Hughes Bennett (1845) and Virchow (1845), purpura hæmorrhagica by Werlhof (1735), pernicious anemia by Addison (1849-55) and Biermer (1872), peliosis hæmorrhagica by Sir William Osler (1901), erythema or polycythemia by Henri Vaquez (1872) and Sir William Osler (1903).  

Of the vasomotor affections, symmetrical gangrene was described by Maurice Raynaud (1862), erythromelalgia by Sir James Paget and Weir Mitchell (1872-8), angioneurotic edema by H. Quincke (1882).  

Of diseases of the blood-vessels, phlebitis was described by John Hunter, peripheral arteritis nodosa by Kussmaul and Maier (1866), gouty phlebitis by Sir James Paget (1875), obliterator arteritis by Friedländer (1876). The modern theory of arteriosclerosis owes its origin to the memoir of Sir William Gull and Henry G. Sutton on arteriocapillary fibrosis (1872). Allbutt says that Galen noted degrees of hardness or softness in the coats of the blood-vessels and that Asclepiades ascribes “certain hemorrhages to decay and rupture of the arterial coats.” Morgagni and Haller initiated the pathological study of the arterial walls. Bichat found arterial disease in seven out of every ten men over 60. Scarpa mentions “steatomatous arteries,” Matthew Baillie, coronary atheroma. Peter Frank, Broussais and Bouillaud mistook cadaveric staining of the great vessels for an arteritis. The name “arteriosclerosis” was introduced by Lobstein (1833). Bright associated atheroma with chronic renal disease. Gull and Sutton showed that the red contracted kidney of “Bright’s disease” is only part of a general arteriocapillary fibrosis, and so established the concept of “arteriosclerosis.” The introduction of the sphygmomanometers of von Basch (1887), Riva Rocci (1896), Leonard Hill, (1897) and others revolutionized the diagnosis of arteriosclerosis and Bright’s disease. Patients were found who had arterial hypertension without Brightic symptoms or albuminous urine, and this was supposed to be due to idiopathic hypertrophy of the heart. Von Basch called this condition “angiosclerosis,” Huchard “presclerosis,” Allbutt “hyperpiesis,” Volhard and Fahr “benign essential hypertension,” Janeway calls it “primary hypertensive cardiovascular disease,” and states that its recognition is entirely due to the sphygmomanometer. Huchard actually regarded arteriosclerosis as a “clinical entity” and described what he regarded as its clinical forms (1909). It is now looked upon as a simple pathological lesion incident to various conditions. “To call arteriosclerosis a ‘disease,’” says Allbutt, “is not pathology but necrology.”

This history of arteriosclerosis is derived from Sir Clifford Allbutt’s splendid work on “Diseases of the Arteries,” London, 1915, I, 3-18, and passim.
The earliest blood pressure observations on a large scale were made by Richard C. Cabot in 58 cases (1903). Joseph Erlanger, Potain, Janeway and others have done much in this field. Janeway says there were only twelve references to blood pressure in 1886; in 1915 he had over a thousand.\textsuperscript{56} The advantage of the sphygmomanometer over the fingers and the sphygmograph has been well brought out in Allbutt’s work on “Diseases of the Arteries” (1915). He points out that every new instrument of precision has been ridiculed by conservative, old-fashioned physicians as “pauperizing the senses.” But the truth is that these instruments, “far from pauperizing our clinical perceptions, have, on the contrary, enriched, enlarged and corrected them.”\textsuperscript{57} Gibson of Edinburgh said “the sphygmomanometer had taught him how fallacious the finger may be.” So, too, the polygraph and the string-galvanometer have given us records of the heart’s condition which are to the clinician what the printed notes on the musical staff are to the musician. As any one with a good musical ear can whistle or hum a tune he has

\textsuperscript{56} Janeway: op cit., 29.
\textsuperscript{57} Allbutt: op cit., 61.

\section*{THE SONS OF SYDENHAM}

Conspicuous among the physicians of the seventeenth century, great among those of all time, is Sydenham. In early life an officer, one of five brothers who fought in the army of Parliament, he remained loyal to the memory of the Protector, and his doctor’s garb covered through life a soldier’s love of action and decision. He brought us back to the near study of nature, taught us to look at it clearly, to derive our knowledge wholly from it, and he stands out in history the very embodiment of the insight and practical character of his race. He had but little respect for mere authority, and it is to be feared that, had he lived a hundred years before the time he did, he would have been cited with Geynes before the Royal College of Physicians for impugning the infallibility of Galen, and would not have recanted. To him everything was observation, experiment. He pointed the way for advance in our science, and happy would he have been if he could have seen the sons of his intellect and endeavor who, following in his path, have made Medicine what it is; for these sons are Jenner and Bright and Addison, and Corvisart and Andral, and Skoda and Frerichs, and the eloquent Trousseau, whose delight it was to quote him, and our own truth-loving Flint.

J. M. Da Costa (1891)
THE JETONS OF THE OLD PARIS ACADEMY OF MEDICINE
IN THE NUMISMATIC COLLECTION IN THE
ARMY MEDICAL MUSEUM AT WASHINGTON, D.C.

By ALBERT ALLEMANN, M.D.

URING the early years of the
Library of the Surgeon General’s
Office, a number of medical med­
als were presented to it by pri­
vate parties. This led Col. Billings, the
creator of the Library, to the idea of estab­
lishing a collection of medical medals. He
went to work with his usual energy so that,
in 1888, he had gathered more than 1500
medals and jetons. In that year he gained
the services of Dr. William Lee of Wash­
ington, a man well versed in medical his­
tory and numismatic lore, to arrange the
collection. Dr. Lee made a card catalogue,
describing and interpreting each medal on
a separate, numbered card. As Col. Billings
had charge of the Medical Museum as well
as the Library, he placed the medals in the
Museum, where they are now exhibited.
After Billings left the Library in 1895 the
collection was continued from year to year
by his assistant, Mr. Myers, so that at pres­
ent it contains more than 3000 medals.
After Mr. Myers’ death, the addition of
new medals to the collection by purchase
was discontinued for a long time, but Col.
William O. Owen, the present officer in
charge of the Army Medical Museum, has
taken a renewed interest in the subject and
has added a number of valuable pieces, in­
cluding those struck off by the Paris mint.

One of the most interesting series of
medals in the Washington collection com­
prises the jetons of the old Academy of
Medicine of Paris. They range from 1638
to 1793, when the corporation was dis­
sovled by the Government of France. It
was a very old custom of the Paris Medical
Faculty that whenever a new Dean was
elected, which took place every two years,
silver or bronze jetons were presented to all
the members of the Faculty. The Dean was
not a professor. He had exclusive charge of
the administrative business of the Faculty.
But he also kept the minutes of the Trans­
actions of this learned corporation, and
these minutes, from 1395 to 1792, still exist
in manuscript and form a complete history
of the Medical Faculty of Paris.

When the practice of striking jetons at
the election of a new Dean was initiated is
not known. The Transactions of the Fac­
ulty mention a jeton as early as 1398, but
the older jetons are now all lost and it is
probable that the custom was not regularly
followed until 1638, when the Faculty de­
cided to strike jetons regularly on a uni­
form model at every election of a new Dean.

Jetons are not medals in the full sense of
the word. They differ from them in that
their imprint is flat like that of a coin. Med­
als are cast while jetons are struck. Jetons
are usually of small size, rarely larger than
our silver half dollar. The French jetons
have all a diameter of $\frac{1}{2}\frac{1}{2}$ inches.

These jetons of the old French Academy
of Medicine are now very rare. Many are
entirely lost. The most complete collection
is in the possession of the Bibliothèque
nationale at Paris. The Academy of Medi­
cine of Paris possesses 108 pieces. Next in
completeness is probably the collection in
the Army Medical Museum at Washington
which has no less than 91 of these rare je­
tons.

From 1638 to 1793 there were in all 65
Deans. Philippe Harduyn, who was Dean
from 1636 to 1638, was the first to be hon­
ored with a jeton of the new model. The
jeton shows on the obverse the coat of
arms of Harduyn with the legend: Decano M. Philip. Harduyno de Saint Jacque. On the reverse is the coat of arms of the Medical Faculty of Paris, viz.: three storks in a row turned to the left, each one with a laurel branch in his beak. The inscription is: Urbi et Orbi Salus. In exergue: Facult. Medic. Paris. 1638. All the early jetons show merely the coat of arms of the retiring Dean on one side and on the other the coat of arms of the Medical Faculty.

Guy Patin (1602-1672) was the first to place his own effigy on the obverse instead of his coat of arms. He was Dean from 1650 to 1652. The jeton shows Patin's head to the right with the legend: M. Guy Patin Doien. 1652. In exergue: Felix Qui Potuit. The M. stands for Maitre (Magister). In the Middle Ages, the Medicinse Doctores called themselves “Magistri in medicina” and the Deans of the Paris Medical Faculty retained this ancient title long after it had been abandoned by the medical profession. “Felix Qui Potuit” is the beginning of a passage in Virgil's Georgics.1

The reverse shows the usual three storks of the Paris Medical Faculty. Patin is chiefly known by his Lettres, which were published in 1713. He was not an originator of new ideas,—he even opposed Harvey's great discovery,—but he was a man of an independent mind, he despised the hollowness and formalism of his time and mercilessly exposed the weaknesses of his contemporaries.

The five Deans who succeeded Patin reverted to the old custom of placing their coats of arms on the obverse of their jetons. Antoine Morand, who was Dean from 1662 to 1664, again placed his own effigy on the obverse of his jeton. From now on the jetons regularly show the image of the retiring Dean, and the coat of arms of the Medical Faculty on the reverse is frequently replaced by other designs.

François Le Vignon was Dean from 1664 to 1666. The obverse of his jeton bears the inscription: M. Fr. Le Vignon. Cond' Es- et Doien. As he carries the title Conseiller d'état, Moehsen² supposes that he was body physician to the queen. The reverse of the medal shows a bare arm thrust forth from the clouds, the hand throttling three serpents. The legend is: Contero Monstra. This refers to the decree of the French Parliament of 1666 which decided the long controversy among the French physicians about antimony in favor of those who advocated its value in medicine.

From 1666 to 1668 the Deanship was held by Jean Armand de Mauvillain. His jeton shows on the obverse his effigy by Du Four. The reverse presents the giant

1Felix qui potuit rerum cognoscere causas
   Atque metus omnes et inexorabile fatum
   Subjecit pedibus, strepitumque Acherontis avari.

Polyphemus lying prostrate, while Ulysses puts out his eye with a burning torch. The circumscription reads: Vero Lumine Ceccat. Polyphemus represents François Blondel, who was one-eyed. Blondel was one of the chief opponents of antimony but lost his lawsuit against the Medical Faculty. Mauvillain is chiefly known by the enmity he bore to Molière. He fell out with Molière's wife and the latter took revenge by inciting her husband to ridicule the haughty physician in *L'Amour Médecin*, in which one of the four physicians is supposed to represent Mauvillain.

From 1696 to 1700, the Deanship was held by Jean Boudin. The obverse of his jeton shows his bust to the right. The reverse represents the centaur Chiron leading young Æsculapius to a distilling apparatus. The inscription is: Servat et Docet. In exergue: Facult. Medic. Paris. Anno 1700. Boudin was the first Dean to hold the position for two successive terms.


It seems Fagon owed the honor of having his bust on Vernage's jeton to the fact that he was at that time President of the Medical Faculty. Fagon was in 1703 66 years old and Vernage, who was then scarcely forty, honored his older colleague by placing the latter's effigy on the jeton of his administrative term.

While a Dean was usually elected only once for a term of two years quite a number held the position for two terms. Besides Jean Boudin, mentioned above, Armand Douté (1716 - 1720), François Geoffroy (1726 - 1730), Jean - Baptiste Boyer (1736 - 1760), Louis Alleaume (1774 - 1778), and several others were elected twice successively. René Le Thuillier (1768 - 1774) and Claude Bourru (1788 - 1793) were elected for three successive terms.

None of these men of the old Paris Medical Faculty gained eminence in medicine. While England, during the same period, produced such men as Harvey, Sydenham, Willis and Mayow, French medicine was barren. "The physician had become a sterile coxcomb," says Garrison, "red-heeled, long-robed, big-wigged, pompous and disdainful in manners. Among themselves the physicians were narrowly jealous of their rights and privileges, regarding their fraternity as a closed corporation yet eternally wrangling about theories of disease and

---


4 Garrison, History of Medicine, Phila., 1913.
current modes of treatment.” The facsimiles of the jetons accompanying this article afford a striking illustration of this fact.

Claude Bourru was the last Dean of the old Medical Faculty of Paris. In 1793 the Revolutionary government of France, which swept away so many mediaeval spiderwebs but in its mania for reforms also did away with many useful and salutary institutions, abolished all scientific corporations and societies, among them the Academy of Medicine of Paris. The practice of medicine was freed from all restriction. It was soon found, however, that the country could not get along without a recognized medical profession and in 1795 the three so-called Ecoles de santé of Paris, Montpellier and Strasbourg were established. Napoleon I, the heir of the Revolution, did not restore the Academy of Medicine. The old corporation had enjoyed great freedom and many privileges and had always been very jealous of governmental interference in its internal affairs. This, of course, did not suit an autocratic mind like that of Napoleon. It was not until 1823, under Charles X, that the Academy of Medicine of Paris was reestablished. But the old custom of striking jetons at the election of a new Dean was not renewed. This is perhaps to be deplored. It was certainly a beautiful custom, which was imitated by many European scientific societies. 

While the old Faculty of Medicine of Paris was barren of men distinguished in medical science, the new Academy at once opened up with a galaxy of illustrious names. In looking over a collection of medical medals Billroth once remarked that “not a single one of them had been struck off to commemorate anything more than respectable mediocrity.” This was true of former centuries when men of merit in medical science were rare and when positions of power and influence were entirely due to birth and wealth. It is not true to-day, for at no time have merit and true worth been more recognized than in our democratic age. Of this the French medals struck in honor of medical men during the 19th century give ample proof. The Washington collection includes a large number of these medals, which have beside their medico-historical importance great artistic value. Among the men thus honored are Corvisart, Dupuytren, Larrey, Pinel, Bernard, Chauveau, Ollier, Pasteur and many others.

BIBLIOGRAPHY

158 Annals of Medical History

Corlieu—L'ancienne Faculté de médecine de Paris, 1900.


Rudolph—Index numismatum. Berolini, 1823.


The photoprints accompanying this article, slightly enlarged, are taken from copper engravings in Moehsen’s “Beschreibung einer Berliner Medail lensammlung,” as it was impossible to make good photographs from the actual medals, though most of them are still well preserved.
THE HISTORY OF INFECTION¹

By ARNOLD C. KLEBS, M.D.,

WASHINGTON, D. C.

Not only among the Greeks and Romans who still are our principal schoolmasters, but long before them there existed in human language a term to designate the process of infection. It did not always have exactly the same significance which it now has. Tradition preserved for it a certain basic meaning; and convention, according to varying necessities and changing interests, modified its application. This is only the natural variation to which all terms are subject and one of the reasons why it is so difficult for us to enter into the thoughts and activities of former generations and fully profit by their experiences.

When the Roman used the verb “infectare” it conveyed to him not only the literal sense of putting one thing into another, but with the qualification that the “infected” object is altered in appearance or effect and chiefly so as to render it unpleasing, harmful or corrupted.² Now, this corresponds in general to our own use of the word and indeed one might think that we chose it for that very reason, making it only more precise and limited. As a matter of fact we had no choice. The term came down to us gradually through all the intervening generations, even preserving its Latin form. It is evidently the importance of the underlying idea which it expresses intelligibly that has preserved it, and this idea is neither Roman nor Greek, but simply human. It offers an appropriate word-picture for something of daily incidence and vital importance. It relates the cause with the effect and thus becomes the word-symbol of a primitive etiologic concept. Words of this kind have a much greater vitality than the more artificial nomenclature of philosophy and science.

Since we have become acquainted with microorganisms and their rôle in diseases, etiologic research, because of its tangible object, has exerted a determining influence on medicine. It has gone almost to the extreme of making etiology and bacteriology synonymous terms. Infection to-day means, if we take it in the broad definition of Hektoen, “the entrance into the body of living agents, capable of multiplication, most commonly microbes, which then cause disease.” The microorganism as the determining factor of infectious diseases, the specificness of the infection and the invariability of microbic species make this the dominant theory of the day in medicine. Its profound influence is felt in private and public life to a degree unparalleled in the annals of human society. So dominant is this doctrine that the question is hardly ever asked: might there not be, apart from the microbe, pathogenic influences of equal if not of greater importance?

Even those who vindicate for modern scientific research its freedom from dogma (Hamilton) adhere to the all-importance of the living agent in the causation of disease. The others, the followers of Koch, whose labors, they say, have brought the question to “a certain and unequivocal conclusion,”

¹ Subject of an address delivered before the Biological Club of the University of Chicago and the Historical Society of Washington University, St. Louis, in December, 1916.

² The adjective and noun (injectus and infectio) had more the sense of our “ineffective,” while “infectus,” at least in Vitruvius, is the thing altered, infected, particularly dyed or colored.
proclaim proudly that the doctrine, even in its most restricted sense, ought to have been long ago "established as a fixed dogma" on the basis of historical tradition and by every-day observation. Here we have in modern times a contrast between empiricism and dogmatism which in the past has led to so many wasteful and sterile conflicts. It is immaterial whether the basic theory on which both are agreed was obtained by syllogistic reasoning or by experimental demonstration, neither is concerned with the continuous reality as it appears to immediate intuition; for practical purposes this is broken up into elements, and fixed by verbal symbols (or images of objects) later to be artificially reconnected.

Most of the historical surveys of the doctrine of infection are nothing but panegyrics of the current doctrine, showing past errors or an assumed evolution from vague unconscious gropings towards that final perfection represented by modern achievements. While entirely legitimate, this kind of historiography can give only an inadequate understanding of human thought in the past and no clear outlook into the future. The higher task of history is to study critically the ideas of man about living nature, in the same way that the biologist studies the various phenomena of the organism itself, to promote the understanding of basic principles. If we study the records of the past with this aim before us, we perceive that the concept "infection," although assuming, from time to time, for practical purposes a varying, transitory significance, tenaciously retains a fundamental and primordial relation to disease, possibly identical to the one ingestion holds to growth and sustenance, or fertilization to the propagation of the species. Such generalization may be deemed unscientific and contrary to the admonition that the historical student should record rather than interpret. But there can be no doubt that the endeavor to disentangle from history the leading and connecting threads adds zest and vitality to the search and no harm is done provided true facts are given without distortion.

The Annals have brought in the last number an illuminating study by Dr. and Mrs. Singer on Fracastoro, the first clear exponent of the theory of infection as we now understand the term. The essay shows very well how the mind of a cinquecento scholar, unaided by the microscope and bacteriologic technique, could formulate what we believe has now been determined as a scientific fact. But there can be no question that the same idea was in the minds of uncounted generations before Fracastoro. To analyze some expressions in available literature that seem suggestive in this direction is the task I have set for myself in the following.

Babylonia and Assyria

Civilizations which have endured for such long periods as did those of the ancient Babylonians and Egyptians must have been founded and advanced by very practical people. Their efforts and thoughts, while in form differing from ours, must have been directed to the realization of very similar aims. Their evident success, if nothing else, must command our attention, although some are inclined to dismiss as superstitions most of the ideas we encounter among them. Perhaps it would be more profitable if we used the word "superstitions" in Lowell's sense as marking the world's "unfinished business." Are we not apt to overlook the fact that the primitive man, when he tries to promote his understanding of the world by attaching a name or some figurative symbol to the invisible power which he feels affects him in some way,
does nothing essentially different from what we are doing all the time? "Seeing is knowing" guided him as it guides us, and the superstitious awe of which we hear so much blinded him far less than is usually thought. Beneath the complex texture of his mythology we find, if we only look for it, frequent evidence of most minute observation and the utilization of experiment.5

Theurgic and numinal concepts form the basis of the nosological nomenclature of the ancient Babylonians and Assyrians. The study of cuneiform inscriptions has opened our eyes to a new world. The texts which deal with incantations, divinations, conjugations (exorcisms) and the like contain a great deal of information on medical subjects. The priest, who filled the place of the physician, as so often in history, used these texts as a sort of practical guide book in his daily routine. They were to lead him to diagnosis, prognosis, prophylaxis and treatment of human ills. The compilation of the most important ones can be traced to the non-semitic priests and magicians who practiced their craft before the advent of the semitic Babylonians (dated variously between 5000 and 4000 B.C., or roughly, before 3000 B.C.). The excavations of the great library of Asurbanipal (668-626 B.C.) at Nineveh brought copies of them to light.

For infectious diseases the most important series is that of incantations against the special disease demons and fever sickness (ekimmu and asakki maršătī) or the "incantations against the appearance of the dead." Consciousness of regret and fear, evoked by the memories of those that have passed away, sublimized by the mystery of death, these are the principal sources of the belief in the troublesome ghost. The idea of the entrance of the demon into his victim is not always clearly expressed. The incantation, which is really the prayer of a troubled soul, has the sense: "Let them accept this offering and leave me in peace."

In the divination series the same ideas prevail. They form a minutely worked out system of prognostics, based partly on observation, partly on hypothesis, intended to serve individuals as well as the king or state. The elaborate descriptions of the birth omen and liver omen have evoked great medical interest because they revealed an unexpected knowledge of anatomical detail. From one of the liver-texts we learn of the mangu-disease, an infection of the throat which seems to have appeared as an epidemic, something like diphtheria, and another of the face which has been identified as erysipelas.6 There is naturally a great deal of arbitrariness in this nomenclature of diseases in which it is often difficult to distinguish whether the demon or the disease that he is supposed to have produced, is intended. Still, whether demon or disease, we have quite a number of names which are thought to specify infectious diseases as, for instance: Bennu, sasatū, sakikkū, batu, mursu, si-ib-tu, ummu, buntu, li'bu and in a class by themselves sidanu and miktu.7

While religious cult, just as scientific research, produces a large and somewhat mysterious nomenclature, the language used to define personal property in sale or purchase strives towards clearness and circumscribed precision. The right of the purchaser of a slave to return the same to the seller at the original price after a certain, stipulated period, in case of an illness or defect which was not obvious at the time of sale, was recognized in the famous law

---

5 Thus we see, for instance, on various Assyrian monuments some divinities depicted in the act of fertilizing manually the flower of the date palm.
6 Cuneiform Texts, Part xxviii, 43; and for many further details the works by Jastrow: "The Civilization of Babylonia and Assyria," and "Religion Babyloniens and Assyriens," in three volumes, which contains translations and discussions of numerous texts (incantations and divinations). Phila., 1915.
Slave contracts based on this law have come down to us in great number not only from Babylonian, but also from Assyrian, Persian, near-Asiatic and finally Greek times. Since the diseases are usually stipulated by a name in these contracts and their most striking traits defined by the practical exigencies of the contract, it was hoped that their study would perhaps bring out more precise details about the ancient knowledge of a circumscribed group of diseases. As a matter of fact it was found that also here accurate identification offered great difficulty and that it was much wiser to be satisfied with the general information obtained.

It is fairly generally agreed among experts that the two names bennu and sibtu which are found most frequently in these contracts were meant to designate those diseases or defects whose occurrence could invalidate the sale. Non-medical Assyriologists were quick to identify them in various ways. Fever and ague (Harper, Jensen), syphilis (Ungnad) and lepra were in turn proposed. Sudhoff, by a very interesting and ingenious argument based upon a mass of corroborative evidence, has come to the rather startling conclusion that both terms together were meant to indicate a seizure of epilepsy. This would put the subject apparently out of consideration in this place. But epilepsy and other psychotic and neurotic affections have been regarded through long epochs as caused by infection, and the term psychic infection is occasionally heard in our own day, so that we may be permitted to devote a little time to Sudhoff’s translation of bennu and sibtu, inasmuch as the material he adduces allows possibly a different interpretation.

Assyriologists derive the word bennu from a Sumerian ideogram which stands for muscle or tendon, and hence they give as the literal translation “the disease of the muscles.” In later contracts, made by Greeks in Asia Minor, Sudhoff found the word ἱερὰ νόσος (“sacred disease”) in the same place inserted with one or two other names of diseases. This he considers definitely identified with epilepsy and hence he concludes that in the Babylonian contracts the word bennu also is meant to designate a disease characterized by spasmodic attacks which incapacitate the victim and by periods of latency might deceive the purchaser. This is quite plausible, but it might be objected that the muscle spasm would not necessarily be the most striking symptom of the attack so as to impose the special name, also that we have no evidence that epilepsy occurred frequently enough to make a special legal provision against it desirable. However this may be, only Assyriologists assisted by medical men can decide the matter. There is, however, a disease the enormous frequency of which in antiquity is abundantly demonstrated by palæopathological findings and which, so far as I know, has never been mentioned in connection with bennu—I mean osteo-arthritis deformans. From the findings in Egyptian mummies we know that it led to marked deformity, such as we see no more, and also that it attacked already relatively young individuals. That it might have appealed as a “rheumatic” muscle disease any modern sufferer of the trouble will readily testify, and thus the terms bennu and rheuma are about on a par as regards etiologic lucidity.

Whether the word sibtu stands for a different disease from bennu, or whether it simply means, as Sudhoff thinks, “seizure” or “attack,” derived from the verb sabatu “to grab, to seize,” is still an open question. Undoubtedly it has been used in various senses, but it seems quite established.
that it designates rather a general concept than a special object and that this corresponds to the Latin *inficere* is more than likely. Very similarly the Greek ἐπαχή is used later in connection with lepra, the verbal derivative of which Thucydides employs to designate the infection, in his famous account of the Attic plague, so that Sudhoff considers the Greek word a literal translation of the Assyrian term. The Hebrew word nega very similarly determines saraath and the two together are translated in our Bible as "the plague of the leprosy."

A series of Babylonian tablets is devoted to lists of animals and plants showing, not only a considerable knowledge of fauna and flora, but also that degree of careful observation necessary for a systematic classification. The latter does not always correspond with ours but that need not disturb us unless we are ready to assume that our classification will survive the next 5,000 years. The Babylonian recognized perfectly well the rôle which certain of the smaller animals played in those diseases which for some reason or other we consider, as parasitic, different from the other infectious diseases.

Dr. F. von Oefele has made a special study of Babylonian entomology and with great courtesy he has put his notes on the subject at my disposal. The texts begin with the large class of zumbu, the fly, in which are enumerated several diptera and hymenoptera. Their names are determined by those of their various hosts and also by water, stone and other objects, or foods for which they showed a predilection. The fly as the symbol of the god of destruction and pestilence, Nergal, appears quite often in pictorial representation as a special emblem, so for instance on a seal cylinder in the collection of the late J. P. Mor-}

10 Nergal is represented in the company of 14 demons over which he has command. They represent various evil influences, some of which surely are diseases, especially fevers. Ungnad in Gressmann: Altorientalische Texte und Bilder, I. p. 69 gives their names as follows: 4. mutabriku, 5. sarabdu, 6. rabisu, 7. dirit, 8. ibitu (?), 9. bennu, 10. sidanu, 11. mikit, 12. bel-abri (?), 13. umnu, 14. ibu. Bennu here heads five others which all stand for various degrees of heat, indicating possibly feverish diseases. (See Sudhoff, op. cit., note 7.)

11 "A lous is a worme with many fete & it commeth out of the filthi and onclene skynne . . . . " Book of the Quinte Essence (ed. Furnival) p. 19.

12 He adds: "It is Mongolian in common; from the time prior to the separation of Mongolian and Indian. It entered Babylonian medicine through the Hittites, whom I consider with the Etruscans and other peoples as Mongolian, split off from them somewhat like the Huns."
Bible has acquainted us. Of course it has been intensively studied, but still many puzzles remain to be solved. It was a revelation when not long ago, in Crete, traces of a very high (Minoan) culture were found, one which antedated considerably that of Mycenae, Troy and of classic Greece. We have also not yet found out about the Hittites, and much remains equally uncertain about the Philistines who seem to have come from Crete. It is in the accounts of the wars between the Jews and the Philistines that we find an early reference to our subject. (11 Sam. ii 3.) When the Israelites were hard pressed by the Philistines they sent, as a last resort, for the Ark of the Covenant to be brought from Shiloh to the front. The Philistines speedily captured it and took it in triumph to Ashdod where it was exhibited in the temple of Dagon. The result was that the statue of Dagon fell down and broke its hands. Then the plague broke out in the town and spread along the coast. This “plague of emerods” is usually identified with the bubonic plague. The subsequent spread of the plague is expressly connected with the arrival of the ark in those three places to which it was in turn removed. During its sojourn of seven months in Philistia it must have done a great deal of harm, and at Ekron, its last station, it was finally decided on the advice of the “priests and diviners” (vi, 2) to send the ark back to the Israelites with an appropriate trespass offering. This was to consist of five golden emerods and five golden mice “according to the number of the lords of the Philistines.” These offerings, the text states (vi, 5), were to represent “images of your emerods and images of your mice that mar the land .. . to lighten his hand from off you, and from off your Gods, and from off your land.” These offerings were to be placed into a separate coffer beside the ark, and to be delivered at the frontier to “those of Beth-shemesh.” Here once more the ark proves troublesome, killing some 50,000 people “because they had looked into the ark” (vi, 19). This last outbreak of the plague among the Israelites themselves would seem to emphasize the authenticity of the story. It was a plain and recognized case of infection per fomitem, independent of theurgic influence.

Another epidemic, several hundred years later, is also briefly mentioned in the Bible (11 Kings xix, 36). This time the “Angel of the Lord” smote 13,000 Assyrians of the invading army of Sennacherib (705-681).18 Herodotus (ii, 141) gives more details about this plague and connects it somehow with mice. According to an Egyptian tradition, the Assyrians were decimated through the intervention of the God Ptah in the rôle of a pestilence deity. This Ptah had a temple at Thebes where he was represented holding a mouse in his hand. We see in all these tales, the mouse creep in somehow. Offord states also that votive mice modeled in silver were found in a river on the Syrian coast, near Sidon, and that mice are carved on Phoenician and Punic monuments. A deity of the latter, Esbmun, was, it appears, equated by the ancients with Æsculapius and that his cult was very similar to that of the “Smintheus” who inflicts the pestilence upon the Greeks before Troy (Iliad, i, 53). Smintheus is the “mouse-god” alternative of Apollo. Other gods with mice attached to their images or receiving offerings of mice were ATM, the associate of the hawk-headed sun god RA of Egypt, the Reseph (Dagon?) of the Philistines, Phoenicians and Cypriotes, according to Offord, worshiped also by Hittite and Syrian tribes.

13 Isaiah xxxvii, 36: “when they arose early in the morning, behold, they were all dead corpses.”
One should think that the correlation of plague and mice, evidently noticed in such remote ages, would have impressed the bacteriologist earlier, inasmuch as we can follow it to the threshold of our times as a historical common-place. When Nicolas Poussin in his famous painting, now in the Louvre, of the "Pest of the Philistines," has rats among the crowd of victims in front of Dagon's temple, he found more justification for doing this in practically all the accounts of plague that he might have consulted, than in the rather meager evidence of the Bible. But it would not be sound reasoning to conclude that all this historical evidence must be taken as vague anticipations of present conceptions. Even the use of mice or rats as emblems of plague divinities, or their models as votive offerings is not necessarily conclusive. One must not forget that all these divinities were the controlling forces of all kinds of destructive calamities, for the prevention or removal of which they were implored. The mouse, all by itself, represented one of the most dreaded plagues to an agricultural people and thus may have been symbolized without any reference to the plague in man. Aschoff (Janus, 1900, v) tried to get to the bottom of the question why the mouse should have symbolized the plague. From a comparison of the passages in the Vulgate and the Septuagint he suggested that the votive offering might simply have attempted to reproduce the size and shape of the bubo. But from the passage in 1 Sam. vi, 5 it is quite clear that models of both bubo (emerod) and mouse were offered, each apparently for a specific purpose. The custom of offering in sacrifice to a deity models of organs or of symbols of disease is also very ancient and, as is well known, persistent in our day. It is of great interest and has an indirect bearing on our subject because these models were probably thought to draw away, specifically, the anger of the deity from that part of the patient's anatomy. The Hebrew "scapegoat" and the Greek "pharmakos" are simply variations in form of the underlying idea.

More important than the decision of the question whether the Hebrew recognized the relation between mice or rats and the plague is the very clear account given of the transmission by fomites and the comparative silence about direct transmission from individual to individual. From the sanitary point of view the decision of the relative importance of these two factors has a definite significance and as it is still under discussion it is interesting to note that the ancient Hebrew apparently decided it in favor of those moderns who oppose the extreme contagionist stand-point in plague prophylaxis.16

The concepts of the insect pests among the Biblical people are largely derived from the Babylonians. Thus the fly, the mosquito and other diptera play also with them a rôle in cult and elsewhere. Ekron, which we have already mentioned as one of the stations of the Ark in Philistia, held an ancient and famous shrine dedicated to Baal-zebub, which name, literally translated, means the "Lord of flies." Macalister identifies Ekron, not with Akir as is usually done, but with the modern Dhikerin farther south, near which still exists Deir edh-Dhubban, "the convent of the fly." The shrine of Baalzebub was so famous for its oracles that the Jewish king Ahaziah, when ill, sent to consult it, disregarding thereby the general prejudice of the orthodox against foreign divinities (11 Kings i). This Baalzebub, who only later in official demonology became one of the governors of the Infernal Kingdom of Lucifer, represents, as fly-averter, a very ancient and widely prevalent anthropomorphic conception. He is surely a Babylonian importation, probably even older. He and his female counterpart Ashtoreth (Astarte, Ish-
tar), so popular among Assyrians, Phoenicians and Canaanites, proved very tempting to the Jews whose leaders painted them so black that their devilish reputation has long survived. The deep appeal which these, we may call them etiological, divinities exerted upon the human soul, is a very interesting fact to note, as well as the opposition which they encountered from the learned. It is also known that Hippocrates had to warn his pupils against the demoniacal theory of disease. Baalzebub of Ekron and the BaalBerek (Berith) of Shechem (in the Talmud) was known to the Greeks as the Βααλ μῦιαν and probably directly transmitted into their own cult as the Olympian Zeus Apomuios, of whom Pliny speaks in his Natural History (xxxix, 34), where he also mentions the use of fly ashes in the treatment of alopecia "to drive away the fly." All these are only echoes of the Elamite and Babylonian rites, brought out by the French excavations at Susa, fixed by the fly-emblem already alluded to. The curious persistency of the popular association of health and fly is illustrated by a pretty story Macalister (I. c.) tells about the healing spring of St. Michael in Kirkmichael (Banffshire) which, in popular tradition, had always been presided over by a fly and the neglect of which as late as 1820 was deplored by an old man who "in the days of his youth enjoyed the pleasure of seeing the guardian-fly." Deeply rooted in the folk soul is this old and ever-young concept of this relation of fly and health; and as we watch the "burnt-offerings" of hecatombs of trapped flies rising to the skies from the camp fires of the U. S. Army we do not seem to be so very far from Babylonia. More closely in concordance with our views on infection are the prophylactic laws against the saraath (the collective name for lepra and similar diseases) which are recorded in the famous chapter xiii of Leviticus, a book which is known to date from the Babylonian phase of the Jewish people. It became the prototype for similar sanitary legislation close to our own times and led to the provision of institutions which we have every reason to admire. It is indeed the current opinion that the wide distribution of the leproseries throughout Europe was mainly responsible for the gradual disappearance of lepra toward the end of the Middle Ages. It is difficult to understand how again and again the opinion can find utterance that these measures were not based on the fundamental recognition of the infectiousness and transmissibility of the disease, because of the demonial prepossessions in the minds of the Jewish law-givers. It is not my intention to enter into this subject fully although in the concatenation of facts it is one of the strongest links. My desire is to bring out facts which are not so clearly self-evident. Morris Jastrow, Jr., has recently discussed the subject (Jewish Quarterly Rev. IV, 357). His view is that the laws are mainly based on the demonistic theory of disease which must not be confounded with our own bacterial theories and that the remedies were not used against the disease but against the demons to whom they were distasteful — pharmacology gradually evolving out of demonology. This is, of course, one way of looking at the matter, but it fails to go to the core of it. J. H. Alexander, on the other hand (Med. Press and Circular, London), following Clerk Maxwell's famous example, substitutes in certain ancient accounts bacteriologic terms for the demonistic ones. Finding them to fit well, he asks whether this is due to mere chance or whether the Ancients did not anticipate to some extent


18 That in our days grave pathogenic possibilities of the fly are recognized is clear from a large special literature which has been admirably reviewed by Henry G. Beyer: The dissemination of disease by the fly. N. Y. Med. J., 1910.
in their crude ideas and beliefs the theories of modern science.

EGYPT

The views the ancient Egyptians entertained about diseases and their causes are much better known than those of the peoples we have just discussed. The differences are in form rather than in substance. I shall content myself to select only a very few examples out of the rich harvest of archeologic research.19

The disease-making possibility of the worm seems to have been uppermost in the Egyptian mind in all times. Worm diseases being very prevalent, this cannot astonish. But that the relation of worm and disease should have been established in ancient time in those cases where only the minutest examination can reveal the parasite, would seem remarkable indeed. Herodotus gives an account of a regulated inspection of the meat which was destined for sacrifices. It shows among other things that the inspector, the priest, was on the look-out for such small invaders as the cysticercus. When only parts of the animal were sacrificed, the rest was available for consumption and so the inspection may have had a direct hygienic intent. But meat was not the main diet of the Egyptian. Cereals, vegetables and fruits were the staple foodstuffs, but to them must be added as of considerable importance the air-dried fish, at least for the early Egyptian. This latter fact allows us to identify a tape-worm for which there is a hieroglyphic sign:

![Hieroglyphic Sign]

i.e., the pend-worm, with tolerable probability as the botrocephalus latus, whose cysticercus lives in freshwater fishes. The taenia solium and other cestodes may of course have occurred also, but for the former this is not very likely since pork as a whole was despised as food.

The Egyptian anaemia, still very fatal, seems to have been known to the ancient Egyptian. At least a description in the Papyrus Ebers has been interpreted in this sense. Here it is stated that the fatal disease was sent by the God of Death, ååå by name, to both sexes, causing abdominal and other pains, bloody discharges. As its immediate cause the worm Neltu is named. Scheuthauer, Joachim, Finlayson identified this ååå-disease with the fatal anaemia caused by the ankylostoma or uncinaria duodenalis, i.e., our hookworm disease. This restricted identification has lately been disputed on very interesting grounds.20 Pfister opposes very rightly the tendency of identifying too closely with modern concepts those ancient descriptions which covered broad complexes of symptoms and not pathologic entities. He demonstrates that very similar symptoms are caused by the schistosoma haematobium in that equally fatal disease Bilharziosis, which attacks in some places as many as 70 to 80 per cent of the population (as against 25 per cent of ankylostomiasis). That Bilharziosis most likely entered into the concept of the ååå-disease, Pfister sees in the fact that in the hieroglyphic sign for the ååå-disease, the phallus is the determinative:

![Hieroglyphic Sign]

If this is so, it would indeed be good evidence, for as he shows in typical pictures, the urethritis with subsequent enormous tumefaction of the penis, as the most striking symptom, would have amply justified the use of this determinative. No other than these two worm diseases seem to have been considered

19 For further detail see the brilliant articles by F. von Oefele: Studien über die altaegyptische Parasitologie. Arch. de parasitolog., Paris, 1901 and 1902, iv and v.

and around this of course hinges the whole question as to what diseases are comprised in the åaa-disease, a question which only the Egyptologists are competent to decide.\(^2\) If the Egyptians could detect the worm as the cause of the disease, it is astonishing indeed, given its small size (about 10 mm. length, the schistosoma being a little longer than the ankylostoma) and the fact that it is not readily observed in the excretions.

CLASSICAL ANTIQUITY AND AFTER

As we leave the era of these remote peoples and approach the one we know better and recognize as the basis of our culture, we seem to notice the gradual development of circumscribed, almost tangible, notions about the subjects which have occupied us. There we saw man apparently satisfied with the vague connection of primordial ideas, apprehended more by feeling, by intuitive perception, than by reasoning. Here he seems to have discovered systematized thinking as a new instrument by which he could with certainty approach the riddles of the material universe and of life, in order to satisfy that new craving for knowledge which had come over him. We saw how the Babylonian had already begun to classify his observations. Now Greek and Roman begin to classify their thoughts and to write them out; not any more as a solemn religious rite, but for the dissemination of what they regard as a record of their wider and more conscious experience. This, broadly speaking, marks the principal distinction of that epoch which we call classical, as the prototype of our own civilization. All becomes very complex suddenly. Fixed concepts based on intricate reasoning multiply with the individualities of the thinkers. And as we project ourselves into that life, we see the analogies and resemblances with our own, passing over the essential differences determined by their closer relationship to and dependence on the older cultures; and we see only the dawn of our civilization and the birth of our science, of progress.

What profound differences between these two "classics." The Greek, in his gay, cheerful attitude towards life, exquisitely receptive to the beauty of form, of color and of thought, casts the forces of nature into beautiful anthropomorphic shapes. The same sense for proportion and harmony which we admire in the artistic products of his hand characterize equally those of his mind. Of much sterner stuff the practical Roman. He takes himself and life more seriously, he has a purpose: action and power; art and thought are there only to serve it, they have to be fixed and codified, made into law. Disease for the Greek is a disturbance of the beautiful harmony of health, he thinks it out on those lines and tries to reestablish the harmony. Hence hygiene is the keynote of his medicine. The Roman proudly refuses to consider disease except when its palpable existence forces him to it. Then only and reluctantly he takes the most necessary steps. There is no such thing as scientific Roman medicine and what was brought in from abroad had soon to adapt itself to Roman ways. But, in general, thought on somatic needs, on medicine, formed only a small fraction of the philosophy which was engrossed with seemingly higher ideals, aesthetical, logical, and religious in turn. And in that small place left for medicine the concept of infection was not apt to thrive.

\(^2\) It is of some interest that Ruffer in his microscopic examinations of Egyptian mummies found the encapsulated or calcified schistosoma hemato-bium, and so demonstrated with certainty the occurrence of Bilharziosis in ancient Egypt.
emergencies such as wars and pestilence, the idea of infection asserts itself in its state of original simplicity. What share has the classical medical thought, with its fund of analyzed observation and experience, in this phenomenon? In the Hippocratic writings, in those of the Alexandrian school, we still detect the influence of the primitive concepts, but gradually they separate and follow different channels. Along with the roaring and sometimes turbid main stream of scientific thought runs the babbling, limpid brook of popular tradition, in which we readily detect the intuitive sources. Here and there they approach each other and sometimes a little runs from one into the other, but on the whole they proceed apart. The poet, the playwright, the philosopher, those spokesmen of folk medicine, the medical writer less and less, re-affirm the eternal validity of the primitive idea of infection whenever they dwell on times of grave danger.22

The history of infection is usually begun with the period when the animate contagium became demonstrated to the satisfaction of exacting scientists. The cornerstones planted are Fracastoro in the sixteenth, Athanasius Kircher in the seventeenth century.23 In a certain sense this is true, in another it may be shown that the history of infection as a broad concept of pathogenesis ended when the attempt was made to convert medicine into an exact science. The supreme effort in this direction is centered in Galen, the most industrious and ingenious prototype of the modern medical scientist. Whenever one examines his great work, and analyzes the reasons for the aggressive and contemptuous attitude he assumed against all other thinkers in medicine, methodists, empirics and pneumatists, one is impressed by the logical sequence of his arguments, by his evident eagerness for objective examination in the solution of his problems, but one can not fail to see that he juggles with his premises and asserts his facts just to show the stupidity of the others and especially that of the “ass of Thessalos,” his chief abomination, and that he is not above a feeling of jealousy towards those successful practitioners.

The differences between the opposing schools were formal rather than real, in theory at least, but the methodists were more ready to adapt themselves to Roman peculiarities which Galen scorned. This is brought out very well by Meyer-Steineg in his essay on Thessalos of Tralles24 where he shows how the Roman always favored popular as against scientific medicine, and how cleverly this was exploited by Thessalos and his methodist confrères. Also how strong this Roman preference was so that even Galen had to submit to it in turn. Both parties in the conflict derived their knowledge from a study of the body and its functions, but both in different ways, wherefore they denied scientific consideration to each other. In common they neglected a broader aetiology. True, Galen had evolved logically an aetiological system, but based it almost entirely on an elaboration of Hippocratic humoral concepts and the theory of innate qualities. He was too much absorbed by the variegated phenomena in the body and too much opposed temperamentally to the superstitious nature of external forces, to stress they start into life and take command. Dumb and invisible, some are yet our masters in all critical times.”

22 From a review of Sir Bampfylde Fuller’s new book (“Man as he is,” London, Murray, 1916), in the Times Literary Supplement of Nov. 23, 1916, which I receive as I am reviewing my Mss. I find that he has come to similar conclusions: “With man as we know him, living in an artificial state, recollections of his experience count for more and more, and the primitive impulses for less and less. They are by no means dead. In certain circumstances of strain and


ever clearly see and admit the fact of infection, or at least its importance. "Who does not know, he exclaims, that brine and seawater preserve meat and keep it uncorrupted (aseptic, ἀσεπτικά), whilst all other water—the drinkable kind—readily spoils and rots it" (διαφθείρει τε και σφηκεῖ). But this did not suggest to him any external origin of this corruption. To him it is a spontaneous process, apt to occur also inside the body, just as the innate heat, which according to him has no outside source, as Erasistratos thought. Such facts as he notes them down serve him only to support ingeniously his humoral theory. For sixteen hundred years scientific medicine speculated and experimented on very similar lines.

The lay writers Celsus, Cato, Varro, Columella, Pliny, Vergil, Vitruvius and others note the fact of infection as a commonplace that needs no argument. Could any one express it more clearly than Lucretius in his famous poem, *de rerum natura*, which had such a great influence on the thought of the Middle Ages?

Primum, multarum semina rerum
Esse supra docui, quae sint vitalia nobis:
Et contra, quae sint morbo mortique, . . .

Had Galen seen in this and in Lucretius' *morbidos aer* and *pestilias* anything else but a poet's license, we would surely have a long treatise from him on the subject, and not only his casual references to the contagiosity of certain diseases. And still, in spite of Galen's science which was triumphantly to conquer the world, we find Ammianus Marcellinus, last but not least of Roman historians, telling that the Antoninian plague was caused by soldiers breaking into the temple of Apollo where Chaldean priests hid the morbific virus. Nergal, the god from Mesopotamia, still wants his voice heard in the matter!

This voice arises again and again as we traverse the coming centuries. Hardly perceptible in the scientific writings of the Middle Ages, though always traceable, it becomes more and more subdued by the one eager interest of Christian aspiration to use the knowledge of the world for the understanding of the Bible. Science becomes the handmaiden of theology: "Non potest intelligi sacra Scriptura sine aliarum scientiarum peritia," wrote Bonaventura. And when modern historians claim that the turn of the tide came in those times with the introduction of the experimental method, hailing Roger Bacon and his "experimental science which neglects argument" as a sort of savior of science, it can not appeal to one who has heard the far cry for observation, experience and experiment from the dawn of human thought. It certainly is difficult to understand how such evaluation could ever be deduced from Bacon's naïve belief in the powers of this "new science" and its master, Pierre de Maricourt. Infinitely more important it is to recognize in those times the profound social reorganization which is taking place, leading to powerful and multiple organizations of corporate interests, the mediaeval townships and universities. This is more significant even than the setting free of the purer classical spirit after the capture of Constantinople, and its influence on arts and sciences, because for the first time an organized popular will asserts itself which henceforth cannot be neglected. Already it shows its creative possibilities in the measures for the protection of the public health. No careful student of the decrees of this

27 "Epist. de tribus quaestionibus."
time providing sanitary legislation, quarantine measures and disinfection against various diseases and especially plague, leprosy and phthisis, can fail to see how much all this is based on the fundamental concept of infection. Imperfect as are all human institutions these measures were often excessive and unnecessarily severe. Because of this inherent defect, which our own measures share, they hardly merited being held up to ridicule by Koehler at the International Conference on Sanitary Legislation in 1897. It is characteristic of the prevailing historical shallowness that he cited the mediaeval decrees against cholera, a disease which first appeared in Europe only 100 years ago.29

Many instances might be cited to show how often the lay mind, grasping a fundamental principle, drew instinctively and spontaneously the necessary consequences and it is somewhat depressing to have to acknowledge that so very often this occurred without the aid of the scientist and sometimes against his protests. But only the recognition of the fact can indicate the road to improvement. I shall not try to cite many instances but I cannot refrain from alluding to that last event in the history of infection, sufficiently remote to permit critical analysis, which shows the extraordinary viability of the primordial concept and its application. I mean the great experiment of prophylactic variolation during the period of from 1721 to 1840. It is almost forgotten over vaccination although neither the one nor the other owed its origin to scientific medicine. I shall merely repeat what I said before about the work of Angelo Gatti in which he gave expression to the thoughts underlying the movement, against the opposition of the Medical Faculty of Paris: First he discusses the aetiology of smallpox and turns sharply against such futile terms as “fermentation, leven, humores, ebullition, effervescence, germ, etc.” On the meaninglessness of such terms a mass of physicians base their therapeutic procedures; they use them even in such cases where a Sydenham or Boerhaave would have been content to observe and describe. For Gatti variola is produced by a foreign body that has entered the organism from without. Transmission takes place by contact, or through the organs of respiration or digestion. The “virus” reproduces and multiplies itself. Smallpox is the constant and definite effect of it, strictly specific. Variolation is the transmission of the disease controlled by intelligence instead of accident. For the purpose of inoculation the virus must be modified. Gatti’s purposeful attempts at attenuation might still be read with profit by modern experimenters.30

CONCLUSIONS

We are too near our own time to form a broad judgment of our methods and concepts. When we review the many fertile applications made by microorganic biology in every-day life, the advances of a purposeful prophylaxis and of sanitary sciences generally, to doubt the correctness and utility of these efforts would require a hypercritical and entirely objectionable attitude of mind. And also as regards our modern methods of laboratory investigation, we must agree with Welch, when he said here at the University of Chicago in 1907, that “we cannot foresee a time when purely observational and descriptive biological studies, which to-day hold the first place, shall not continue to have their value.”31 It is probably better in the interest of our aims that we should rather over- than

29 See G. Sticker in Heft 2, Zur historischen Biologie der Krankheitserreger, Giessen, 1910.


31 Welch: The Interdependence of medicine and other sciences of nature. Science, 1908, Jan. 10.
under-estimate the absolute value of our methods and achievements. In the wider realm, just as in individual life, an insidious dwelling on the past may lead to paralyzing speculation, self-depreciation and hesitation. Here as there, such tendencies must be discountenanced. But, on the other hand, it can not be denied that the taste for self-exaltation, rampant to no small extent, merits equal attention, as it may easily lead to overindulgence and mental indigestion.

Viewed with this general proviso it may perhaps not be unprofitable to picture the impressions a future historian might gather from a perusal of our bulky literature. Would he see that the elaboration of the doctrine of the specificity of cause and effect in infectious diseases, which “de tout le temps toutes langues ont dit” as Brettoneau put it, already in 1855, has led us to a deeper and more correct comprehension of these diseases? May he not conclude that we have not drawn from it the full logical consequences, that we have persistently disregarded our negative findings and, in overestimating the importance of the positive ones have come to a sterile generalization of contagionism? Will he admire with Sticker the courage of Pettenkofer when he insisted, in his famous cholera doctrine, less on what he had determined and knew, than on what he did not know and what needed to be brought out? Or, will he brand him, with Liebermeister, as “a subtle and sometimes humorous dialectician,” notwithstanding the solid results obtained as a consequence of Pettenkofer’s and others’ sanitary reforms?

It is worthy of serious reflection whether the day is not likely to come when those efforts now occupying the center of the scientific stage, that is, the search after the specific microorganism, its minute identification by complex experimentation and the prophylactic and therapeutic application derived therefrom, will be relegated to a less conspicuous place. We admit contributory causes, but by their very subordination we show how difficult it is for us to see in them anything but unimportant influences. And we forget that it is only the obviousness of one factor and the lacking clearness of the other which determine the artificial subordination. Pettenkofer’s x we have found but the equally important y and z have yet to be supplied in the aetiolologic formula.

Shall we desist from this deeper aetiolologic search because of intrinsic difficulties? The reserved position of Virchow and Cohnheim toward it will be recalled. To them aetiology seemed too vast a subject, involving too many different factors and technical methods which could not all be fitted into one scientific garment. Hence they persisted in observational and descriptive methods. Koch and his school of technical artists, without any such restraint but also without the broad outlook of their predecessors, were heralded as the founders of a new medicine. Their historian, Abel, describes the final triumph in these eloquent words: “Laboriously, slowly and late, but at last with certainty, the pure contagionistic theory has attained to the sole rulership in science.” All this in barely forty-five years and based almost entirely on technical and instrumental improvements. The “sole ruler” is difficult to please, a failure to solve some particular problem is invariably put to faulty or inadequate technic, never to a wrong direction of effort, and the object of research, may it be the infecting organism or its carrier, must remain unalterably the same. We look down upon the mediaeval scholar who attempted the solution of similar problems by syllogistic structures of thought based upon insufficient facts. We have undoubtedly more facts, but can we prove their sufficiency by subtleties of experimental research, so often unrelated to actual exigencies? Multiple facts brought out by inductive research do not combine, as Francis Bacon expected they would, infallibly leading to really useful gen-
eralization. Never yet in the world’s his-
tory has a great progress, a discovery of
fundamental importance, been achieved by
this method.

There are some signs of a reaction against
the present concepts and methods of path-
ology. It is no more a cellular pathology
in Virchow’s sense. The doctrine of the cell
as the vital unit, one of the most useful gen-
eralizations in biology, does not rule path-
ology any longer. The limits of cellular
autonomy and the interdependence of the
units, only dimly admitted by Virchow, are
becoming better defined. The concept of
the organism as an entity (also in its path-
ological phenomena) and of its essentially
fluid constitution opens a wide outlook
through the work of W. Roux, Jacques Loeb
and Albrecht. In accord with these modern
concepts, it was one of the pioneers of aeti-
ologic research, Edwin Klebs, who defined
infectious disease as the resultant from the
interaction of different bodies, yielding dif-
ferent products and phenomena. And he al-
ready postulated, as of prime importance,
that all processes within the sphere of liv-
ing bodies just the same as in that of the
non-living, must take place according to the
same fundamental laws; that, therefore, also
in pathology, there is no room left for a
special vital force.

In all these newer tendencies the inter-
derpendence of medicine and the other natu-
ral sciences becomes ever more clearly visi-
ble. It will need the work of genius to bring
about the needed efficient interaction. We
may have to wait long for such an one.
Meanwhile the common ground might be
prepared, and we believe that nothing can
do it so well as organized historical research
in science, because, in George Sarton’s
admirable words: “Science, divided into
water-tight compartments, makes us feel
uneasy;—a world split into selfish and
quarrelsome nations is too narrow for us.
We need the full experience of other coun-
tries, of other races; we need also the full
experience of other ages. We need more air!”

MARSHALL HALL’S PROOF OF REFLEX ACTION

You observe this living frog: its sentient and volun-
tary functions are obvious. I divide the spinal marrow,
below the occiput, with these scissors: all is still.
There is not a trace of spontaneous motion. The ani-
mal would remain in this very form and position,
without change, until all signs of vitality were extinct.
But now I pinch a toe with the forceps. You see how
both posterior extremities are moved. All is now
still again; there is no spontaneous motion, no sign
of pain from the wound made in the neck. It is with-
out sensibility—without volition; the power to move
remains—the will is extinct. I now pinch the integu-
ment. You observe the result—the immediate recur-
rence of excito-motory phenomena.

I now destroy the whole spinal marrow with this
probe. It is in vain that I pinch the toes; the animal,
the limbs are motionless!

Could the former excited motions be those of irrita-
bility? I will try the truth of this suggestion by seeing
whether, now that the axis of the excito-motory system
is destroyed, with its phenomena, the application of a
slight galvanic shock will prove the subsistence of irrita-
bility. You see bow instantaneously and forcibly the
muscles are simulated to contraction.

Is not the proof, from these experiments, of the
distinction between the motions of volition, of the
excito-motory system, and of those from those of irrita-
bility perfectly and unequivocally complete?
THREE Districts Northern, middle and Southern.

To each one Director General—
His duty, with the advice of the general or Command-in-Chief, in his respective Department.

To establish a sufficient number of Hospitals at proper places for receiving the sick & wounded of the army & to dispose of the same as he shall think proper—
To provide & prepare medicines Instruments & dressings; Bedding, & other necessary furniture, proper Diet & every thing necessary for the subsistance & comfort of the sick & wounded Soldiery & the officers of the hospital & to pay the salarys of the latter agreeable to establishment of Congress, together with all other expences of the hospital.—
To execute which He shall be allowed the following officers to be appointed & discharged by him in such numbers as the necessity of the army may require & the General approve an authentick report of which to be immediately transmitted to Congress.

Assistant Directors—to superintend the Hospitals to the care of which they shall be appointed & see that ye same are provided as before specified agreeable to ye instructions of the Director Gen1—
An Apothecary General whose Duty shall be receive, prepare & deliver medicines and other articles of his department to the Hospital & ye Army as shall be ordered by ye Dir. Gen. Apothecary and mates to obey ye Apoth. gen'.

A Commissary—whose duty shall be to procure store and deliver provisions, forage such other articles as the Director shall judge necessary for ye use of ye hospitals in the purchase of wch he shall frequently consult with & be regulated by the prices of the Quartermast' and Commiss' generals.

Adjutants to ye Commissary & Storekeeper, a Steward for every 100 sick who shall recieve from ye commissary provisions, distribute them agreeable to ye orders of the Genl. or Physician & surgeon genl. of his dept. & be accountable to ye commissary for ye same.

a matron to every 100 sick who shall see the provisions are properly prepared, the Wards, Beds, & Utensils shall be kept in neat order, & that ye greatest Econo- my be observed in her department. A nurse to every 15 sick at the direction of ye matron.

An Hostler or Stabler to receive ye forage from the commissary and to take care of ye Waggon & other horses belonging to the Hospital agreeable to orders he shall recieve from the Dr. genl. or such other officer of ye Hospital he shall appoint.

A Secretary whose Business shall be to keep the accounts of the Hospitals, shall
There shall be a Director of Surgeons, whose duty, in subordination to the Governor, shall be to receive from him a suitable number of large strong Vessels, Bilk, Boat, Medicine & Hospital Stores for such wounded persons as cannot be transported to the general Hospitals or may be rendered unfit for duty in action: He shall also see that the sick & wounded time in his Hospital are properly attended & when able, be conveyed to the general Hospital for which last purpose he shall be supplied with a proper number of Conveyances, Wagons & Drivers.

He shall see that the regimental Surgeons & mates attend their Wounded, & those who refuse to obey his orders, his directions shall be tried & punished as long as shall direct. The Mates have under him.

Orders to receive & properly dispose of such articles of sick as to make room.

Brigade Surgeon, who shall superintend
recieve and deliver ye monies agreeable to ye orders of the Direct' Genl.—

Clerks for the same.—

Such officers & soldiers as the general shall think proper to guard ye hospitals & to conduct such as shall be weekly discharged ye Hospital to their respective regiments & who shall obey the directions of the Direct' Genl. or the Physician and Surgeon Genl. while on this duty. There shall be also

Two Physician and Surgeon Generals—who must superintend & regulate the practice of Physic & Surgery in such Hospitals as the Dir. Genl. shall appoint them to, & in his absence they shall appoint the Physicians Surgeons and other officers of said Hospital to such duties as they shall think proper & shall report weekly to ye Dir. genl. or in his absence to ye ass. Dir. the state & number of the sick & wounded of their Hospital & the delinquent officers of ye same. They shall also see that those who are fit shall be delivered every week to the officer of the Guard to be conducted to ye army.

Senior Physicians & Surgeons who shall attend, prescribe for & operate upon and see properly treated such sick & wounded as shall be allotted them by ye Dir. genl. or either of the Physician & Surgeon genl.

Second Surgeons to assist ye senior Surgeon and be under ye same direction.

Mates who shall attend the physicians and Surgeons when they prescribe and operate, shall dress ye wounded, recieve from the apothecary, mate of ye Hospital & put up the medicines & see that they are regularly & properly administered to ye patients.

A suitable number of covered and other Wagons to be supplied by ye G. M. G.

For the Flying Hospital

There shall be A Director and Surgeon Genl. whose Duty in subordination to ye Dir. Genl. shall be to superintend & receive from him a suitable number of large strong Tents—Beds, Bed[ding,] Medicine, & Hospital Stores for such sick & wounded persons as cant be transported to ye general Hospital with safety or may be rendered fit for duty in a few days—He shall also see that the sick & wounded while in his hospital are properly attended & dressed and when able, to be conveyed to ye genl. Hospital for which last purpose he shall be supplied by ye Dir. Genl. with a proper number of convenient Wagons and Drivers.—He shall see that the regimental Surgeons and mates attend their regiments. Those who refuse to obey his or ye Dir. Genl.'s directions shall be tried and punished as Congress shall direct.

He shall have under him

Stewards to recieve and properly dispense such articles of diet as ye Director General shall give or order to be given him by the Comy of ye Army or Hospital.

Brigade Surgeons—who shall superintend the medical department in their respective Brigades, report the state thereof to the Director of ye flying Hospital & see that the sick & wounded are sent in proper time & in a proper manner to ye flying Hospitals—they shall also attend & prescribe for ye sick and wounded in ye Hospital under ye Direction of ye Surgeon Genl.

A suitable number of mates to dress, & of Nurses and orderly men ye number to be determined and they appointed and paid by ye Dir.

All the above officers to be appointed & recieve such Salarys as the Congress shall please to direct.
Aristotle (B.C. 384-322) saw the blood of a fish flow from its heart into its gills. ("De Part. Animalium," III.) Undoubtedly many men who have had the taste and disposition for wandering in the sinuous paths of medical investigation, or who have found joy in philosophizing with the ancients, have dreamed dreams of speculation as to what might have been the position of the theory and art of medicine and our civilization and religious thought, had Aristotle but had sufficient imagination to have gone a step farther and have thought of the possibility of the way of the return of the blood to the heart.

There is no limit to the horizon toward which such dreams might lead; and to speculate upon the possibilities of such a conception is almost to wander away among the djinn of an Arabian tale, or to intoxicate oneself with musings among the Sephiroth of the Kabbalah.

Whatsoever might have been the result that must of necessity have been the outcome of such a discovery at a period almost 2000 years before the time of Harvey, it is not beyond the realm of reason to believe that the world would have been spared the degradation of the ignorance of the Dark Ages, and the erroneous philosophy of St. Thomas Aquinas, founded upon the physiology of Aristotle, the controversies of the scholastic and dogmatic theologians, the proposition of "two kinds of truth: the Philosophical, founded upon proof, and the Theological, founded upon faith" (See Mattheiu Paris. "Hist. Maj.", p. 541, and Mosheim. "Eccl. Hist.", Part II, Cap. 3.), the futile discussions as to the nature of and location of the soul, the problems of generation, metabolism and nutrition: the nature and functions of the liver, spleen, lungs, and heart, and a thousand other things which are but common-places today, but which were insurmountable obstructions to true knowledge up to the middle of the seventeenth century, would never have been considered, or would many centuries ago have been cleared away.

The reader may well ask, What has all this to do with the subject upon which this paper is supposed to treat? The answer is not difficult.

Nothing that can result from philosophizing is ever of any value, until, like the result of any other form of mental activity, it finds its application ad hominem. The study of the history of medicine is, in the most intense degree, the study of the development of civilization, not only as applied to community life but as well when applied to the development of the individual. It is a study of the great struggle of mankind as led by its teachers, against the destructive forces of nature, and in so far as the teachers have failed in their grasp of the meaning of things and phenomena about them, in so much has man failed in the speed of his journey toward better health, better mentality, better living and better appreciation of the things of life.

Throughout the world, up to the time of William Harvey, mankind was struggling blindly in a fog of theory, superstition and fear, toward the light, the first glimmerings of which came with the coming of the great anatomist Vesalius, the controversialist Servetus, the keen observer Fabricius; a glimmering which was to burst into a full effulgence which should illumine the path that science might tread, when Harvey by his discovery of the circulation of the blood, illumined the leaders of the world of philos-
ophy and science, and through them gave to the human race those facts which have made all exact medical knowledge possible since his time.

It has seemed to me in view of the great interest that the medical profession has taken in the matter of intravenous medication since the introduction of salvarsan, that a short account of the early history of that method of treatment may not be without interest, and therefore I have to offer a somewhat incomplete review of the records relating to infusion of medicaments and transfusion of blood, during the period between 1490 and 1680.

It will be necessary to glance first at the conditions of knowledge in our profession in relation to the physiology of the blood and its movement during the centuries previous to the discovery of the circulation by Harvey in the year 1613, and his announcement of his discovery by the publication of his book in Frankfort in 1628.

In the year 201 A.D., there died a man in Rome, a physician, who had had seven emperors as his patients and who left behind in his writings, an accumulation of the knowledge of his predecessors, and a system of medicine, which was perfect in its kind, logical in its reasonings, complete and well proportioned in its form and which ruled the medical world for 1400 years; influencing not only the writers on medicine as no other man had influenced them, not only as to the physical welfare of the entire world, but also furnishing the Christian world with a basis for a complete system of theology, although but little of it was founded upon anything more than speculation, while those parts of it which seem to be demonstrations of facts were but falsehoods and erroneous conclusions due to error in observation. This man was Galen.

If we but stop to consider our own surroundings and relations to our own patients, we are brought to realize that his influence extends even to ourselves, and that on every hand and every day the medical profession here, now, is forced to contend with the erroneous conceptions that were handed down through the years from Galen, and which still hold not only in the minds of the laity, but also in the acts and thoughts of many men within the profession of medicine itself.

Erasistratos, of the School of Alexandria, had established the belief in the minds of medical men and philosophers that the arteries contained only air. Galen by his famous experiment with the hollow reed or a bronze tube (Liber, "An Sanguis in Arteriis Contineatur," Cap. 8) had proved the folly of this belief.

For Galen, the liver was the source of the blood and the natural spirit, and the heart was the seat of the essential heat and of the vital spirit, while the blood mixed with air in the left ventricle of the heart and passing to the brain through the carotid arteries became perfected in the lateral ventricles, so as to produce the animal spirit, which was the food of the soul.

The soul was looked upon as a sort of a triad. The concupiscent soul, the epithumos, resided in the liver. This was the passive or feminine element, the desiring or acquiring element in the triad. In the heart resided the acting soul, the thumos, the active, masculine element of the triad which produced the vital heat and sent it throughout the body, and which when refined became part of the governing soul, the begemonos, which was the controlling element of the triad. The natural spirit was in the liver and veins, the vital spirit was in the heart and arteries, the animal spirit was in the brain and nerves.

A certain movement of the blood was recognized, and had been since the time of Hippocrates; but this movement was in no wise recognized as a circulation but rather as a periodidos haemos, a tide-like movement which was compared to the tides of Eripos, in the strait of that name in
Greece. The blood was produced from the chyle in the liver and then moved back and forth in the veins until it was consumed, a new supply always being produced by the liver.

Some of the blood oozed through certain foveae, or supposed porosities in the intraventricular septum of the heart, from the right to the left ventricle there to form the vitalized blood, which, mixed with air, was sent out through the arteries up to their finer filaments which were supposed to be nervous in character. Some of this vitalized blood went to the brain for further perfection, but none returned, in a circulating sense, to the heart. That blood that went to the lungs was sent to them to nourish them, or to be cooled by them.

It is necessary that we should recall these things in order to understand that which occurred after the discovery of the circulation of the blood.

Wm. Harvey of Folkstone and London, England, lectured to the students upon his discovery of the circulation at St. Bartholomew’s Hospital, in the year 1613; this date should be kept in mind. In the year 1628 his book “De Motu Cordis” was published in Frankfort. His discovery was quickly accepted in England, Holland and in Germany; but such was the temper of the time, the respect paid to and the fascination of the opinions of the ancients, that almost an hundred years elapsed before it was admitted in Italy, the southern part of France or by the acknowledged master-teachers in medicine of the University of Paris; for we find a certain Vigerius, professor of medicine at Montpelier, still teaching the Galenic ideas as late as 1694, while his colleague of the same faculty, Dionis, was demonstrating its truth at the Royal Garden in Paris, by command of Louis XIV and at the same time it was being denied in the same city, under the lingering influence of Riolan, by the Faculty of Medicine of that center of learning.

In view of the absence of any speedy means of communication between nations at the time when this discovery was published, it is with astonishment that we observe how quickly information in regard to it was transmitted throughout Europe.

Its acceptance by the master minds of medicine, with but few exceptions, was very rapid. The foundations of medical belief were shaken as they had never been shaken before, and on every side men arose, armed with this first of physiological facts, who were only too ready to use it for the purpose of clearing away the banked clouds of theory which, up to that time, had obscured the vision of the medical world from any sane perception of rational methods of treatment of disease.

Hope was high in every breast that through this knowledge disease and its cure might be approached with confident tread. Alas! these hopes were to be dashed to the ground because of too sanguine anticipations, the result of the lack of other facts that were to be learned only through experience, or by the gradual evolution of instruments of precision, used as aids to the acquirement of collateral and related knowledge.

No discovery or discoverer is great enough to be beyond the range of shafts of doubt or envy, and it was so in the case of Harvey. Hardly had his discovery been noised abroad, before there arose a number of detractors whose purpose it was to prove by what seemed to them sufficient evidence that the knowledge of the circulation was as old as civilization.

An attempt was made to show by the testimony of a work by Père Halde, put into Latin by Michael Boym and published by Andreas Cleyer of Cassel, and Batavia in Java, that the circulation was understood by the Chinese at a time 4000 years before the Christian era, and later Cleyer wrote a book (“Specimen Medicae Sinicae,” Frankfort, 1682) in one chapter of which,
“Tractatus de Pulsibus,” this claim is maintained. It will not be without interest for any one desiring to go further into this matter, that the article on Chinese medicine by Neuburger, Vol. I, and Renouard in the Douai version of the Vulgate, “Before the silver cord be broken, and the golden fillet shrink back, and the pitcher be crushed at the fountain, and the wheel be broken upon the cistern.” (Eccl. xii, 6.)

To the writer it would seem that these men must have been possessed with most marvelous capacity for engendering conceptions based upon unwarranted imaginations.

In investigating this matter it seemed so far beyond possibility that such deductions should be drawn from this text, that, fearing that a misprint may have led me astray, I took pains to discover what might have been written in the book of Ecclesiasticus, of Jesus Son of Sirach, which appears in the Vulgate but not in the St. James version. The citation as given in English reads: “Do good to the humble, and give not to the ungodly: hold back thy bread, and give it not to him, lest thereby he over-master thee.” Which seems to be very good practical advice, but hardly applicable to the problem of the knowledge of the circulation.

It would take too much time for the reader to enter upon the various claims for the discovery, on behalf of Cesalpinus and Sarpi, nor is such a digression desirable in this article, but it may not be without interest at this point to note some of the ideas entertained among the ancients as to the use of blood as a remedy, or as to the effects of the abuse of the blood, as in certain cases of perversion.

I quote from Petro de Abano (“De Venenis,” circa 1250-1316, Editio Jacobus Thanner, Liptzen, 1498, Cap. 74, “De Sanguine Menstruo aut Leprosi.”)

“He who drinks of menstrual blood or...
of that of a leper, will be seen to be distracted and lunatic, evil minded and forgetful, and his cure is to drink of daisies, powdered and mixed with water of honey, and to bathe in tepid water, and to copulate with girls according to the law natural, and to play with pretty girls and young boys: and the antidote (bezoar) is to eat serpents whose heads and tails have been cut off with the edge of a palm frond.”

Pliny (“Natural History,” fol. 498, v. 9) describes the drinking of the flowing blood of gladiators in the arena “as if out of living cups,” for epilepsy.

Again Pliny states that “a man’s own blood rubbed upon himself will relieve him of pain.” (Fol. 501, v. 2.)

Again Pliny, as does Diodorus Siculus, describes the employment of baths of human blood by the Egyptian kings as a cure for elephantiasis. (Fol. 469, v. 49.)

The use of blood as a remedy is mentioned in many other places in Lib. XXII.

In Thomas Bartholin’s famous book, “De Sanguine Vetito” (Frankfort, 1673), we shall find numberless instances of the use of blood as a remedy, many of the stories being not without humor as, for instance, in that portion in which he treats of the use of the blood of cats, doves, turtles and other animals in the treatment of epilepsy, he tells of a certain girl, an epileptic, at Breslau, who, after taking cats’ blood, was quickly endowed with the characteristics of a cat. She climbed upon the roofs of the houses, imitating the manners of cats in voice, jumping, scratching, yowling, and even sitting for hours gazing into a hole in the floor.

Ettmüller gravely informs us, upon the authority of Hildesheim (“Spicilegium,” VII, p. 609) that if a black cat’s tail be cut off at the distal third, and the first three drops of blood that exude be given to an epileptic, it will prove a powerful means for cure, but he considers the blood from a wild cat to be more potent. However, blood from the ear of a black cat is most valuable in the treatment of erysipelas.

The ancient pagans advocated the use of the blood not only of brutes, but also of human beings in the treatment of epilepsy.

Scribonius Largus (Comp. XVI) says: “A simple woman, one of the common people, sold as a valuable remedy and a secret one, the mixed blood of a turtle and a pigeon — as much as would flow out — as a certain cure for this disease (epilepsy), which seems to have been as mysterious a malady then as it is to-day.”

Paulus Aegineta (“De Re Medica,” Lib. VII, Cap. 3) advises the use of the mixed blood of many animals for this disease and Galen and Dioscorides also, the drinking of the blood of a weasel, or the blood of a dog for the cure of the bite of one that was rabid.

Cælius Aurelianus (Lib. I, Chronic., Cap. 4, Editio Amsterdam, 1722, fol. 314) ridicules the use of the mixed blood of men, seals and turtles for the cure of epilepsy, and says, “from this remedy none reaches a cure.” Among the Norwegians from time immemorial the blood of seals and whales has been used as a remedy for fits and scurvy, and the blood of the reindeer is used in Lapland for the same purpose.

Arteus (Lib. I, “De Cur. Diut. Morb.,” Cap. 4) describes the manner of filling a vial with the blood flowing from the wounds of the soldiers, that it might be drunk as a remedy, and says: “Oh what a mighty necessity, that any one should be forced thus to cure one evil by the use of a greater.”

Nicolaus Marepsus (Sect. I, “De Antidotis,” c. 439) advised the use of the mixed blood of kids, geese, and male and female ducks for a number of diseases affecting the “spirits.” Celsus (Lib. III, Cap. 23) deplores the custom of the people who rushed into the arena at the time of the gladiatorial games to drink the blood fresh-flowing from the jugular veins of the dying
victims, and Tertullian ("Apolog.", IX) asks, "Where are those who at the shows in the Arena, where men are slaughtered, drank the flowing blood (but not that from the throat) with eager thirst, that they might be cured of epilepsy?" Here we have a reference to the danger of taking in any portion of the "spirit" of the bleeding man in the froth of his blood. There can be but little doubt of the use of distillates from the blood, for we shall find in the "De Distillatione" of Hieronymus Rubæus (1585) a full description of its use on pages 123-127 et seq., and the distillate of blood was often employed combined with the waters and oils extracted by distillation from human and other feces for many diseases.

One might well quote from Dioscorides, Galen, Alexander of Trales, Benedictus Victorius, Mizingus, Levenius Lemnius, Avicenna and a long list of others, but what has gone before is quite enough to prove a multitudinous use of blood as a remedy.

About the use of blood hung always the idea that it was the container of the various spirits, and that therefore it might be, if rightly chosen or confected, of use as a restorative in cases of maladjustment of those mythical factors when they were disarranged. Indeed we may well imagine that in its use, as well as in the employment of the crushed testicles of goats, asses, rabbits and cocks, there was some sort of foreshadowing of the organotherapy of to-day. What could be more convincing (if precedent were a proof) of the value of goats' lymph in the treatment of diminished virility, than the grave and serious statements of the ancients as to these things of applied medicine being arcana or specifics.

INFUSIONAL SURGERY

There can be but little doubt that the original conception of the possibility of introducing remedies into the blood stream was the result of reasoning from the knowledge that the vessels might be injected after death, as was done by Mondinus in a certain degree, as early as 1316, at Bologna. This process was developed to a greater extent by Silvius, Eustachius and Vesalius. It is difficult to believe that the theories of Servetus as to the lesser circulation were the outcome of a correct knowledge of the anatomy of the vessels of the lungs, derived from an examination of injected vessels, although at the time he was a fellow student with Vesalius at Louvain under the teachings of Guinter of Andernach he must have known something of the method of exhibiting them.

Whatever may be the truth of this opinion it is certain that the first record of a suggestion of any such method or attempt is to be found recorded as originating in England in the year 1657.

In the transactions of the Royal Society of England, Vol. I, page 96, there is a statement by Robert Boyle, the celebrated physicist and chemist of the seventeenth century, to the effect that early in the year 1657 the idea of the intravenous introduction of medicines was proposed to him by Sir Christopher Wren, the famous architect of the St. Paul's Cathedral in London. This suggestion seems to have remained without fruition up to the year 1664 when Johannes Daniel Major, physician and professor of anatomy and botany at the University of Kiel, a man who was pronounced by his contemporaries as "perquam eruditius, sed perquam etiam vagus," published his "Prodromus a se inventae chirurgiae infusionis," in which he narrates the following experiments. (Cap. 1, Sec. 4.)

Major's Experiments

1. A large dog was infused with liquid extract of opium one ounce. After half an hour he became stupid and torpid, then he fell asleep and would permit needles to be
The Beginnings of Intravenous Medication

thrust through his tongue without resisting, hardly noticing them, and after having slept for two days and one night he recovered.

2. A dog was infused with (Croci metal-lorum) oxidised sulphuret of Antimony gr. 16, in one ounce of water, not filtered. This brought on vomiting and the following day he died.

3. In another large dog (a mastiff) a very small quantity of the same medicine was infused. Nothing unfortunate happened, and afterwards the same medicine to the ordinary dose, namely, one ounce was given; the dog, like the other, vomited violently.

4. Then with acids a large number of infusions were made, but it was observed that all these coagulated the blood and death quickly supervened; but a few grains of oil of tartar (liquor potassii subcarbona-tis) produced only a bright and very red condition of the blood.

5. When a decoction of arsenic in common water was infused up to one ounce, into a dog, death was brought on.

6. In the same manner, when a solution of one half drachm of corrosive sublimate dissolved in water was injected into the crural vein of a strong dog, the dog after a short time passed away.

7. Another dog was injected in the crural vein with nitre (potassium nitras), and nothing happened.

Major made note of the fact that if the dog were injected in the jugular vein he died, but that if a common vein were used for the infusion he usually survived. (Were these deaths by air embolism?)

A large number of experiments were made upon dogs, cats and other animals for the purpose of finding out how far this method of medication might be of use for the benefit of mankind. Although somewhat intoxicated by his enthusiasm for his newly discovered method, Major (or Meyer) was in the end obliged to admit that his experiments had proved to be of but little value, and that the danger of their action was greater than any benefit derived from them.

Further experiments were made by many investigators, and among others a certain physician of Danzig named Fabricius injected seven grains of resin of scammony, dissolved in three drachms of the essence of guaiac, into the median cephalic vein of a soldier suffering with lues, having indolent ulcers on both legs, a tumor of the right arm, horrible pains in the head, as well as laboring with gummatas or nodes upon the bones. “Although the medicine was injected with the greatest care and success,” the effect of all these things was that vomiting supervened and the soldier died.

After the time of the suggestion by Sir Christopher Wren and before the appearance of the book of Major a number of propositions in regard to infusion were made in England by Dr. Clark, afterward Physician to King Charles the Second, which are frequently noted in the transactions of the Royal Society.

In the year 1665 appeared the three letters of Carolus Fracassatus of Pisa, written to Malpighi, in which are related his experiments having in view the renewal of the blood after removal of a certain amount of it, for the purpose of “preventing its fermentation, or the depression of its quality,” by means of infusion of medicinal substances. This series of letters was published at Bologna. It is clear that Fracassatus was seeking for a specific for epilepsy and that he was greatly hampered in his work by the fact that when he injected spirit of vitriol (sulphuric acid), for some strange reason, the blood of his victim always coagulated and the aforesaid victim died, and post-mortem—mirabili dictu—the blood was not found to be entirely concreted, but in the lungs was frothy and slimy, and as the dog died with symptoms of suffocation
and with frothing at the mouth, as well as with ululations, it was thought that these symptoms confirmed the idea that epilepsy was induced by a natural concretion of the blood similar to that induced by the vitriolic spirit injected.

In the year 1661, Johannes Sigmund Elsholz, physician in ordinary to the Elector of Brandenburg, as the result of a dissection (for the purpose of proving the theory of the circulation of the blood) of the body of a woman who had been drowned, came to the conclusion that intravascular injections of medicines ought to be of the greatest and most certain value for the treatment of all diseases. (His book containing his observations, "Chlysmatica Nova," was published in 1667.)

The same year, Mauritz Hoffmann, Doctor of Medicine and Public Professor of Anatomy and Botany at Altdorf, taught that in cases of melancholia, epilepsy and other hypochondriacal diseases, the cure lay in the injection of the blood of a "florid youth" into the veins of the patient.

A curious story is related by Ettmüller of a certain nobleman who lived in upper Lusatia (Lausitz in Austria) in the year 1642. Being a great huntsman and having a large number of dogs, the kennelmaster found great sport in filling his mouth with Spanish wine and then injecting or blowing it into an opened vein in the leg of one of his dogs through a quill. At other times he used spirits of wine. The wounded vein being then tied, the dogs were made drunk, and afforded great amusement to the owner by their inebriated howlings and actions, and they after a time, like the porter in Macbeth, were "cozened into a sleep" to recover from their unwilling bacchanalia. Whether it was his practice when his dogs were sick to treat them for their diseases in the same way with various medicaments, I do not know.

As an evidence of the tendency of the minds of men to run in the same general direction, it is of interest to note the similarity of method and material employed in the prosecution of the investigations made by experimenters far removed from each other, at a time when communication was slow, and in the absence of any postal or telegraphic arrangements that were in the least degree comparable to those of our era.

We find that even before the book of Major was sent to the press, dogs and cats seem to have been almost invariably the victims of the inquisitive surgeon or private investigator, for there were many such.

In Elsholz' book is given an account of a gentleman—"curiousus in sciencia"—who injected the crural vein of a large dog with one ounce of plain water and who reported that for the space of half an hour the dog licked the wound, and then ran about without apparent disturbance.

Elsholz injected one ounce of Spanish wine into the veins of a dog, and reported that even a large dose did not seem to produce any other effect than to cause a short period of drunkenness.

Schottus infused a much larger amount and states that "after a few minutes the dog staggered about in a drunken manner, and then fell flaccid upon his side and slept for many hours, snoring like a drunken man"; and when he injected one ounce of spiritum vitae aureum (tincture of gamboge) as much as would be sufficient for a man, the dog was seen to be feeling badly, to wander about in a state of confusion and then after a lapse of seven hours, to have two very copious dejections.

Elsholz himself infused a large dose of yellow antimonial emetic into a large dog at noon of a certain day. The poor beast had hicough and frothing at the mouth, was greatly depressed, and lay torpid with snoring respiration, and the second hour after the infusion vomited severely, wandered from one corner of the room to another, and when the night was past was found dead; but in another dog, when two
ounces were infused “the dog vomited up both soul and body.” Daniel Boyle injected one ounce of liquid extract of opium into a mastiff. The dog slept, anesthetic, for two days and nights, and then recovered.

In the course of these experiments it was noted that the effect of a drug upon one animal was different from its effect upon another. Thus Boyle the English scientist discovered that the amount of the tincture of opium enough for a dose for a man, was enough to drive a cat into a condition of violent madness like that of rabies; while the same dose given to a dog had but little effect other than to soothe him into a prolonged slumber, and that afterward the dog grew fat.

The injection of a watery solution or dilution of nitromuriatic acid into the jugular and crural veins of a dog quickly caused death, and as we might expect, the body being opened, the blood was found to be coagulated throughout the body in the veins, while in the heart the valves were found to be lacerated or ruptured, and apoplexy of the lungs was seen to have occurred.

Other experiments were made with spiritus nitri (nitric acid) and spiritus vitreoli (sulphuric acid) by Fracassatus and Malfighi, as well as with oleum sulphuris (sulphuretted oil) with the same result. Helmont then began a process of deligation of an area or a limb of a dog, and experimented with acids for the purpose of watching the effect of permitting a slow invasion of the body with the acid. In Helmont’s work appears a long account of the post-mortem findings in these cases, but it is hardly worth while for us to go into them at length. It is sufficient to say that the total picture in all these cases is the same in general, as that of the dog, dead of the infusion of the nitromuriatic acid.

Alkalies were then tried and an ounce of the oleum tartari (liquor potassii subcarbonatis) was infused into a large dog. Immediatley he became furious and with whining testified to his pain. The abdomen became inflated and then the subcutaneous tissues, after which he died. An autopsy showed that there was a general coagulation of the blood analogous to that found in the case of the injection of the acid.

An experiment was made to try if by drawing off a certain portion of the blood, and substitution for it of a solution of a drug, better results might be obtained.

With this object in view, a portion of blood was drawn from a large dog and an equal amount of decoction of arsenic in water was substituted. “The poor dog died in the greatest misery, with grave symptoms; coughing, vomiting and with a multitude of dejections both from the bladder and rectum, and with violent convulsions of the body and contortions of the eyes.”

A certain German named Garmanthus experimented with the desire to see what might be the possibilities of use of the method as a means of introducing antidotal remedies. First he infused a big cat with a small portion of the spirits of Rhenish wine, and as usual the cat was made drunk. Shortly afterward a certain number of drops of liquor narcotici (probably liquid extract of opium) were superinfused; when, oh, horror! the cat fell down in a stupor as if dead. A short half-hour elapsed during which the cat had a continuous discharge of a fluid from the rectum, then a large fluid evacuation took place, and the cat died.

One might prolong the description of the many experiments upon animals, through many pages. But, Quid moror?

At the end of his chapter upon animal experimentation in infusional surgery, an old writer of the period has said, “These are those attempts to acquire knowledge which were carried on by the investigators for the benefit of man, upon those martyrs of the anatomists, the dogs and cats.”

In Belgium many experiments were made with infusional surgery for the purpose of
establishing methods, not of medication, but of means of feeding through the vessels, for improving nutrition, and for sustaining life by the introduction of nutrient into the blood. None of these was fortunate.

The first methodical efforts at the treatment of disease in man were made by Elsholz in 1664-5.

He treated three soldiers, with their consent (I suspect from the context, that it was forced), by infusion. The first had an ulcer of the leg. The crural vein was opened at a place near the ulcer and by means of a syphon a small quantity of aqua plantaginea was injected.

The next was a man suffering from a continued fever. After having been bled from the median vein, while the vein was still open, a teaspoonful of the distilled water of Carduis Benedictus—our old friend—was introduced.

The third suffering from a "scorbutic corruption of the humours," was, in the same manner as the second, infused with a portion of the "water of Cochlearia." The results in these cases has not yet been reported. Fabricius, before mentioned, injected the soldier whose case of syphilis has already been mentioned. Also he treated a servant girl of uncertain age, who was a victim of epilepsy, with an infusion made of six grains of jalap dissolved in the spirit of liliu convallium. After a period of severe vomiting she seemed to be otherwise unaffected, and for a number of months remained free from fits. In his report of the experiment, Fabricius says, "Whether or not she was entirely cured, I do not know."

The discussion of the value of this means of medication raged among the medical authorities of the world for more than a quarter of a century, and we find as many names ranged upon the one side of opinion as upon the other.

A list of the names of the men who in the two decades from 1657 to 1677 argued the question pro and con, reads like a roll-call of the great lights of medicine in the age when experimental medicine was in its infancy. All wrote and each called to his aid for authority upon the ancients, Aristotle, Hippocrates, Celsus, Galen and the Alexandrians, but as it were, among the clash of the many weapons of words, a sudden "silence fell upon the multitude."

Infusorial surgery fell into a state of innocuous desuetude, and was almost forgotten, or was considered as one of the curiosities of medical history.

**TRANSFUSIONAL SURGERY**

It has been shown that the English were the first to suggest the investigation of the merits of infusional treatment, and it was but natural that the next step, transfusion, but a modification of the former, as a remedial measure should follow, transfusion being but the child of infusion. In this the English were the leaders.

Perhaps no subject in the history of the progress of our profession has caused so much discussion as that of the priority of the venture of the transfusion of blood. I shall endeavor to cover the ground as conclusively as may be in as few words as possible.

We have vague references to what may have been attempts at transfusion in the writers of the Augustan period of Roman civilization. Pliny vaguely mentions it, and a passage of Ovid, in the eighth book of the "Metamorphoses," seems to indicate that something of the kind was conceived of, but there is nothing definite about it, as it may also be taken to mean that the blood vessels of the recipient were to be filled by the drinking of blood. I cannot believe anything that was said by Roussel in his citations as to there having been true transfusions in the old days, for those of them that I have investigated are not in
The Beginnings of Intravenous Medication

the least proofs of any such operation having been done; therefore we may pass over his pronunciamentos as to the cure of Naaman, the writings of Herophilus, the case of Tanquilla in the time of Tarquinius Priscus, or those which he finds in Celsus and Pliny, Eubages and Apollo (sic) for they are not there. We may safely start in the month of June, 1490, or 1492 at Rome, when blood is said to have been transfused by a Jewish physician, named Abraham Meyre of Balmes, into the veins of Pope Innocent VIII.

The blood was taken—according to the story—from the veins of three boys of ten years of age, to each of whom a ducat was paid. It was introduced into the veins of the Pontiff and he either died or recovered, accordingly as you read the history of his life in Enuphrius, or De Cormenin. The fact is that about the year 1490, two years before the death of the Pope, he, apparently suffering from Bright’s disease, fell into a stupor, and became breathless and pulseless. He was pronounced dead, and the Cardinals gathered together to elect a new Pope. However, the good man could not permit this, and after about 70 hours, recovered consciousness and continued to rule the Church for a period of two years, dying in 1492.

It may be well for us to enter a short distance into a review of what has been written upon this subject. The testimony is most conflicting.

Rafael Sabatini in his “Life of Caesar Borgia,” states that the blood was drawn from three boys. Too much was taken. They all died. The Pope, hearing of this, was horrified and the Jewish physician fled. De Cormenin ("History of the Popes") states that it was a frightful beverage and given in the year 1492.

Raynaldus states that the blood was taken “in order that the quack, from this (the blood) might, by chemical art, prepare a distillate for a draught for the Pontiff.”

Frederic Baron Corvo believed it to have been a drink of a prepared distillate.

In Leo’s “Geschichte von Italien,” Vol. IV, p. 618, the historian considers it to have been a transfusion, as does also Pasquale Villari. ("Life of Savonarola.")

Ciaconius and Enuphrius Panvinus, follow Steven Infessura, a contemporary of the Pope, whose statement will be seen in a later paragraph.

Gregovorius ("Geschichte der Stadt Rom im Mittelalter," Vol. VII, p. 279) states that the blood was transfused.

All of the beforementioned writers refer in one way or another to Infessura. Let us see exactly what he says.

Steven Infessura in his “Diaria Rerum Romanorum” (quoted in “Fonti per la Storia d’Italia,” pages 275-6):

“Interea in Urbe nunquam cessaverunt tribulationes et mortes; nam primo tres pueri decem annorum, e venis quorum Judaeus quidam medicus qui papam sanum reddi promiserat sanguinem extraxit, incontinenti mortui sunt. Dixerat namque Judaeus se ville sanare pontificem, dummodo habere posset certam quantitatem sanguinis humani et quidem juvenis; quem propterea extrahi jussit a tribus pueris, quibus post flebotomiam unum ducatum pro quodlibet donavit; et paulo post mortui sunt. Judaeus quidem auffugit, et papa sanitus non est.”

This, in English, is about as follows:

“Nevertheless the deaths and distress in nowise ceased; for three boys of ten years of age from whose veins a certain Jewish physician, who had promised to save the Pope’s life, drew the blood, died incontinently. For the Jew said that in order to cure the Pontiff, it was necessary to have a certain quantity of blood, and that it must be drawn from young people, for which reason it was ordered to be drawn from the veins of three boys, to
each of whom, after the phlebotomy, a ducat was given, and shortly after they all died. The Jew, of course, fled, and the Pope was not cured.”

There is no assurance that the Holy Father ever received either the transfusion or the drink. There is nothing in regard to any new instrument, no account of any air embolism, nothing whatever from which either conclusion may with certainty be drawn.

It may be that whatever was done was at the time when the Pope was in the state of uremic coma, in 1490.

It only remains to investigate as to what was really accomplished. It is hardly probable that there was any interchange of blood between the boys and the Pontiff. The following facts seem to stand out of the jumble of reports. There was a Pontiff. There was a quack doctor, a Jewish pharmacus. There were three boys who were bled, and who were paid a ducat apiece for their blood. They died before they had time to spend the money. The “Judaeus aufugit” before the Pope had a chance to get his drink (or was it a transfusion?), for the pharmacus did not tarry to confect it. The Pope died. The reader may take his choice as to what it was.

An hundred and twenty years elapse before we come to anything that seems definite as to transfusion, and that instance is found in a rather satirical collection of statements derived from a thousand sources by a certain Andreas Libavius (1546-1616), who, having written an extensive book upon chemistry and chemical medicine, sought to defend his postulates, against his critics, by gathering together the various curiosities of theory in regard to cures, from every source, and in the course of this process introduces a perfect description of a transfusion, at a period even before the announcement of the discovery of the circulation by Harvey.

This book of Libavius was published at Frankfort in 1615, hence it must have been before that date that the transfusion described took place, if it was done at all.

It is to be remembered that Harvey first lectured to his students at St. Bartholomew’s Hospital upon his theory as to the circulation, in the year 1613. (Dezeimeris, Dict., Tome 3, Part 1, fol. 56.) The book of Libavius, “Syntagma Arcanorum Medicorum,” was somewhat of a firebrand to the Galenists, the Hermetics and the followers of Paracelsus, and was at once attacked most virulently, especially by Scheunemann, and in reply to this attack he published his “Defensio Syntagmatis,” in which the passage occurs. After reciting a number of the ridiculous methods of the Paracelsians, and citing the miracles of Elisha and Elijah, as well as the story of David and the young woman who was sent to him to restore his vitality (I Kings i, 3), he says:


Which being put into English is as follows: “But the powers of Elisha and Elijah did not descend to MAZENTIUS, since
Defensio Syntagmatis anec. Chym.

Necesse poterat ex homina Philosophorum esse praeeminenter. Alius Claudius antiquator, eo commentario, L. F. et syntagmu system planum, quodam omnem vitrum in parvis multos sermones consecutus

he could not restore the dead to life by application of the living to the dead, but on the contrary he killed them. Was he not that man among us who thought that by employing the following most unusual procedure he might bring about that result? ‘Let there be a young man, robust, full of spirituous blood, and also an old man, thin, emaciated, his strength exhausted, hardly able to retain his own soul. Let the performer of the operation have two silver tubes fitting into each other. Let him open the artery of the young man and put into it one of the tubes, fastening it in. Let him immediately after open the artery of the old man, and put the female tube into it, and then the two tubes being joined together, the hot and spirituous blood of the young man will pour into the old one, as if it were from a fountain of life, and all of his weakness will be dispelled.

‘Now, in order that the young man may not suffer from weakness, to him are to be given good care and food, but to the Doctor, hellebore.’"

(I cannot imagine why the Medicus should need hellebore, but perhaps it was on the principle that a veratrum cock-tail might reduce his blood-pressure after his exciting experiment.)

Contrary to what has been advanced by many historians of medicine, I cannot find in any of this the slightest intimation that Libavius either advocated or performed this operation of transfusion. A certain Mazentius seems to have been the man who suggests the method. It will be noted that two arteries are to be used. This alone would indicate that Mazentius had no conception of the circulation, and that his idea was that the blood would rush into the old man because of the greater pressure of the spirits in the young man. I cannot believe with Dr. Garrison (‘History of Medicine,’ p. 144) that Libavius was an advocate of transfusion. Rather he seems to be casting ridicule upon the experiment.

Now who was this man Libavius whose statement has been a sort of stumbling block to the solution of priority in the performance of transfusion. One writer speaks of him as being ‘vir scribendo prolixus, sed insignis scoticus et scepticus.’ As to his prolixity—I show you a page of his writings whereon appears the extract above translated. He surely was energetic and learned, as well as skeptic, and a very good business man withal, for we learn from Garrison (‘Hist. of Medicine,’ p. 144) that he had at Coburg a large establishment, a private laboratory, and his quarters were furnished with rooms for patients, a gymnasium, baths, enclosed corridors for exercise in cold weather, and a well-stocked wine-cellar. He was the great chemist of his time and was the discoverer of stannic chlorid. His nomenclature of many chemicals remains in use to this day.

It is certain that Johannes or Giovanni Colle, of Belluno, in Italy, who was Professor of Medicine at Padua, Physician to Cosimo II of Florence, and who wrote extensively upon Morbus Gallicus, described a method of transfusion in a medical tractate at a period anterior to the year 1628, as his book, in chapter seven of which he gives the account, “Methodus Facile Procurandi Tuta, et Nova Medicamenta,” appeared at Venice in that year.

There was a little book published about 1660, in Italy, that bears the title—when put into English—“A Pair of Medical Scales, in Which Are Weighed Not Only the Infusion of Medicines and Other Novelties, but also the Favorable and Unfavorable Opinions as to the Transfusion of Blood.”

This book was written by one Francesco Folli, a native of Poppi, born in 1624. He practiced medicine in various cities and provinces of Italy and was, about 1650, called to Florence to become body-physi-
The Beginnings of Intravenous Medication

The beginnings of intravenous medication began in the 16th century. In his book, he shows that he was familiar with the theory of the transfusion of blood, that he had developed a technique of his own and had had instruments made for that purpose. He states that he demonstrated the operation of transfusion in the year 1654 in the presence of the Grand Duke Frederick II. This would have been 11 years before the operation was done by Richard Lower, the English surgeon. In the year 1766, a book was published in Florence entitled "A Series of Portraits of Distinguished Tuscan Men." In this publication there appears a portrait of Folli and a pictorial reproduction of the instruments invented by him.

Folli proposed to employ a silver tube inserted into the artery of the donor, and a cannula of bone into the vein of the recipient, and to connect the two by means of a hollow pipe made from a blood-vessel taken from an animal. This tube was provided with a lateral branch that permitted the escape of the air as the blood poured through it from the artery toward the vein. It would seem that but for his lack of knowledge of hemolysis, Folli was practically as well prepared to do the operation as we are today.

I now quote from Roussel.

"In France they had not dared to attempt arterial transfusion, for the reason that in opening the carotid artery of the donor, his life was inevitably sacrificed. In 1653 Robert des Gabets, a monk of Cluny, demonstrated the possibility of performing intravenous transfusion, which he designated 'communication,' by means of two little tubes of silver which he had manufactured at Maçon in 1651 under the direction of another monk, Dom Eloy Pichot. These tubes were connected by a leather ball the size of a walnut, and each contained a valve to regulate the flow of the blood. By compressing the ball the necessary force was communicated to the venous blood to make it penetrate, and the quantity of blood could be measured. The ideas incorporated in the construction are the same as are demonstrated in the most modern apparatus for direct transfusion today." (1880)

We are now approaching the date of the first visual demonstration of the actual flow of the blood from the arterial into the venous side of the circulatory system, for it was not until 1661 that Malpighi saw the passage of the corpuscles of blood through the capillaries in a frog's foot, and by that vision supplied the final link to the chain of evidence proving the truth of Harvey's theory.

You will remember what I have said in an earlier portion of this paper as to the first suggestion of the infusorial surgery by Sir Christopher Wren in 1657. During the period following that suggestion the experiments along that line were followed, as I have shown you, for a period of eight years before any attempt was made to transfuse blood from one animal to another. Then "in the year 1665, toward the end of February," as says the author of "The Gold Headed Cane," "Richard Lower made this experiment at Oxford; by means of long tubes, the blood of the vertebral artery of one dog was made to pass into the jugular vein of another, and it appeared proved that there was no reason to fear any mischief, and that the character or nature of one animal was not likely to be changed by injecting into its veins the blood of another."

Whatever may have gone before, whether it be the work of Abraham Meyre of Balmes, the operation described by Libavius, the efforts of Folli, or the instruments of the Monks of Cluny, the date of the demonstration by Lower is the starting point of the long series of transfusional ex-
periments upon animals, by a multitude of learned men all over Europe, leading up to the triumphant experiment of Dionis of the Faculty of Montpelier, in Paris, of direct transfusion of the blood of an animal into man.

But before we go into the matter it will be well to quote once more from "The Gold Headed Cane" and tell a little story that is not without interest. ("The Gold Headed Cane," p. 97.)

Dr. Mead is made to say, "So late as the middle of the seventeenth century, about the time when Lower was making at Oxford the daring and original experiment of transfusion (of the blood), a grave dispute arose in Germany as to the position of the heart itself. The contest was terminated at length by the Professors of Heidelberg, where the question was agitated: having recourse to the delicate experiment of killing a pig in the presence of the Margrave of Baden-Durlach, and clearly proving to His Highness, who then labored under palpitation of the heart, that it really was situated on the left side of the thorax.

"The result of this important discovery was fatal to the fortunes of His Highness' physician, who, though he stoutly maintained by a refinement of courtly flattery that the heart of his master could not have a position similar to that of a pig, was dismissed in disgrace."

In Samuel Pepys' Diary, under date "Nov. the 14th, 1666," we find the following reference to the work of Lower:

"Dr. Croone told me that at the meeting at Gresham College to-night (which, it seems, they now have every Wednesday again), there was a pretty experiment of the blood of one dog let out (till he died) into the body of another on one side, while all his own run out on the other side. The first died upon the place, and the other very well, and likely to do well. This did give occasion to many pretty wishes, as of the blood of a Quaker to be let into an Archbishop, and such like; but, as Dr. Croone says, may if it takes, be of mighty use to man's health, for the amendment of bad blood by borrowing from a better body."

It will be seen that the experimental forms of transfusion took three classifications.

First, From brutes to brutes.
Second, From brutes to man.
Third, From man to man.

The particular objects that were believed to be worthy of an effort at transfusion were as follows. (I quote from an old authority, Ettmüller):

"To correct a vicious condition of the blood.
To prolong the lives of the aged.
The cure of Melancholy delirium.
The eradication of Scoury.
The cure of Consumption.
The mitigation of Arthritis.
The removal of Epilepsy.
The amelioration of Scabies and Leprony.
The restitution of diminished strength, as well in the young weakened by disease, as in the aged worn out with years.
For the alteration of the habits of people of evil disposition.
For the solution of calculi produced by a tartarous state of the blood."

It is needless to say that none of these objects was accomplished. Pierre Dionis, one of the surgeons to the Dauphin of France, son of Louis XIV, after a multitude of experiences made in the transfusion of blood from animal to animal, with varying results, in the month of June, 1667, made the following experiment. This was the first instance, properly recorded, of the transferrence of blood directly into the veins of a
human being from the arteries of an animal.

Thanks to the willingness of a certain strong and robust porter, Dionis was allowed, first to remove from the median vein of the man 10 ounces of blood, and immediately afterward the vein was connected by means of a tube with the crural vein of a lamb and twenty ounces of blood was poured into the circulation of the porter. Dionis paid the man and he at once went to an inn and ate and drank.

The experiment was repeated upon the man a number of times without harmful result. It is to be noted that the man was in good health.

The next instance of transfusion was that of the introduction of blood into a sick man, the result not being as fortunate. The case is well worthy of complete rehearsal.

"In Paris there was a boy of ten years of age who was suffering from a long continued tertian fever, weakened by continuous clysters and a vast number of bleedings, brought to a state of complete lethargy by the depauperation of the spirits, and whose life and intellect were reduced to the lowest ebb. For the relief of these conditions, and to improve the thickness of the blood and to increase its spirituosity, transfusion was attempted, but the boy being corrupted by his feverishness and his diarrhea, three ounces of thick, coarse and blackish blood were taken from him, and then eight ounces of blood from the carotid artery of a lamb were transfused into the vein. The boy soon felt better, took food, moved about and slept during the middle of the day; but after 24 hours he was again attacked with diarrhea and coma, and died."

In the month of December, 1667, Dionis transfused five ounces of the blood of a calf into the veins of a man suffering from mania and melancholia, after he had been bled to the amount of three ounces. This seems to have had a good effect upon the patient, but we do not learn that his improvement was permanent.

On November 23rd, 1667, Lower had attempted the same thing at Arundel House, upon Mr. Arthur Coga, "a mildly melancholy insane man," with the blood of a lamb, without mishap, but without any specially favorable result. The experiment was to have been repeated, but for some reason not stated, it never was. After the operation, Coga stated that he felt himself better.

There is no doubt that Lower would have gone on with his work to the final test to transfusion of blood from man to man, but that the law and local prejudice prohibited such an operation.

The work begun by Lower and Boyle attracted the attention of many philosophers and physicians in England and on the Continent, and we find them being repeated with many variations by King, Coxe and others in England, by Dionis and Gayen in France, by Graaf and others in Germany and Cassini in Bologna.

Reports of all these efforts are to be found in the Transactions of the Royal Society.

Similar experiments were carried on in Italy at Rome, by Guillelmos Riverius or Riva, of Montpellier. The following case, reported by him, is not without interest, in that it is probably the first instance recorded, possibly, of hemolysis.

It is not to be wondered at that, since these experiments in infusion and transfusion were in progress at a time when there was no possible chance that there could be any true knowledge of the

1 The context in the report of this case makes it rather doubtful as to the city at which it was done, but it would seem that it was done either by Guillelmos Riva, who was a well known surgeon at Rome, or by Dionis at Paris.
histology of the blood, there should have been accidents of this kind, and that through the occurrence of a number of them the method of treatment fell into disrepute. The case is as follows:

"There was living at that time in Paris a certain Swedish Baron named Bond, who was sick with a peculiar continued miliary fever of a light form, which was complicated by a colliquative diarrhea with bloody discharges from the bowels, indicating an hepatic complication.

"The man had been bled 32 times, but nevertheless his strength was failing and he was approaching death, the disease being so long drawn-out.

"Now when he was in a half-dead condition, a transfusion of a great number of ounces of blood from a calf was made into his veins.

"The pulse immediately became stronger to the touch, and after two days he was so much improved that he was able to speak, but after the lapse of two more days he suddenly died. An autopsy having been made, it was found that in the whole of his body and vessels there was not to be found blood to the amount of a teaspoonful."

Was this a case of hemolysis from the use of a blood that was lytic to that of the recipient? The intervening time between the immission of the blood and the death would seem to be too long, yet the possibility of hemolysis having taken place is not improbable.

As to the question of priority of transfusion from animal to animal, and animal to man, the matter is made clear in the following table.

It is very likely that experiments both in infusion and transfusion were made as early as 1660 by Wren, Richard Lower and Boyle, at Oxford.

It is certain that transfusion from animal to animal was done by Lower and Boyle at that city in February, 1665.

On May 17th, 1665, Lower made his demonstration of transfusion by means of quills, from dog to dog, before the Royal Society in London.

Pierre Dionis, at Paris, had been experimenting in infusional surgery during the year 1665 and 1666, and his letter in regard to his experiments appears in the Transactions of the Royal Society, No. 25, May 6th, 1667. He had also done some work in the way of transfusion on animals, as for instance the transfer of the blood of four goats into the veins of a 26-year-old horse, with success.

In the month of June, 1667, Dionis made his first transfusion from an animal to a healthy man. This experiment was repeated either in July or August of the same year by him, the recipient being a sick boy.

In November 23d, 1667, Lower transfused the blood of a sheep into the veins of one Arthur Coga.

In December, 1667, Dionis transfused the blood of a calf into the circulation of man suffering from mania and melancholy.


"The method observed in transfusing the blood out of one animal into another. It was first practised by Doctor Lower in Oxford, and by him communicated to the Honorable Robert Boyle, who imparted it to the Royal Society as follows:

"First take up the carotidal artery of the dog or other animal whose blood is to be transfused into another of the same or a different kind, and separate it from the nerve of the eighth pair, and lay it bare above an inch.

"Then make a strong ligature on the
upper part of the artery, not to be untied again; but an inch below, videlecit, towards the heart, make another ligature of a running knot, which may be loosened or fastened as there shall be occasion. Having made these two knots, draw two threads under the artery between the two ligatures, and then open the artery and put in a quill, and tie the artery upon the quill very fast by those two threads, and stop the quill with a stick. After this make bare the jugular vein in the other dog about an inch and a half long, and at each end make a ligature with a running knot, and in the space betwixt the two running knots draw under the vein two threads as in the other. Then make an incision in the vein, and put into it two quills, one into the descendent part of the vein to receive the blood from the other dog and carry it into the heart, and the other quill put into the other part of the jugular vein which comes from the head (out of which the second dog's own blood must run into dishes).

"These two quills being put in and tyed fast, stop them with a stick till there is occasion to open them.

"All things being thus prepared, tie the dogs on their sides towards one another, so perfectly that the quills may go into each other (for the dogs' necks cannot be brought so near but that you must put two or three several quills more into the first two to convey the blood from one to another).

"After that unstop the quill that goes down into the first dog's jugular vein and the other quill coming out of the other dog's artery, and by the help of two or three other quills put into each other according as there shall be occasion, insert them into one another. Then slip the running knots, and immediately the blood runs through the quills as through an artery, very impetuously. And im-mediately as the blood runs into the dog unstop the other quill, coming out of the upper part of the jugular vein (a ligature being first made about his neck, or else his other jugular vein being compress'd by one's finger), and let his own blood run out at the same time into dishes (yet not constantly, but according as you perceive him able to bear it, till the other dog begins to cry and faint and fall into convulsions, and at last dye by his side).

"Then take out both the quills out of the dog's jugular vein and tye the running knot fast and cut the vein asunder (which you may do without any harm to the dog, one jugular vein being sufficient to convey all the blood from the head and upper part by reason of a large anastomosis, whereby both the jugular veins meet about the larynx). This done, sew up the skin and dismiss him and the dog will leap from the table and shake himself and run away as if nothing ailed him.

"There are many circumstances necessary to be observed in the performing of this experiment. . . . Secondly, that you constantly observe the pulse beyond the quill in the dog's jugular vein (which it acquires from the impulse of the arterial blood). For if that fails, then 'tis a sign the quill is stopt by some congealed blood, so that you must draw out the arterial quill from the others, and with a probe open the passage again in both of them, that the blood may have its free course again. For this must be expected when the dog that bleeds into the other hath lost much blood his heart will beat very faintly, and then, the impulse of the blood being weakened, it will be apt to congeal the sooner, so that at the latter end of the work you must draw out the quill often and clear the passage. . . .

"The most probable use of this experiment may be conjectured to be that one
animal may live with the blood of another, and consequently that those animals that want blood or have corrupt blood may be supplied from others with a sufficient quantity, and of such as is good, provided the transfusion be often repeated, by reason of the quick expense that is made of the blood.”

Here the scientific Mr. Boyle comes into the matter with certain, “Tryals proposed by Mr. Boyle to Dr. Lower to be made by him for the improvement of transfusing blood out of one live animal into another.” (Philosophical Transactions, Monday, February 11, 1667, page 385, Vol. I.)

“The following queries and tryals were written long since, and read about a month ago in the Royal Society, and so now come forth against the author’s intention, at the earnest desire of some learned persons, and particularly the worthy doctor, to whom they were addressed, who thinks they may excite and assist others in a matter which to be well prosecuted will require many hands. At the reading of these the author declared that of divers of them he thought he could foresee the events, but yet judged it fit not to omit them, because the importance of the theories they may give light to, may make the trials recompense the pains, whether the success favours the affirmative or negative of the question, by enabling us to determine the one or the other upon surer grounds than we could otherwise do. And this advertisement he desires may be applied to those other papers of his that consist of queries or proposed tryals.”

The queries themselves follow:

“1. Whether by this way of transfusing blood the disposition of individual animals of the same kind may not be much altered (as whether a fierce dog, by being often quite new stocked with the blood of a cowardly dog may not become more tame, or vice versa).

“2. Whether immediately upon the unbinding of a dog, replenished with adventitious blood, he will know and fawn upon his master, and do the like customary things as before; and whether he will do such things better or worse at some time after the operation.

“3. Whether those dogs that have peculiarities will have them either abolished or at least much impaired by transfusion of blood.

“4. Whether acquired habits will be destroyed or impaired by this experiment.

“5. Whether any considerable change is to be observed in the pulse, urine, and other excrements of the recipient animal by this operation, or the quantity of his insensible transpiration.

“6. Whether the emittent dog being full fed at such a distance of time before the operation that the mass of blood may be supposed to abound with chyle, the recipient dog being before hungry will lose his appetite, more than if the emittent dog’s blood had not been so chylous.

“7. Whether a dog may be kept alive without eating by the frequent injection of the chyle of another, taken freshly from the receptacle into the veins of the recipient dog.

“8. Whether a dog that is sick of some disease chiefly imputable to the mass of blood may be cured by exchanging it for that of a sound dog; and whether a sound dog may receive such diseases from the blood of a sick one as are otherwise of an infecting nature.

“9. What will be the operation of frequently stocking (which is feasible enough) an old and feeble dog with the blood of young ones as to liveliness, dulness, drowsiness, squeamishness, &c., and vice versa?

“10. Whether a small young dog by
being often fresh stockt with the blood of
a young dog of a larger kind will grow big­
ger than the ordinary size of his own kind.

“11. Whether any medicated liquors
may be injected, together with the blood,
into the recipient dog. And in case they
may, whether there will be any consider­
able difference found between the sepa­
rations made on this occasion and those
which would be made, in case such medi­
cated liquors had been injected with some
other vehicle, or alone, or taken in at
the mouth.

“12. Whether a purging medicine be­
ing given to the emittent dog a while
before the operation, the recipient dog
will be thereby purged, and how.

“13. Whether the operation may be
successfully practised in case the inject­
ed blood be that of an animal of another
species, as of a calf into a dog, and of
cold animals as of a fish, or frog, or tor­
toise, in the vessels of a hot animal, and
vice versa.

“14. Whether the colours of the hair
or feathers of the recipient animal, by
the frequent repeating of this operation
will be changed into that of the emittent.

“15. Whether by frequently transfus­
ing into the same animal of another
species, something further and more tend­
ing to some degree of a change of species
may be effected at last in animals near of
kin (as spaniels and setting dogs, &c).

“16. Whether the transfusion may be
practised upon pregnant bitches, at least
at certain times of their gravitation, and
what effect it will have upon the whelps.”

In Paris, Dionis was arrested and brought
before a court, accused of murder of one of
his transfused patients, but he proved him­
self innocent, and the court, while it ac­
quitted him, prohibited further experi­
ments with human beings as subjects, ex­
cept with the consent of the Faculty of the
University, and then they were to be done
only by a registered physician of that
city.

The many accidents and deaths that fol­
lowed these experiments and the divided
opinion of the Faculties of the various
countries of Europe quickly attracted the
attention of the different governments to
the work being done by the experimenters,
and in France, transfusion was prohibited
by an edict of the Parisian Parliament.
However, experiments upon dogs or other
animals were not frowned upon in that
country.

Further progress in the investigation of
the transfusional surgery was brought to a
stand-still in almost all parts of Europe by
a special edict of the Pope at Rome about
the year 1678.

One might go deeply into a considera­tion
of the various conclusions arrived at by
the wise ones of that generation as to the
value of this method of treatment.

There seems to have been as many opin­
ions as there were investigators, and no
common opinion among them. This was
but natural at a period when so much was
yet to be learned as to the physiology of
the blood, chyle and lymph,—their circula­
tion and purposes.

The whole proposition fell into oblivion
and almost a century and a half elapsed
before interest was again awakened in the
question. But that is a matter beyond the
meaning of the title of this essay. I leave it
for others to investigate.
S

O far as I have been able to acquire it, the original method of caring for the sick and wounded in the Revolutionary War, which is the beginning of our medical history, was to employ individual medical men wherever they might be found to take care of the sick or wounded who happened to fall in some particular fight in their locality.

Little by little the generals in command, the Provincial Congresses of the colonies, and the Continental Congress of the United Colonies had medical matters forced upon their attention by the numerous bills coming in from doctors, here, there, and everywhere that there had been a battle. The Provincial Congresses and the Continental Congress had a number of medical men in their memberships, and in looking over the histories of this date we find constant references to them. Among those who were found in the legislative bodies of Massachusetts was Dr. Benjamin Church. He was afterwards sent as a member to the Continental Congress itself. He and three other doctors formed the first Army Medical Examining Board of which we can get any history, for I find in the Journal of the Provincial Congress of Massachusetts, 1775, p. 203, that on May 8th, 1775, this Congress

"Ordered, That the President pro tempore, Doct. Church, Doct. Taylor, Doct. Helten and Doct. Dunsmore, be a committee to examine such persons as are, or may be, recommended for surgeons for the army now forming in this colony."

and they,

"Resolved, That the persons recommended by the commanding officers of the several regiments, be appointed as surgeons to their respective regiments provided they appear to be duly qualified upon examination."

In Thacher's Military Journal, 1775-1783, on pages 34-35, we read:

"On the day appointed, the medical candidates, sixteen in number, were summoned before the board for examination. This business occupied about four hours; the subjects were anatomy, physiology, surgery and medicine. It was not long after, that I was happily relieved from suspense, by receiving the sanction and acceptance of the board, with some acceptable instructions relative to the faithful discharge of duty, and the humane treatment of those soldiers who may have the misfortune to require my assistance. Six of our number were privately rejected as being found unqualified. The examination was in a considerable degree close and severe, which occasioned not a little agitation in our ranks. But it was on another occasion, as I am told, that a candidate under examination was agitated into a state of perspiration and being required to describe the mode of treatment in rheumatism, among other remedies said that he would promote a sweat, and being asked how he would effect this with his patient, after some hesitation he replied, 'I would have him examined by a medical committee.' "

Thacher was so fortunate as to obtain the office of surgeon's mate in the provincial hospital at Cambridge, the senior surgeon being Dr. John Warren, brother and pupil of the gallant General Joseph Warren, who was slain in the memorable battle on Breed's Hill.

"This gentleman has acquired great reputation in his profession, and is distinguished for his humanity and attention to the sick and wounded soldiers, and for his amiable disposition. Having received my appointment by the Provincial Congress, I commenced my duty in the hospital, July 15th. Several private, but commodious houses in Cambridge are occupied for hospitals, and a considerable number of soldiers
who were wounded at Breed's Hill, and a greater
number of sick of various diseases, require all our
attention. Dr. Isaac Foster, late of Charlestown, is
also appointed a senior hospital surgeon; and his
student, Mr. Josiah Bartlet, officiates as his mate;
Dr. Benjamin Church is Director General of the
hospital."

I find in Thacher's *Military Journal*,
1775–1783, on page 294, the following:

"January 1st, 1781.—On this, the first day of the
new year, an arrangement of our army takes place,
according to the late resolve of Congress. The su­
pernumerary regiments are to be incorporated with
those which continue on the new establishment fixed
by Congress, and are to be entitled to the same
privileges and emoluments, which are to be allowed
to those who continue to the end of the war. It
being optional with me, either to retire or to con­
tinue in service, I shall retain my commission as
surgeon to Colonel H. Jackson's regiment. We are
encouraged to anticipate more favorable circum­
stances, and more liberal compensation, Congress
having at length passed several resolves, entitling
all officers who shall continue in service till the end
of the war, or shall be reduced before that time, as
supernumeraries, to receive half pay during life, and
a certain number of acres of land, in proportion to
their rank. Besides these pecuniary considerations,
we are actuated by the purest principles of patriot­
ism; having engaged in the mighty struggle, we are
ambitious to persevere to the end. To be instru­
mental in the achievement of a glorious Independ­
ence for our country, and posterity, will be a source
of infinite satisfaction, and of most grateful recol­
lection, during the remainder of our days. Notwith­
standing the unparalleled sufferings and hardships,
which have hitherto attended our military career,
scarcely an officer retires without the deepest re­
gret and reluctance. So strong is the attachment,
and so fascinating the idea of participating with
our illustrious commander in military glory, that a
separation is like a relinquishment of principle, and
abandonment of the great interest of our native
country."

The successive steps in the legislative
history of our Army Medical establish­
ment during the Revolution will be found
in the following pages, which I have care­
fully excerpted, from the Journals of each
Provincial Congress of the Colony of Mas­
sachusetts Bay, and from the twenty odd
volumes of the Journals of the Continental
Congress. Buried as they are in these
lengthy archives, such records are valueless
for medico-historical purposes. Presented
here, as purely archivistic material, they
are but the crude ore of medical history.
Yet this record is undoubtedly the basic
material upon which future historians must
rely in their work, which is my reason for
presenting it. To the medical officer, these
records are of exceptional interest; to the
patriot they will not seem dry and unin­
spiring.

Our military medical history began, as
we have seen, in the Colony of Massachu­
setts Bay. In the Journals of the Continent­
al Congress, we trace the prehistory of
our present Army Medical Corps, from the
appointment of Dr. Benjamin Church as
Director General and Chief Physician of
our first Army Hospital, at a salary of four
dollars a day, to the final acts relating to
the reduction of the army in 1783. The
subsequent act of June 2, 1784, practically
disbanded the U. S. Army, but it was im­
mediately followed by acts of June 3, 1784,
April 7, 1785, October 20, 1786, and October
3, 1787, providing for the levying of troops
and officers to guard our Northwestern
frontier and other localities. These were,
however, only militiamen. The U. S. Army
proper was still non-existent. Following the
appointment of Major-General Henry Knox
as Secretary of War, on March 8, 1785, an
act of September 29, 1789, authorized the
formation of a corps of 700 men, rank and
file, to guard the western posts. This force
had a medical complement of one surgeon
and four surgeon's mates. These forces were
enlarged up to their disbandment in the
fall of 1791, and on March 5, 1792, our
military forces were reorganized as a "Le­
gion" by Congressional enactment, with
Richard Allison, as "Surgeon to the Le­
gion," or Chief Medical Officer on the Gen­
eral Staff, at seventy dollars per month,
the pay of regimental surgeons (surgeon’s
mates) being forty-five dollars monthly.
Major General Anthony Wayne commanded the whole Legion, and in August, 1794, fought the decisive battle of Maumee Rapids against the hostile Indians. The Medical Department was enlarged by the acts of May 28, 1798, and March 2, 1799, which, at the earnest request of Washington, provided for the appointment of James Craik of Virginia as Physician General to both the Army and the Navy. Craik served in this capacity from July 19, 1798, to June 15, 1800, when he was mustered out by disbandment of these forces. On March 3, 1813, in the midst of the War of 1812, the office of Physician and Surgeon General was created, and on June 11, James Tilton of Delaware was appointed to this position. With Tilton's appointment, the history of the Medical Corps of our Army, as we now know it, begins.

In the pages immediately following, one may find the legislation relating to the treasonable action of Church, his trial and confinement, the appointment of John Morgan as his successor, the famous act of July 17, 1776, limiting and defining the authority of medical officers, Morgan's dismissal, through his disputes with Shippen and the unsoldierly neglect of duty of Stringer, the appointment of Shippen, Rush, and others, Shippen's trial for malfeasance in office, his acquittal and the resignation of Dr. William Brown, Shippen's resignation, the appointment of Cochran as Director General, and his services up to the disbandment of the Army in 1783. In the different plans considered for organization and reorganization of medical service, in such things as the bits of legislation bearing upon preventive inoculation against small-pox, we get a clear idea of what Congress was actually doing for the medical establishment of the Continental Army.

The main source books for the early history of our Army Medical establishment have been James Tilton's "Observations on Military Hospitals" (1813), the Military Journal of James Thacher (1826), James Mann's "Military Sketches of the Campaigns of 1812-14" (1816), and "The Medical Department of the United States Army from 1775 to 1873" by Harvey E. Brown (1873). It is in the hope of stimulating further interest and research that I add the subjoined record.

I. FROM THE JOURNALS OF THE PROVINCIAL CONGRESS OF MASSACHUSETTS BAY (1775)

April 27, 1775 (A. M.) 160

Ordered, That Capt. Kingsbury, Doct. Holten and Deacon Stone, are appointed to enquire, and endeavor to get an exact account of the men killed, and wounded, and murdered, in the late scene on the 19th instant.

May 8, 1775. 203

Ordered, That the president pro tempore, Doct. Taylor, Doct. Holten and Doct. Dunsmore, be a committee to examine such persons as are, or may be, recommended for surgeons for the army now forming in this colony.

Resolved, That the persons recommended by the commanding officers of the several regiments, be appointed as surgeons to their respective regiments, provided they appear to be duly qualified upon examination.

May 16, 1775. 232

The committee reported, that Doct. Benjamin Church was chosen.

May 17, 1775. 236

Resolved, That Doct. Church be allowed one servant to attend him in his journey to Philadelphia.

June 2, 1775. 290

Ordered, That Doct. Whiting and Doct. Bailies, be added to the committee which was appointed by the last Congress, to examine those persons who might be nominated for surgeons of the Massachusetts army.

June 12, 1775. 321

Ordered, That Doct. Whiting, Doct. Taylor and Mr. Parks, be a committee to consider some method of supplying the several surgeons of the army with medicines.

(Afternoon)

The committee appointed to consider some method for supplying the surgeons in the army with medicine, reported: the report was read and accepted, and is as follows, viz.: The committee appointed to take into consideration a complaint that the surgeons in the army are not properly furnished with medicines, have attended that service, and beg leave to report: that whereas, it appears that there is not, as yet, a suffi-
and wounded of the army, having attended that served, and is as follows, viz.:

Spring, relative to the use of his house for another necessaries for the hospitals.

Doct. Whiting, be a committee to consider what medicines, and all other method is proper to be taken to supply the hospitals.

Doct. Spring, be a committee to hire the same.

Mr. Hunt, at Cambridge, be hired for a hospital.

the proposal made by the committee of safety, relative to the killed and wounded in the late battle.

the same.

the committee of safety, relative to the killed and wounded in the late battle.

Doctor Whiting, per order.

Ordered. That the same committee be appointed to examine into the medical stores, and make a list of what is necessary for the supplying each regiment, that the same may be laid before the committee: and that the same committee consider what medicines are necessary, and bring in a list of what medicines are in the medical store: and that they be directed to report what instruments are necessary for the surgeons of the army.

June 16, 1775. 341

Doct. Hall and Doct. Jones were added to the committee to examine surgeons for the army. Resolved, That any three of said committee shall be a quorum.

June 19, 1775. 355, 357, 360–1

Doct. Hall, Doct. Jones and Mr. Bigelow, were appointed a committee to consider the expediency of establishing another hospital for the sick and wounded of the army, and ordered to sit forthwith. The committee appointed to consider the expediency of establishing another hospital for the army, reported, that a house belonging to Doct. Spring, of this place, may be had for that purpose, whereupon,

Resolved, That said committee be directed to inquire at what rate, per month, Doct. Spring will let the same.

Doct. Gunn was appointed to report a resolve on the proposal made by the committee of safety, relative to the killed and wounded in the late battle. Upon a motion made, Resolved, that the house of Mr. Hunt, at Cambridge, be hired for a hospital, and that the committee appointed to treat with Doct. Spring, be a committee to hire the same.

Ordered, That Doct. Church, Doct. Taylor, and Doct. Whiting, be a committee to consider what method is proper to be taken to supply the hospitals with surgeons: and that the same gentlemen be a committee to provide medicines, and all other necessaries for the hospitals.

The committee appointed to confer with Doct. Spring, relative to the use of his house for another hospital, reported: the report was read and accepted, and is as follows, viz.:

The committee appointed to consider of the expediency of establishing another hospital for the sick and wounded of the army, having attended that service, beg leave to report, that they judge it is really expedient to have another established, and they judge that the house of Doct. Spring, in Watertown, is convenient for that purpose; and that he is willing said house should be improved by the province for that use, but that he cannot at present ascertain the damage it may be to him, but is willing to submit that matter to the judgment of a committee to be hereafter appointed by this honorable Congress or the house of assembly.

June 22, 1775. 374, 375, 377

Ordered, That Doct. Francis Kittridge be desired to attend the hospital, as a surgeon, till the further order of Congress, and that Mr. Kendall be desired to inform Doct. Kittridge of his appointment.

Ordered, That the colonels of the several regiments in the Massachusetts army, be directed to recommend, immediately, suitable persons for surgeons and surgeons’ mates.

Ordered, That a hospital be provided for the camp at Roxbury, and that Col. Davis, Doct. Taylor and Doct. Whiting, be a committee to provide one accordingly, and to supply the same.

Resolved, That (the colonels 1) in the Massachusetts army, be and they are hereby directed, immediately to inform the committee appointed by Congress to examine the surgeons for said army, whom they recommend for the surgeons and surgeon’s mates of their respective regiments, and send them to said committee for examination, without delay; except such as have been examined.

June 23, 1775. 378

The committee appointed to provide a hospital for the camp in Roxbury, reported as follows: That they have appointed the house belonging to Joshua Loring, in said Roxbury, for a hospital, and for the use of said camp. The report was accepted.

June 24, 1775. 383, 384, 387

Voted, That there shall be two surgeons and two mates appointed for each hospital, and commissioned accordingly.

Ordered, That the committee appointed to examine the surgeons, be desired to report an establishment for surgeons of hospitals.

The committee appointed to consider an establishment for the surgeons of hospitals, reported: the report was accepted, and is as follows, viz.: that it is their opinion, that the establishment of the chief surgeons should be at the rate of eight pounds per month, and each mate, four pounds, ten shillings, per month.

The committee appointed to hire a house of John Hunt, Esq., for a hospital, reported the following proposal, which was accepted, viz.:

Gentlemen:—With respect to the hire of the house belonging to John Hunt, Esq., for a hospital, the proprietor only expects such a consideration from the colony, as will be a satisfaction for the necessary damage to the house, expecting proper care will be taken that the out-houses, &c., be kept in good order.

W. Hunt, in behalf of the proprietor.

1 (each colonel).
June 27, 1775. 406

Ordered, That the committee appointed to provide hospitals for the army, be directed to provide another hospital, to be appropriated solely for such of the army as may be taken with the small pox, and to consider what measures can be taken to prevent the spreading of that distemper, and that Doct. Rand, and Doct. Foster, be added to the committee.

June 28, 1775. 415

The form of a warrant for the surgeons was read and accepted, and is as follows, viz.:

The Congress of the Massachusetts Bay, to A. B. Greeting.

Being informed of your skill in surgery, and reposing especial trust and confidence in your ability and good conduct, we do, by these presents, constitute and appoint you the said A. B., to be surgeon of the regiment of foot, whereof ______ is colonel, raised by the Congress aforesaid, for the defence of said colony. You are, therefore, carefully and diligently to discharge the duty of a surgeon to the said regiment, in all things appertaining thereto, observing such orders and instructions as you shall, from time to time, receive from the colonel of said regiment, according to military rules and discipline established by said Congress, or any your superior officers, for which this shall be your sufficient warrant.

By order of the Congress, ______ President.

Dated at Watertown.

June 30, 1775. 423, 4

The committee appointed to consider some measures to prevent the spreading of the small pox, were directed to sit forthwith.

The form of a warrant for surgeons of the hospital, was read and accepted, and is as follows, viz.:

The Congress of the Colony of the Massachusetts Bay, to ______ Greeting.

Being informed of your skill in surgery, and reposing special trust and confidence in your ability and good conduct, (we) do by these presents, constitute and appoint you the said ______, to be surgeon of the hospital, established by order of the Congress, in ______, for the sick and wounded of the said colony army. You are, therefore, carefully and diligently to discharge the duty of a surgeon of said hospital, in all things appertaining thereto, observing such orders and instructions as you shall, from time to time, receive from the colonel of said hospital, which the sick or wounded person belongs, finds the sick or wounded as abovesaid cannot be properly taken care of in the regiment to which he belongs, said surgeon shall send the sick or wounded as abovesaid, to the hospital provided for the use of the camps to which they belong, and a certificate of the man’s name, and the company and regiment to which he belongs; and in that case, the surgeon of the said hospital shall receive said sick or wounded under his care; and in case said hospital shall become too full, in that case, the surgeon of said hospital shall send such of his patients as may with safety be removed, to the hospital in Watertown and a certificate setting forth the man’s name, what company and regiment each belongs to; and in that case the surgeons of the Watertown hospital shall receive said sick or wounded under his care.

July 4, 1775. 446, 448

Ordered, That Mr. Pickering, Mr. Partridge, and Mr. Goodwin, be a committee to prepare a letter to General Washington, informing him of the provision this Congress has made for the sick and wounded of the army.

Ordered, That Doct. Taylor, Doct. Church, and Mr. Johnson, be a committee to bring in a resolve appointing Doct. (Andrew) Craigie, a commissary of medical stores, and that said committee be directed to consider what is a proper establishment for his pay.

The committee appointed to bring in a resolve for appointing Mr. Craigie, medical comissary, reported. (The report) was read, and is as follows, viz.:

Resolved, That Mr. Andrew Craigie be, and he is hereby appointed a medical comissary and apothecary for the Massachusetts army, and that said Craigie be allowed five pounds per month, for his services as abovesaid.

Ordered, That the committee for making out commissions make out a warrant for Mr. Craigie, medical comissary.

July 5, 1775. 449, 450, 455.

A list of surgeons who have been examined and approved of, by a committee of this Congress, was laid before the Congress, and read, and is as follows:

Doct. David Jones, surgeon; Samuel Blanchard, mate, in Col. Gerrish’s regiment; Aaron Putnam, mate, in Col. Fry’s regiment; Joseph Hunt, mate to Doct. Joseph Foster, in Cambridge hospital; Jacob Bacon, mate in Col. Scammon’s regiment; Harris Clary Fridges, mate; Edward Durant, surgeon, Col. Mansfield’s regiment; Josiah Harvey, mate, Col. Fellow’s regiment; Abraham Watson, Jr. surgeon,

Thereupon, Ordered, That warrants be made out for them agreeably thereto.

Ordered, That the order of Congress relative to the date of the warrants for the staff officers, be so far reconsidered, as that the warrants for the surgeons be dated the 28th June, ultimo.

A form of a warrant for a medical commissary, was read and accepted, and is as follows, viz.:

The Congress of the Colony of the Massachusetts Bay, to — Greeting.

We, being informed of your skill in medicine, and reposing especial trust and confidence in your ability and good conduct, do, by these presents, constitute and appoint you the said — — —, to be medical commissary and apothecary to the army raised by the Congress, for the defence of this colony. You are, therefore, carefully and diligently to discharge the duty of a medical commissary and apothecary in all things appertaining thereto, observing such orders and instructions as you shall, from time to time, receive from any your superior officers, according to the rules and discipline established by said Congress, for which this shall be your sufficient warrant.

By order of Congress, — — —, President.

The committee appointed to prepare a letter to General Washington, enclosing a resolution of Congress relative to the sick and wounded, reported. The report was accepted, and is as follows, viz.:

(To his Excellency General Washington:)

This Congress ordered the enclosed resolution to be prepared, and sent to Generals Ward and Thomas; but by the agreeable event of your excellency's appointment to the chief command of the American army, and arrival at camp, the propriety of that step ceases. We mean not to dictate to your excellency, but presume, that to secure the health of the army, and (to afford) relief for the sick, will naturally engage your attention. Every thing in the power of this Congress (to do) to enable you to discharge, with ease, the duties of your exalted and important station, will be, by us, attended to, with the greatest alacrity. If the enclosed resolution has that tendency, we attain the end intended by transmitting to you the same, and are, with respect,

Your Excellency's most humble servants.

July 7, 1775. 464

Ordered, That a warrant be made out for Doct. Isaac Foster, as surgeon of the hospital at Cambridge, and another to Doct. Isaac Rand, as surgeon of the hospital at Roxbury.

July 8, 1775. 470, 473, 476

A list of surgeons examined by a committee appointed for that purpose, was exhibited to Congress, and warrants ordered to be made out agreeably thereto.

Resolved, That three o'clock, in the afternoon, be assigned, to consider the expediency of appointing a surgeon general for the Massachusetts forces.

Resolved, That eight o'clock to-morrow morning be assigned for the consideration of the expediency of appointing a surgeon general of the Massachusetts army.

July 11, 1775. 488, 489

Ordered, That Mr. Crane, and Mr. Fox, make out warrants for several surgeons and surgeons' mates, agreeably to a list this day exhibited by Doct. Taylor, and that such warrants, when made out, be transmitted to the committee of safety.

Resolved, That Doct. Church, Doct. Taylor, and Doct. Whiting, be a committee to take into their custody all the medicines, medical stores and instruments, which are, or may be provided for the use of the army, by this colony, and to distribute them at their best discretion, so that no peculation or needless waste be made of the medicinal stores belonging to the public.

December 20, 1774. 506

Voted, unanimously, that Doct. Warren, Doct. Church, and the Hon. John Hancock, Esq., be a committee to inspect the commissaries' stores, in Boston, and report what surgeon's stores and stores of other kind are there.

February 21, 1775. 509

Voted, That Docts. Warren and Church be a committee to bring in an inventory of what is necessary in the way of their profession, for the above army to take the field.

February 24, 1775. 512

Voted, That Doct. Warren, Doct. Church, Mr. Gerry, Mr. Cheever, Col. Orne and Mr. Devens, make inquiry where fifteen doctor's chests can be got, and on what terms, and report at the next meeting.

March 7, 1775. 512

Voted, That the committee of supplies be directed to make a draft on Henry Gardner, Esq., the receiver general, in favor of Doct. Joseph Warren and Doct. Benjamin Church, for five hundred pounds, lawful money, to enable them to purchase such articles for the provincial chests of medicine as cannot be got on credit, to be deducted from the provincial tax payable by the town of Boston.

April 18, 1775. 517

Voted, That two medicinal chests still remain at Concord, at two different parts of the town; three of said chests at Sudbury, in different parts of the town; six do. at Groton, Mendon, and Stow, two in each town, and in different places; two ditto in
Worcester, one in each part of the town; and, two in Lancaster, ditto; that sixteen hundred yards of Russia linen be deposited in seven parts, with the doctor's chests; that the eleven hundred tents be deposited in equal parts in Worcester, Lancaster, Groton, Stow, Mendon, Leicester, and Sudbury.

April 21, 1775. 521

Voted, That Major Bigelow be applied to, to furnish a man and horse to attend the surgeons, and convey medicines agreeably to their directions.

April 29, 1775. 527

Voted, That Dr. Isaac Foster be directed and empowered to impress out medicines to such persons as he shall think proper for said hospital, and that this be a sufficient order for him to draw on the commissary for such articles as he can supply, and to draw orders upon the commissary for the payment of whatever expenses are necessary for procuring the above mentioned articles.

April 30, 1775. 530

Voted, That Andrew Craigie be appointed to take care of the medical stores, and to deliver them out as ordered by this committee; and that the secretary make out his commission accordingly.

May 7, 1775. 538

Whereas, it appears to this committee, that great uneasiness may arise in the army, by the appointment of surgeons who may not be agreeable to the officers and soldiers in their respective regiments, therefore, Voted, that it be recommended to the Congress, to allow the colonel of each regiment to nominate the surgeon for his regiment; said surgeon to nominate his mate; and unless there is some material objection made against them, that they be accordingly appointed.

May 13, 1775. 544

Voted, That General Thomas be desired to deliver out medicines to such persons as he shall think proper, for the use of the sick soldiers at Roxbury, until the surgeons for the respective regiments are regularly appointed.

Voted, That the provisions and chest of medicines belonging to Madam Vassal, now under the care of Col. Starks, be stored as Col. Starks may direct, till further orders: and that the other packages may pass into Boston or elsewhere.

May 14, 1775. 545

Mr. Andrew Craigie, commissary of the medicinal stores, &c., was directed and empowered to impress beds, bedding, and other necessaries for the sick, as they may be wanting, giving the owners a receipt for such articles as he may take for the purpose aforesaid.

June 13, 1775. 566

The committee earnestly recommend to the honorable Congress that the representations from the quarter master general, be taken into immediate consideration, especially as the committee, from their own knowledge, find the rooms too much crowded, and the healths and lives of the soldiers thereby greatly exposed; and if tents cannot be immediately furnished, that some barracks be forthwith erected.4

June 14, 1775. 566

Whereas, this committee are informed, that Dr. How, of Andover, is prepared to receive (insane patients,) and is well skilled in such disorders as Daniel Adams, of Boston, sent on the 13th instant, to the town of Woburn, is affected with, therefore, Resolved, that the selectmen of the town of Woburn, be, and they hereby are released from keeping said Daniel Adams in the town of Woburn, and they are required to provide a horse and carriage, with provisions, to forward the said Adams to Andover, the expense of which will be paid by this colony.

Resolved, That Daniel Adams, a lunatic, now at Woburn, be carried to the town of Andover, and committed to the care of Dr. How, and the said Dr. How is hereby desired to take proper care of the said lunatic, at the expense of this colony.

June 19, 1775. 571

Resolved, That the house of the Rev. Samuel Cook, of Menotomy, be improved as a hospital for the colony army; and that Mr. William Eustis be, and hereby is appointed, to the care of the sick and wounded in said hospital, till the further order of this committee.

Ordered, That Dr. Isaac Foster be, and he hereby is directed, to take up and improve as hospitals, so many houses in Menotomy, as he may find necessary for the safety of the sick and wounded of the colony army, and that he employ such person or persons as may be necessary to carry such provisions and other necessaries as may be wanted for the use of the aforesaid sick and wounded; and further, that he take such precautions, respecting the small pox hospital, as may be necessary for the prevention of the spreading of that epidemical disorder in the camp or elsewhere.

June 26, 1775. 578

Whereas, this committee find the public hospital in this town has been much neglected, to the great injury of the patients in said hospital, occasioned by the want of some suitable person being placed there as surgeon, therefore, Resolved, that Dr. John Warren, be, and he hereby is appointed, to the oversight of said hospital, and that he take proper care such provision be made as may be necessary for the comfortable support of the patients in said hospital until further orders.

July 15, 1775. 597

Complaint having been made to this committee by the honorable General Ward, and other officers in the army, that several men are dangerously sick, and their lives would be greatly hazarded, except 4 The quartermaster general represented, that there was great want of tents and barracks, and that the least delay in making provision for the shelter of the troops, would be attended with injurious consequences.
immediate application of medicine be made to them, and that the surgeons of some of the regiments had applied, but could not obtain any; a sub-committee was therefore chosen to visit the hospital, and to see the surgeons, and, upon inquiry, found that there were no such medicines as are immediately wanted: therefore, Resolved, that as the lives of some part of the army are in great danger, for want of medicines, notwithstanding the commission of the committee of safety does not admit of direction in this matter, that Mr. Commissary Craigie be desired to procure, at the expense of the colony, such medicines as may be immediately and absolutely necessary; in consequence of which, the following order was given Mr. Commissary Craigie:

Sir:—You are hereby desired immediately to supply the store under your care, with such medicines as are absolutely necessary for the present relief of the sick in the army.3

Report of the Committee sent to Ticonderoga, Cambridge, July 6, 1775.

Your committee, being of opinion, that a major should be appointed under Col. Easton, and one surgeon to the battalion, and having inquired into the disposition of the officers and men who have engaged, have appointed John Brown, Esq., as major, and Mr. Jonas Fay, as surgeon.

All which is humbly submitted, WALTER SPONER, by order.

II. FROM JOURNALS OF THE CONTINENTAL CONGRESS (1774–83)

June 2, 1775. 76

The President laid before the Congress a letter from the Provincial Convention of Massachusetts which was read and was as follows:

In prov. Congress, Watertown, May 16, 1775.

Resolved, That Doct. Benjamin Church be ordered togo immediately to Philad. and deliver to the president of the Hon’ble American Congress there now sitting, the following application to be by him communicated to the members thereof: and the s’ Church is also directed to confer with the s’ Congress, respecting such other matters as may be necessary to the defence of this colony and particularly the state of the army therein. . . .

July 19, 1775. 191

Resolved, That a Committee of three be appointed to report the method of establishing an hospital.

The committee chosen, Mr. (Francis) Lewis, Mr. (Robert Treat) Paine, and Mr. (Henry) Middleton.

July 24, 1775. 203

The Committee for that purpose app(oin)t’d bro’t in a report for establishing a hospital. Ordered to lie on the table.

July 25, 1775. 203.

Report read:

Although the sessions of the committee continued after the fifteenth day of July, 1775, the journal is not preserved to a later date.
That he be authorized and have power to appoint a number of surgeon mates under him, not exceeding four.

That the pay of said mates be 2/3 of a dollar per day.

That the number be not kept in constant pay, unless the sick and wounded be so numerous as to require the constant attendance of four, and to be diminished as circumstances will admit, for which reason the pay is fixed by the day, that they may only receive pay for actual service.

That the deputy Commissary general be directed to pay Doctr. Stringer for the Medicines he has purchased for the use of the army, and that he purchase and forward such other medicines as General P. Schuyler shall, by his warrant, direct, for the use of said army.

That M' (Eliphlet) Dyer, M' (Thomas) Lynch, M' (John) Jay, M' (John) Adams, and M' (Francis) Lewis, be a Committee to devise ways and means for supplying the continental army with Medicines.

September 23, 1775. 261

On motion Ordered, That the Committee appointed to devise ways and means of supplying the Army with Medicines, do buy a parcel of Drugs in the hands of Mr. Rapalje, which he offers at the prime cost.

October 14, 1775. 294-295

On motion made, Resolved, That a director general and chief physician of the Hospital in Massachusetts bay, be appointed in the room of Doct'r (Benjamin) Church, who is taken into custody for holding a correspondence with the enemy.

Resolved, That the Congress will, on Monday next, proceed to the election of a director general and chief physician of the Hospital, in the room of Doct'r Church.

October 17, 1775. 297

The Congress proceeded to the election of director general and chief physician of the Hospital, in the room of Doct'r (Benjamin) Church, and the ballots being taken and exam'd,

Doct'r (John) Morgan, (of Philadelphia,) was elected.

November 7, 1775. 334

Resolved, That Dr. Church be close confined in some secure gaol in the colony of Connecticut, without the use of pen, ink, and paper, and that no person be allowed to converse with him, except in the presence and hearing of a Magistrate of the town, or the sheriff of the county where he shall be confined, and in the English language, until farther orders from this or a future Congress.

November 10, 1775. 344

Resolved, That the medicines purchased in this city for the army at Cambridge, be sent thither by land.

December 8, 1775. 416

On motion, Resolved, That a surgeon be allowed to each regiment, (in the service of the United Colonies;) That the pay of a regimental Surgeon be 25 Dollars per (calendar) month.

William Barnet, jun. was unanimously elected surgeon of the first or eastern battalion raised in New Jersey.

December 21, 1775. 442

Doctor James Holmes was chosen surgeon to Colonel Maxwell's regiment.

January 8, 1776. 38

Resolved, That the provisions heretofore made for an hospital in the northern army, when it was more numerous than it is now, is sufficient.

January 17, 1776. 61

A Petition from Benjamin Church was presented to Congress, and read: 6

Ordered, That the same be referred to a committee of three.

January 18, 1776. 65

The committee on the petition of Dr. Church, brought in their report, which being taken into consideration,

Resolved, That Governor Trumbull be desired to give order for the removal of Dr. Church to some more comfortable place of confinement than that where he now is, if such can be found in that colony; and that, for the advancement of his health, the said Dr. Church be permitted to ride out, at proper seasons, under a trusty guard, who will be careful to prevent his carrying on any correspondence, or doing any act prejudicial to the safety and welfare of the United Colonies.

A letter from the committee of Frederic town, (Maryland,) enclosing sundry intercepted letters of Connolly, taken on Dr. John Smith, (one of Connolly's associates,) and brought by the guard who had the charge of bringing down said Smith, was laid before Congress and read:

Resolved, That it be recommended to the committee of the county of Pennsylvania, to take the examination of Dr. Smith, and then commit him to safe and close confinement.

January 25, 1776. 87-8

A letter from Richard Huddleston, . . . . 7

The same Committee on considering Dr. Huddleston's Letter, are of Opinion, That he be immediately set at Liberty on the Terms he mentions. And that a verbal Proposition be sent by him to General Carleton, to enter into a Stipulation on both sides, not only to release all Physicians and Surgeons; but that if by the Fortune of War, the Hospital of either Army should fall into the Power of the other, the same Subsistence and Supplies should be afforded to the Sick

6This petition is in the Papers of the Continental Congress, No. 41, II, folio 5.

7The letter of Huddleston is in the Papers of the Continental Congress, No. 78, XI, folio 13.
and Wounded as if Friends; and that neither they nor the Attendants of the Hospitals should be considered or detain'd as Prisoners. And it is farther the Opinion of the Committee, that if Govr. Carleton should not agree to the mutual Release of Surgeons, Dr. Huddleston is to be on his Parole, to return immediately hither.4

January 30, 1776. 101

Resolved, That Dr. Cadwalader and Dr. W. Shippen, Jun' be desired to inspect the room of the gaol where General Prescott is confined, and enquire into the state of his health, and report to Congress.

January 31, 1776. 103

Dr. Cadwalader and Dr. Shippen returned their report respecting the room where General Prescott is confined, and the state of the general's health, which was read.

March 1, 1776. 180

Resolved, That the Secret Committee be empowered to treat with the owners of some medicines lately imported, and purchase the same on the most reasonable terms for the use of the continent.

March 7, 1776. 188

Resolved, That the Committee appointed to provide medicine chests be directed to supply the first and third New Jersey battalions with proper medicine chests and instruments.

March 11, 1776. 197

Resolved, That the committee on applications and qualifications &c. be directed to provide 6 medicine chests for the 6 Virginia battalions.

March 22, 1776. 225

A petition from Thorowgood Smith, and others, was presented to Congress, and read, setting forth, that they have procured a vessel, and raised money to fit her out as a privateer, in order to guard and cruise on the coast of Virginia, and praying that a commission be granted to William Shippen, to whom they propose to give the command of said vessel; and that the Congress will grant them a cruise on the coast of Virginia, and praying that a commission be granted to William Shippen, as captain of the above mentioned vessel, for the purposes aforesaid.

Resolved, That Captain William Shippen be supplied with three hundred weight of powder by the Secret Committee, he paying for the same.

4 This report, in the writing of Benjamin Franklin, is in the Papers of the Continental Congress, No. 19, III; folio 210. The following notes in the writing of Franklin are in No. 78, XIX, folio 7. "Agreed to set Dr. Huddleston at Liberty on the Terms he mentions. And send by him a Proposition to Gen. Carleton, that it be Stipulated on both Sides, not only to release all Surgeons; but that if by the Fortune of War, the Hospital of either Army should fall into the Power of the other, the same Care should be taken of the Sick and Wounded as of Friends, and that neither they nor the Attendants of the Hospital should be considered as Prisoners. And if Govr Carleton should not agree to the mutual release of Surgeons, Dr. Huddleston is to be on his Parole to return immediately." 

March 30, 1776. 242-3

Resolved, That each regimental surgeon be allowed a mate:

Resolved, That the pay of a surgeon's mate be 18 dollars per month.

Resolved, That (suitable chirurgical) instruments be purchased with each medicine chest.

April 11, 1776. 271

To Dr. Jonathan Potts, for attendance on the prisoners at Reading, the sum of £28.15.0 (=76.6 dollars); and for sundry medicines, &c. provided for the middle department, the sum of £50.9.1 (=134.6 dollars), amounting, together, to the sum of £79.4.1=211.2 dollars.

April 20, 1776. 317

A letter from Thomas Bullit and a petition from Dr. J. Potts, was presented to Congress and read.9

Resolved, That they be referred to the foregoing committee.

May 6, 1776. 330

Resolved, that the convention, or committee or council of safety of Virginia, be empowered to appoint surgeons to the battalions raised in said colony, for the service of the continent.

May 10, 1776. 344

G. 6. That Dr. Potts be taken into the Pay of the Continent and be employed in the Canada Department or at Lake George as the Genl Schuyler shall think fit. But that this Recommendation be not considered so as to supersede Dr. Stringer. That the Pay of Dr. Potts be Dollars per Mo.

May 11, 1776. 348

Resolved, That two sets of trepanning instruments be sent to Virginia for the use of the surgeons of the continental troops there; and that two sets of trepanning instruments, and 100 lb. of Peruvian bark, be sent to North Carolina, for the use of the continental troops in that colony.

May 13, 1776. 350

Sundry petitions were presented to Congress and read, viz.: One from Benjamin Church, accompanied with one from Benjamin Church, Samuel Church and Edward Church, and a certificate from three Doctors (respecting the health of Dr. B. Church;) one from John Connolly and John Smith, accompanied with a letter from Dr. (Thomas) Cadwalader.10

9. . . . The petition of Dr. Potts is in the Papers of the Continental Congress, No. 78, XVIII, folio 66. . . .

10 The petition of Connolly is in the Papers of the Continental Congress, No. 78, V, folio 39. That of Smyth is in No. 78, XX, folio 20. That of Cadwalader is in No. 78, V, folio 43.
May 14, 1776. 352

The committee to whom the petition of Dr. Benjamin Church, now confined in gaol in Norwich, in the colony of Connecticut, and also a petition from Benjamin, Samuel, and Edward Church, together with a certificate from physicians, respecting the dangerous state of the aforesaid Dr. Church, were referred, brought in their report, which was read and agreed to: Whereupon,

Resolved, That Dr. Benjamin Church be sent to the colony of Massachusetts bay, and that the council of the said colony be requested to take a recognizance from him, with two good sureties, in such penalty as they shall think sufficient, not being less than one thousand pounds, lawful money, for his appearance before such court as shall be erected for his trial, and at such time and place as such court shall direct, and to abide the judgment of the same; and that they be farther requested, to take his parole, not to hold any correspondence with the enemies of the United Colonies, or at any time, to depart out of the same colony, without their license; and that, upon the performance thereof, the said Dr. Benjamin Church be set at liberty.

May 16, 1776. 358

A letter from General Washington, of May (14), enclosing a letter (to him) from Dr. Stringer.11

Resolved, That the letter from Dr. Stringer to General Washington, be referred to the committee appointed to prepare medicine chests:

May 18, 1776. 284

That a continental Hospital be established in Virginia, and a director to the same be immediately appointed by Congress.

May 22, 1776. 378

15. That——Surgeons and——mates be added to the Hospital in Canada and that Doct' Stringer be directed to procure them.12

June 5, 1776. 419

That the pay of the regimental surgeons be augmented to thirty three dollars and one third of a dollar a month.

June 6, 1776. 424

Resolved, That doctor Jonathan Potts be employed as a physician and surgeon in the Canada department, or at Lake George, as the general shall direct; but, that this appointment shall not supersede Dr. Stringer.

June 17, 1776. 449. 453

U. 6.13

R. 8. That the committee, appointed to provide medicines, be directed to send a proper assortment of medicines to Canada:14

June 18, 1776. 460–461, 463

A memorial from Dr. (John) Morgan, director general and chief physician of the Hospital, was laid before Congress, and read:15

Resolved, That it be referred to the committee appointed to provide medicines.

Resolved, That Mr. (Thomas) Heyward (Jr.), and Mr. (Lyman) Hall be added to the committee for providing medicines.

June 19, 1776. 466

To Mary Thomas, for nursing and boarding two of Captain Benezet's men, in the small pox, the sum of £4.10.0 = 12 dollars:

Ordered, That the said accounts be paid.

Resolved, That the committee for preparing medicine chests, be directed to send a chest of medicines to the surgeon of said battalion.

A memorial from the mates of the Hospital was laid before Congress and read:16

Resolved, That it be referred to the committee for providing medicines.

June 20, 1776. 469

To Abraham Mills, for nursing and boarding six soldiers in the small pox, the sum of £12.14.8 = 33 36/90 dollars:

Resolved, That a committee of five be appointed to consider what provision ought to be made for such as are wounded or disabled in the land or sea service, and report a plan for that purpose:

The members chosen, Mr. (Robert Treat) Paine, Mr. (Francis Lightfoot) Lee, Mr. (Lyman) Hall, Mr. (William) Ellery, and Mr. (Francis) Lewis.

July 8, 1776. 528

Resolved, That the committee for providing medicines, be directed to supply the militias aforesaid, with a sufficient quantity of suitable medicines.

July 12, 1776. 556

The committee appointed to take into consideration the memorial of the director general of the American hospital, brought in their report, which was read:

Ordered, To lie on the table.

July 13, 1776. 562

Resolved, That a chief physician be appointed for the flying camp, and that his pay be four dollars per day:

The ballots being taken (and examined,)

William Shippen, Jun' was elected.

July 17, 1776. 568–571

The Congress took into consideration the report of the committee on the memorial of the director general of the American hospital; Whereupon,

[Resolved, For the better Government of the general Hospital of the American Army, for explaining and ascertaining more fully the duties of the Director-General, the directors of Hospitals, the Surgeons and Mates, both Hospital and Regimental:]

11 The letter of Washington is in the Papers of the Continental Congress, No. 132, I, folio 686. It is printed in Writings of Washington (Ford), IV, 80.

12 Against this paragraph is written: "Referr'd to to-morrow."

13 This paragraph, relating to the appointment of Dr. Jonathan Potts, is stricken out of the Jefferson report, having been printed under June 6, p. 424, ante.

14 In the Jefferson report this paragraph read: "Resolved, That a proper assortment of medicines be sent to Canada." Against it Harrison has written "Com'd already appointed to provide medicines."

15 This memorial is in the Papers of the Continental Congress, No. 41, VI, folio 3.

16 This memorial is in the Papers of the Continental Congress, No. 41, III, folio 167.
Resolved, That the number of hospital surgeons and mates be increased, in proportion to the augmentation of the army, not exceeding one surgeon and five mates to every five thousand men, to be reduced when the army is reduced, or when there is no further occasion for so great a number:

That as many persons be employed in the several hospitals, in quality of store keepers, stewards, managers, and nurses, as are necessary for the good of the service, for the time being, to be appointed by the directors of the respective hospitals:

That the several regimental chests of medicines, and chirurgical instruments, which now are or hereafter shall be, in the possession of the regimental surgeons, be subject to the inspection and enquiry of the respective directors of hospitals, and the director general regular returns of the number of sick persons shall, from time to time, when thereto required, render account of the said medicines and instruments to the said directors, or if there be no director in any particular department, to the director general; the said accounts to be transmitted to the director general, and by him to this Congress; and the medicines and instruments not used by any regimental surgeon, to be returned when the regiment is reduced, to the respectively directors, and an account thereof by them rendered to the director general, and by him to this Congress;

Resolved, That an Additional Apothecary with such Number of Mates as the Service may require, be allowed, under the Title of Apothecary to the Army, and in subordination to the General Hospital Apothecary of the General Hospital.17

That the several directors of hospitals, in the several departments, and the regimental surgeons, where there is no director, shall transmit to the director general regular returns of the number of surgeons' mates, and other officers employed under them, their names and pay; also, an account of the expences and furniture of the hospital under their direction; and that the director general make report of the same, from time to time, to the commander in chief, and to this Congress:

That the several regimental and hospital surgeons in the several departments, make weekly returns of their sick to the respective directors in their departments:

That no regimental surgeon be allowed to draw upon the hospital of his department, for any stores except medicines and instruments; and that, when any sick person shall require other stores, they shall be received into the said hospital, and the rations of the said sick persons be stopped, so long as they are in the said hospitals; and that the directors of the several hospitals report to the commissary the names of the sick, when received into, and when discharged from the hospital, and make a like return to the Board of Treasury:

That all extra expenses for bandages, old linen, and other articles necessary for the service, incurred by any regimental surgeon, be paid by the director of that department, with the approbation of the commander thereof:

That no more medicines belonging to the continental hospital be disposed of (by sale till the army is fully supplied) till further order of Congress:

Resolved, that no Surgeon or Surgeon's Mate shall receive a Commo as such in the Army, without having first undergone an Examination by the director, of the hospital of the Department in which he may desire employment or the director Genl and obtained a Certificate from the Commndr and director of that department, or the Director Genl, of his Abilities and knowledge in his business.

That the pay of the hospital surgeons be increased to one dollar and two thirds of a dollar by the day; the pay of the hospital mates be increased to one dollar by the day; and the pay of the hospital apothecary to one dollar and two thirds of a dollar by the day; and that the hospital surgeons and mates take rank of regimental surgeons and mates:

Resolved, that the Storekeepers of the several Hospitals be paid by the month, and the Stewards and Managers of the said Hospitals be paid by the Month a sum not exceeding dollars.18

Resolved, That the duties and privileges of the Surgeons and Mates, not heretofore particularly ascertained, be conformable to the established Usage of other well regulated Armies, as far as is consistent with the Good of the Service, until otherwise settled and directed by this Congress.18

Resolved, that the Appointments of Surgeons (Surgeons Mates) Storekeepers, Stewards, Managers and Nurses, heretofore mentioned, shall be made by the Director General in the Northern and Eastern Departments; and of the Middle department by the Director, which may hereafter be app'd in that dep't; and in the Southern Dep't by the director of that dep't with the approba. of the Commandr of the respect departments.19

Resolved, that it be recommended to Congress to purchase the Medicines (now in Phila) belonging to Doctor Morgan.19

Resolved, that in all levies of Troops hereafter to be raised for the Service of the Continent a stoppage of out of the month's pay of each Man be made for the Use and support of the several Continental Hospitals.19

That the director general, and the several directors of hospitals, be empowered to purchase, with the approbation of the commander of the respective departments, medicines, and instruments for the use of their respective hospitals, and draw upon the pay master for the same, and make report of such purchases to Congress.20

July 20, 1776. 595
Resolved, That Dr. Senter be recommended to Dr. Morgan; who is desired to examine him; and if, (upon examination,) he finds him qualified, to employ him in the hospital as a surgeon.

July 26, 1776. 612
Resolved, That an order for 2,000 dollars be drawn on the treasurers in favor of Dr. W. Shippen; he to be accountable.

17 A paragraph that was not retained.
18 A paragraph that was not retained.
19 This report, in the writing of Thomas Stone, is in the Papers of the Continental Congress, No. 19, IV, folio 181.
Annals of Medical History

July 31, 1776. 632

Resolved, That the committee for providing medicines be directed to provide, and send forward, such a quantity of medicines as may be necessary for the Hospital in the northern army:

That the said committee be directed to procure and send forward such a quantity of medicines as may be necessary for the hospital in the southern department.

August 6, 1776. 633

Resolved, That the committee for procuring medicines be directed to supply the director general of the Hospital with such medicines as he may want.

August 7, 1776. 636

Resolved, That Dr. (Benjamin) Rush be added to the committee for procuring medicines.

August 16, 1776. 661

A petition from Dr. Samuel Stringer, was presented to Congress and read:

Resolved, That it be referred to the Medical Committee.

Resolved, That the Medical Committee be empowered to purchase such medicines as they judge proper and useful for the army.

August 20, 1776. 673

The committee to whom was referred the petition of Dr. Stringer brought in their report, which was taken into consideration; whereupon,

Resolved, That Dr. Morgan was appointed director-general and physician in chief of the American hospital:

That Dr. Stringer was appointed director and physician of the hospital in the northern department only.

That every director of a hospital possesses the exclusive right of appointing surgeons and hospital officers of all kinds, agreeable to the resolutions of Congress of the 17 of July, in his own department, unless otherwise directed by Congress:

That Dr. Stringer be authorized to appoint a surgeon for the fleet now lying off the lakes:

That a Druggist be appointed in Philadelphia whose business it shall be, to receive and deliver all medicines, instruments, and shop furniture for the benefit of the United States:

That a salary of thirty dollars a month be paid to the said druggist for his labour.

Congress proceeded to the election of a druggist, and, the ballots being taken, Dr. William Smith was elected.

August 26, 1776. 705

Provided, that all such officers and soldiers that may be entitled to the aforesaid pension, and are found to be capable of doing guard or garrison duty, shall be formed in a corps of invalids, and subject to the said duty; and all officers, marines, and seamen of the navy who shall be entitled to the pension aforesaid, and shall be found capable of doing any duty on board the navy, or any department thereof, shall be liable to be so employed:

Ordered, That the above be published. 21

21 This report, dated "at a board of war, Sept. 14th, 1776" and in the writing of Richard Peters, is in the Papers of the Continental Congress, No. 147, I. folio 5. It is endorsed: "partly agreed to. Two paragraphs postponed, Sept. 18, 1776."
amiss those who offer to serve as surgeons or surgeons' mates in the army and navy; and that no surgeon or mate shall hereafter receive a commission or warrant to act as such, in the army or navy, who shall not produce a certificate from some or one of the examiners so to be appointed, to prove that he is qualified to execute the office:

That all regimental surgeons and mates, as well as those of the hospitals, be subject to the direction and control of the directors in the several departments:

That no soldier be discharged from the service as disabled, unless the certificate of disability be countersigned by the director, assistant physician, or first surgeon of the hospital, nor be excused from duty for sickness, unless the certificate of sickness be countersigned by one of those persons, where access may be had to them.

Resolved, That the remainder of the said report be postponed.

October 7, 1776. 852–3

Three Camp Kettles for the use of the Hospital, to W. V. Wimpey Surgeon;

That said Nicholson delivered five Camp Kettles, to Colo. Hazen, 3 ditto to Doct. Lynn for the General Hospital, and 3 ditto for the red hospital at St. Foys.

October 9, 1776. 857–8, 9

Congress resumed the consideration of the report of the committee who went to the camp; 21 Whereupon,

Resolved, That no regimental hospitals be, in future, allowed in the neighborhood of the general hospital:

That John Morgan, Esq' provide and superintend a hospital, at a proper distance from the camp, for the army posted on the east side of Hudson's river.

That William Shippen (Jun.), Esq' provide and superintend an hospital for the army, in the state of New Jersey:

That each of the hospitals be supplied by the respective directors with such a number of surgeons, apothecaries, surgeons' mates, and other assistants, and also with such quantities of medicine, bedding, and other necessaries, as they shall judge expedient:

That they make weekly returns to Congress and the commander in chief, of the officers and assistants of each denomination, and also the number of sick and deceased in their respective hospitals:

That the regimental surgeons be directed to send to the general hospitals such officers and soldiers of their respective regiments, as, confined by wounds or other disorders, shall require nurses or constant attendance, and, from time to time, to apply to the quarter master general, or his deputy, for convenient waggons for this purpose; also, (that they apply to the directors in their respective departments, for medicines and other necessaries;) 24 That the wages of nurses be augmented to one dollar per week:

That the commanding officer of each regiment be directed, once a week, to send a commission officer to visit the sick of his respective regiment in the general hospital, and report their state to him:

That for the promoting health in the army, the commissary general be directed to cause the same to be well supplied with Indian meal and vegetables.

October 14, 1776. 869

A letter . . . . One from General Washington, of the 7, enclosing a letter from Dr. Morgan, were laid before Congress, and read.

Resolved, . . . That the letter from Dr. Morgan, enclosed in General Washington's letter, be referred to the Medical Committee.

November 4, 1776. 921

It being represented that some of the marines in the barracks are sick,

Resolved, That Doctor Rush be desired to take them under his care, and see them properly provided for.

November 12, 1776. 940

A letter . . . . and one, of the 9, from Dr. Shippen, were read. 25

November 13, 1776. 948

To Doctor Samuel Wilson, for board, attendance, and medicine, to sick soldiers of the 6 Virginia regiment, 33 60/90 dollars:

That there should be paid to Thomas Armer, on account of Elizabeth Robinson, for so much short paid on settlement of her account, the 14th October last, for board, &c. of sick soldiers belonging to Captain Grier's company, 10 dollars:

That there should be paid to the Pennsylvania hospital, for the support and cloathing of John Hughes, a wounded soldier, 36 54/90 dollars:

November 19, 1776. 963

That, on any sick or disabled non-commissioned officer or soldier, being sent to any hospital or sick quarters, the captain or commandant of the troop or company to which he belongs, shall send to the surgeon, or director of the said hospital, or give to the non-commissioned officer or soldier, so in the hospital or quarters, a certificate, (countersigned by the pay master of the regiment,) of what pay is due to such sick non-commissioned officer or private, at the time of his entering the hospital or quarters; and the captain or commandant of the troop or company, shall not receive the pay of the said soldier in hospital or quarters, or include him in any pay abstract during his continuance therein. And, in case any non-commissioned officer or soldier shall be discharged from the hospital or quarters, as unfit for farther service, a certificate shall be given him, by the surgeon or director, of what pay is due to him; and the said non-commissioned officer or soldier, so discharged, shall be entitled to receive his pay at any pay office, or from any pay master in the service of the United States; the said pay master keeping such original certificate, to prevent impositions, and giv-

21 See note under October 3, p. 844, ante.
24 This sentence is in the writing of John Hancock.
25 The letter of Dr. Shippen is in the Papers of the Continental Congress, No. 78, XX, folio 75.
ing the non-commissioned officer or soldier his dis-
charge, or a certified copy thereof, mentioning, at
the same time, his having been paid:

November 26, 1776. 983
That the committee, who are sent to the camp,
be directed to make particular enquiry into the
abuses in the medical department in the army, and
report thereon to Congress.

November 28, 1776. 989
The Medical Committee, to whom Dr. Shippen's
letter was referred, brought in a report, which was
taken into consideration; Whereupon,
Resolved, That Dr. Morgan take care of such sick
and wounded of the army of the United States, as
are on the east side of Hudson's river, and that Dr.
Shippen take care of such of the said sick and
wounded as are on the west side of Hudson's river;
and that they both be directed to use the utmost
diligence in superintending the surgeons and mates
of the army, so that the sick and wounded may be
effectually provided with everything necessary for
their recovery.

November 29, 1776. 990-991
Resolved, That Mr. Mease be directed to supply
the sick soldiers, in the House of Employment in
Philadelphia, with one shirt apiece.
Resolved, That the Medical Committee be directed
to provide sufficient quantities of antiscorbutics for
the use of the hospitals in the northern army;
That the hospital at Fort George be continued
for the reception of soldiers labouring with con-
tagious diseases, and that there be a general hospi-
tal erected on Mount Independence:
That a suitable spot of ground for a garden be
enclosed in the neighbourhood of the general hospi-
tal, to supply the army with vegetables; and that
labourers be hired to cultivate it, under the direc-
tion of an overseer, to be appointed by the general
or commanding officer:
That the general, or commanding officer, in each
of the armies, cause strict enquiries to be made into
the 36 conduct of the directors of the hospitals, and
their surgeons, officers, and servants, and of the
regimental surgeons, that if there has been any just
grounds of complaint in those departments, the of-
fenders may be punished:
That the colonel or commanding officer of every
regiment, make frequent enquiry into the health of
the men under his command, and report the state
thereof, with any negligence, mal-practice, or other
misconduct of the surgeons or others, to the general,
and to Congress, delivering copies of such reports

to all persons therein accused:

December 1, 1776. 998
Resolved, . . . That the Medical Committee be
directed to take such steps, as they shall judge
proper, for the accommodation of the sick of the
army.

December 5, 1776. 1006
Resolved, That it be and is earnestly recommend-
cured the Pennsylvania hospital, for the purpose of
accommodating the sick belonging to the continen-
tal army:

Resolved, That the Medical Committee be em-
powered to procure suitable persons to take care of
the sick, and to remove them to such convenient
places in the country, as they shall think proper.

December 12, 1776. 1024
That $4,000 dollars be advanced to Dr. Nicholas
Way, (of Wilmington,) for the public service; he to
be accountable.

Resolved, That the continental apothecary be di-
rected immediately to pack up all the continental
medicines, and send them to the quarter master
general:
That the quarter master general be directed to
remove all the medicines belonging to the continent
in this city to a place of security:

STANDING COMMITTEES

Resolved, That the Medical Committee be di-
rected to the council of safety of Pennsylvania, to pro-
36 The original report here contained "past as well as future."
January 17, 1777. 44
A letter with a number of papers, from Dr. Morgan, were laid before Congress, and referred to the Medical Committee.

January 18, 1777. 48
To Dr. J(ohn) Witherspoon, for wood supplied the troops at Princeton; for the expences of sick soldiers; and the allowance due to John M'Kinzie, a prisoner from North Carolina, from the 18th October to the 10th January, inclusive, being 12 weeks, 104 78/90 dollars:

Ordered, That the said accounts be paid.

January 20, 1777. 70
Resolved, That the Medical Committee write to Doctor (John) Witherspoon, having represented to Congress that the situation of his private affairs requires his returning home for a short time, desires leave of absence.

January 31, 1777. 79-80, 81
Resolved, That a committee of four be appointed to consider what honours are due to the memory of General Warren, (who fell in the battle of Bunker's Hill, the 17th of June, 1775;) and of the late General H. Mercer, who died on the 12th instant, of the wounds he received on the 3d of the same month, in fighting against the enemies of American liberty, near Princeton:

The members chosen, Mr. (Benjamin) Rush, Mr. (Thomas) Heyward, Mr. (Mann) Page, and Mr. S(amu)el Adams.

To Dr. Samuel Mackenzie, for sundry medicine purchased by him for the use of the hospital in Baltimore, 86 74/90 dollars:

To Dr. John Hindman, for sundry medicine supplied by him for the use of Colonel Richardson's battalion of Maryland forces, 20 6/90 dollars:

February 4, 1777. 87
A memorial from Dr. Thomas Young was read, and referred to the medical committee.

Resolved, That Dr. (Thomas) Burke be added to the Medical Committee; and that he be appointed a member of the Marine Committee, in the room of Mr. (William) Hooper, who has leave to return home for some time.

February 5, 1777. 91
Ordered, That the Board of War digest the said conference, and bring in a proper report on the several matters mentioned, saving what relates to medicines.

Resolved, That the Medical Committee be empowered to employ a suitable person in each of the states, to purchase such medicines as they shall direct, for the use of the army, which can be procured at any reasonable rates. ||Ordered|| That the said committee enquire what is become of the medicines which Dr. Morgan took from Boston, and which Dr. Stringer bought for the northern army, and take measures to have them secured, and applied to the use of the army.

February 12, 1777. 110
Ordered, That the Medical Committee write to General Washington, and consult him on the propriety and expediency of causing such of the troops in his army, as have not had the small pox, to be inoculated, and recommend that measure to him, if it can be done consistent with the public safety, and good of the service.

February 20, 1777. 139
To Dr. Frederick Phile, for the amount of his account for medicine and attendance to the German battalion, in Philadelphia, (£74 16 6 =) 199 48/90 dollars:

Ordered, That the said accounts be paid.

At a Board of War, 20th Feb, 1777.
Agreed to report to Congress: . . .

That the Assembly of the State of Maryland be requested to deliver to Doctor McKenzie so much medicines of the following Denominations as he shall want and they can spare, to enable him to inoculate the Continental Troops in this Town, in the following Proportions for one hundred Men.

Six ounces Calomel
Two Pounds Jallop
Three Pounds Nitre

Elix Vitriol
One Pound Peruvian Bark
One Pound Virginia Snake Root.

February 22, 1777. 143
Resolved, . . . That 1,200 dollars be paid to Dr. Samuel M'Kinzie, for the use of the hospital in Baltimore; he to be accountable.

February 25, 1777. 155, 156
Two officers of the 2d and 7th Virginia battalions, who were left to bring up the baggage of their respective battalions, and a surgeon's mate belonging to the 2d battalion, of the Virginia forces, being arrived in Baltimore, applied for two months' pay (for themselves and the men with them,) to enable them to proceed with their companies.

Resolved, That they be referred to Mr. Jonathan Hudson, who is directed to pay the said officers and [their] men [one] two months' pay; [and to the sur­geon two months' pay]; and return an account to the General, and to the pay master general.

Doctor (John) Witherspoon, having represented to Congress that the situation of his private affairs requires his returning home for a short time, desires leave of absence.

Resolved, That leave be granted.

To Dr. Benjamin Rush, for sundry medicine and attendance to sick soldiers and prisoners, the sum of (£177.9 =) 473 18/90 dollars:

To Richard Stockton, Esq. and to be paid to Dr. Benjamin Rush, for the hire of two horses, a sulky, &c. for his journey to Ticonderoga last fall, by order of Congress, 151 30/90 dollars:

February 27, 1777. 161-4
The Medical Committee, to whom the report on the hospital was re-committed, brought in a report, which was read:

The Medical Committee having taken into their
consideration a plan 29 for establishing Military Hospitals, [transmitted to Congress by General Washington], agree to report—

Section 1. That the Continent be divided into three districts. The Middle to extend from Hudson's river to Potomac. The Southern to extend from Potomac to Georgia, and the Northern from Hud­son's river to Quebec or Crown Point.

2. That there be a Surgeon and Physician Gen1. 29, with a suitable number of Senior physicians, Senior Surgeons and mates to each district. That the sick be taken care of by the physicians, and the wound­ed by the Surgeons in different apartments.

3. That there be a physician and Surgeon General whom the main army whose business it shall be to attend the general and principal Officers of the Army, to enquire into the quality of the food of the Soldiers, to superintend the regimental Surgeons and Mates, and to attend when called upon in consulta­tion with them in all extraordinary cases.

4. That there be an Apothecary General whose business it shall be to purchase medicines and instruments as shall be judged necessary by the Surgeons and physicians general of the Army. That he have the liberty of appointing three assistant Apothecaries in different parts of the United States, in order to supply with the more convenience the several hospitals, and regimental and Naval Sur­geons with medicines and instruments.

4. That there be an Inspector General of the Army of the United States whose business it shall be to visit the Military hospitals and Apothecaries Shops in every part of the Continent; to examine the medicines and instruments belonging to the States; to enquire into the conduct of the several Officers in the medical department and report to the Congress, and Commander in chief at least once a month.

5. That the Surgeons and Physicians General of the hospitals have the liberty of appointing hospital Apothecaries, Senior physicians, and Surgeons, Mates, Purveyors, Clerks, Commissaries, Ward­masters, Servants, Washerwomen, Nurses, Cooks, and all such Officers as shall be necessary for the accom­modation of the sick and wounded in the hospitals.

6. That the Surgeons and Physicians General of the hospitals have the liberty of appointing hospital Apothecaries, senior physicians, and Surgeons, Mates, Purveyors, Clerks, Commissaries, Wardmasters, Servants, Washerwomen, Nurses, Cooks, and all such Officers as shall be necessary for the accommodation of the sick and wounded in the hospitals.

7. That the business of the Commissaries shall be to provide provisions, and liquors, also straw, hay and fuel for the hospitals. Also to bury the dead. He shall likewise provide, and superintend the wag­gons employed in transporting the sick, and wound­ed, and the baggage of the hospitals.

8. That the business of the Wardmaster shall be to take care of, and distribute the provisions, and other Articles provided by the Commissaries for the sick and wounded both in the camp and hospitals.

9. That one Clerk be allowed to every general hospital, and one Nurse to every ten sick. That each military hospital be furnished with a number of shirts, sheets, blankets and cases for straw for the accommodation of the sick.

That each regiment be furnished with a number of hospital tents according to their number of men, a full regiment not to have more than six tents.

10. That the pay of the Surgeons and physicians Generals be four dollars and six rations a day. That the inspector General have five dollars and six rations a day. That the pay of the Apothecary General be 2 dollars and one tenth of a day. That the pay of the Apothecary General be 3 dollars, and 4 rations a day. That the assistant Apothecaries appointed by the Apothecary General have one dollar and 1/3 per day. That the pay and rations of the senior physicians of each hospital be the same as those of a senior Surgeon.

11. That the pay and rations of the commissioners of the hospitals be the same as the deputy com­missaries in the Army.

12. That the pay and rations of the Wardmasters be the same as that of a Commissary.

13. That the pay of the Clerks, Cooks, Nurses, Washerwomen, Servants, &c., be regulated by the Physicians and Surgeons General.

14. That the pay and rations of a regimental Sur­geon be the same as those of a Captain and the pay and rations of a Mate be the same as those of a 1st Lieutenant.

15-16. That no senior Physician, or Surgeon, no hospital Mate, nor shall any regimental Surgeon or Mate be appointed in the Army who has not previously undergone an examination before one or more of the Physicians and Surgeons General, or before the Inspector General of the medical department.

17. That a Sergeants guard be constantly placed at each general hospital to prevent the unnecessary visits of Strangers, and the desertion of convalescent patients, and to assist, if necessary in enforcing the rules, and orders of the Surgeons, and physicians of the hospitals.

18. That the Officers of the several regimental companies to which the sick and wounded belong be ordered to concur by means of their Authority with the Surgeons and physicians in taking care of their respective Soldiers.

19. That the physicians and Surgeons General with the Inspector General of the medical depart­ment be authorized to make such further improve­ments in this plan for regulating the medical de­partment as the exigencies and situation of the Army may make necessary, and that they report the same when made to Congress for their Approbation.

20. That it be recommended to each of the States to make suitable provision for the maintenance of such maimed, and incurable Soldiers and Seamen as shall be discharged from the service of the united States. 30

Ordered, To lie on the table.

29 This plan, in the writing of William Shippen, is in the Papers of the Continental Congress, No. 22, folio 9. It was prepared by Doctors Shippen and John Cochran, and was transmitted to Congress by Washington, February 2, 1777.

30 This report, in the writing of Benjamin Rush, is in the Papers of the Continental Congress, No. 22, folio 1. Against paragraphs 1, 2, and 4 is written "Query if necessary."
Resolved, That as Congress proceeded to the dismission of Doctor Stringer, upon reasons satisfactory to themselves, General Schuyler ought to have known it to be his duty to have acquiesced therein: Resolved, That the suggestion in General Schuyler’s letter to Congress, that it was a compliment due to him to have been advised of the reasons of Doctor Stringer’s dismissal, is highly derogatory to the honour of Congress; and that the president be desired to acquaint General Schuyler that it is expected his letters, for the future, be written in a stile more suitable to the dignity of the representative body of these free and independent states, and to his own character as their officer.

March 19, 1777, 186

Resolved, That the extract of Mr. Deane’s letter, relative to Dr. Williamson, be referred to a committee of five, who are empowered to send for Dr. Williamson and examine him:

The members chosen, Dr. (John) Witherspoon, Mr. (Jonathan Bayard)? Smith, Mr. (George) Clymer, Mr. (James) Wilson, and Mr. (Thomas) Heyward.

March 22, 1777, 103

The report of the Medical Committee was taken up and considered; (and, after debate,) Whereupon, Resolved, That said report, together with Dr. Shippen’s plan, be recommitted.

Resolved, That a committee of five be appointed to devise ways and means for preserving the health of the troops, and for introducing better discipline into the army:

The members chosen, Mr. (Oliver) Wolcott, Mr. (Daniel) Roberdeau, Dr. (John) Witherspoon, Mr. (Samuel) Adams, and Mr. (Abraham) Clarke.

March 24, 1777, 197–200

The Medical Committee, to whom the plan of the general hospital was recommitted, brought in a report, which was read:

The Medical Committee, having taken into their consideration the establishment of the medical department in the army, Report as follows:

1st, That to each regiment there be appointed one Surgeon and one Surgeon’s Mate, who shall constantly attend the Regiment, to afford present relief to the sick and wounded, and take care of such as it may be proper to remove to the hospital.

2nd, That Senior Surgeons of approved Abilities in Physick and Surgery be appointed to each Brigade or a greater number of Regiments as the General commanding in each department or grand division of the Army shall judge necessary; whose business shall be, to Superintend the Regimental Surgeons and Mates, see that they do their duty, advise and direct them in all difficult cases, and direct or perform all Capital Operations, give Assistance to the director of the hospital when such assistance is necessary; direct the Commissary of the Sick in the Articles Necessary to be procured for the Sick and wounded out of the hospital, and see that the Commissary, purveyor and Nurses Regularly perform their respective duties, and provide proper Nurses to attend the sick when Necessary; and also from Time to Time furnish the Regimental Surgeons with such Medicines and instruments as they may have Occasion for out of those furnished them by the Apothecaries, taking receipts for the same, and render Accounts of all medicines and instruments by them received or delivered out when required thereto by Congress.

3rd, That a Commissary for the Sick be appointed to attend each grand division of the Army, who shall appoint a Medical Officer as necessary, whose business it shall be to purchase and deliver to the purveyor all such Provisions, Liquors, and other necessaries for the Sick and wounded as directed by the Senior Surgeons, and keep accounts of and take receipts for the same: he shall provide Straw, hay and fuel for the hospitals, and have the care of burying the Dead: he shall furnish the hospital with such a number of shirts, sheets, blankets, and cases for straw for the Accommodation of the Sick as the General commanding in such grand division of the Army shall direct: he shall likewise provide or obtain from the Quarter master general a proper number of hospital tents for the Sick in case the Army is likely to be stationed in places where houses convenient cannot be obtained for that purpose: and also provide and Superintend the Wagons necessary to be employed in removing the Sick and wounded, the number of hospital tents and Waggon necessary for the above purposes to be fixed and ascertained by the Generals commanding each division, and certified under their hands respectively: when provided, the Commissary shall take proper receipts and vouchers proving that the same were furnished, which he shall lay before Congress when required.

4th, That one Purveyor be appointed to attend each grand division of the Army, with one or more Assistants if necessary; whose duty it shall be to receive from the Commissary, take care of and distribute the provisions and other necessaries provided for the Sick and wounded in such manner as the Senior Surgeons shall direct: which provisions and necessaries are to be delivered in lieu of well rations.

5th, That the General commanding in each Department or grand division of the Army, direct one hospital to be provided in some Convenient place contiguous to the Army consisting of different or separate houses, if such can be had, in order that the wounded may be kept apart from the sick, and also that: he sick may be properly divided, as may be most conducive to their recovery: to which hospital all such sick and wounded are to be sent as the Senior Surgeons may think proper, and whose circumstances will admit being removed, which hospital shall be supplied by the Commissary for the Sick, with such provisions and other necessaries for the use of the Sick and wounded, as the director shall require in lieu of well rations.

6th, That one director of approved skill in Physick and Surgery be appointed for each hospital, who shall have the liberty of appointing one assistant Surgeon and four mates; a purveyor and such a number of Washerwomen and Nurses as he shall
judge necessary for the comfortable accommodation and attendance of the sick and wounded under his care, always observing that no more than necessary are employed. Also that the director may call to his assistance one or more of the Senior Surgeons when the number of sick and wounded in the hospital requires such assistance. Also that the director take an Account of each of the sick and wounded under his care, with the Time of their coming to the hospital, and when discharged, or deceased; and also of the Number of attendants employed in Nursing and taking care of the sick: and make due returns thereof every month to the General commanding in each grand division of the Army to be by him transmitted to Congress.

7th. That there be two Apothecaries, one in the middle, and one in the eastern department, whose business it shall be to receive all such medicines and instruments as shall be procured by the Secret Committee, to purchase such others as they shall direct. That the Apothecaries prepare and put up such medicines and instruments for each hospital, and for each Regimental Surgeon, and also for each Senior Surgeon to be used by them or dealt out to the Regimental Surgeons when needed, as the medical committee shall direct and forward the same with supplies from time to time agreeable to their orders, keeping exact accounts and taking proper receipts for the same to be laid before Congress when required. Each Apothecary to be allowed one mate.

8th. That the sick and wounded as well in the Army as in the hospital be kept separate from each other, when circumstances will admit thereof; and that the sick be always placed at such a distance from those in health as to prevent the spread of infection in the Army.

9th. That the pay of the medical department be as follows—

The director of the hospital dollars per month and rations per day. The Senior Surgeons and assistants to the directors dollars per month and rations per day each. The Apothecaries dollars per month and rations per day each. The Regimental Surgeons dollars per month and rations per day each. The directors Apothecaries and Surgeons mates dollars per month and rations per day each. The Commissary of the sick dollars per month and rations per day each. The Purveyors dollars per month and rations per day each. The Assistant Commissaries and Assistant Purveyors dollars per month and rations per day each.

Ordered, That it be referred for consideration to morrow morning.

This report, in the writing of Abraham Clark, is in the Papers of the Continental Congress, No. 22, folio 15.

March 27, 1777. 206
Congress resumed the consideration of the report of the Medical Committee on the hospital;

Resolved, That it be referred to a Committee of the Whole. Congress then resolved itself into a Committee of the Whole, to take into consideration the report of the Medical Committee, and after some time, the President resumed the chair, and Mr. (Daniel) Roberdeen reported it re-committed.

April 2, 1777. 219
Congress resumed the consideration of the report of the (medical) committee on the hospital, and, after debate,

Ordered, That the said report lie on the table (for farther consideration).

Resolved, That a committee of three be appointed to revise Dr. Shippen's plan for the regulating the hospital, and report thereon.

The members chosen, Mr. (Elbridge) Gerry, Mr. (Thomas) Burke and Mr. (John) Adams.

April 4, 1777. 225
The Committee on the hospital, brought in a report, which was taken into consideration, and after debate,

Resolved, That the farther consideration thereof be postponed till to morrow.

April 5, 1777. 227
Congress resumed the consideration of the report on hospitals, and, after debate,

Resolved, That the farther consideration be postponed till Monday next.

April 7, 1777. 231–7
Congress resumed the consideration of the report on the hospital; Whereupon,

Resolved, That there be one director general of all the like weekly returns to their respective directors, mutatis mutandis:

That the deputy directors general cause the like returns to be made, once every month, to the director general, together with the names and denominations of all the officers in the respective hospitals:

And that the director general shall make a like return for all the hospitals and armies of the United States, once every month, to the Medical Committee;

That the Medical Committee have power to appoint any of their members to visit and inspect all or any of the medical departments, as often as they shall think proper, to enquire into the conduct of such general officers of the hospital as shall be delinquent in this or any parts of their duty, and to report their names to Congress, with the evidence of the charges, which shall be brought against them.

Resolved, That the farther consideration of the report be postponed till to morrow.

This report, in the writing of Thomas Burke, is in the Papers of the Continental Congress, No. 22, folio 19.

(Continued in the next issue.)
EDITORIAL

Through the courtesy of Colonel William O. Owen, Curator, Army Medical Museum, Washington, D. C., we are able to print, in this number, the first installment of the complete procedure of Congress in regard to the organization of medical service during the War of the Revolution (1775-83). As archival material of greatest value for the earlier medical history of our country and of interest to all American physicians of colonial extraction, we regard it as a privilege to print this record, lengthy as it is. It shows exactly what Congress did or did not do for military medicine in the most crucial period of our history. In this connection, however, it would seem apposite to specify our intention in regard to the printing of material of this kind in future. Any archival material of exceptional national and historical importance, if not too extensive, will be most welcome in these pages. Really valuable material of this kind is excessively rare in this country. We cannot, however, engage to print the archival histories of medicine for separate states, counties, cities or smaller localities. This we conceive to be the proper function of the journals of the state medical societies, the city and county journals, and the local periodicals devoted to medical history. Moreover, these separate histories have already been very well taken care of for some of the several states, cities and counties, whether in book or periodical form. Dr. Stephen Wicke, for instance, wrote the medical history of New Jersey (1879); Dr. Samuel Abbott Green, the medical history of Massachusetts (1881), and of Groton, Mass. (1890) in particular; Dr. Eugene F. Cordell, the “Medical Annals of Maryland, 1799-1899” (1903). Drs. Samuel C. Busey and Daniel S. Lamb have covered the medical history of the District of Columbia in several volumes; Dr. Frederick P. Henry wrote the medical history of Philadelphia (1897). Dr. Otto Juettner has given an exhaustive history of medical Cincinnati in his “Daniel Drake” (1909). Old medical New York has been the theme of memoirs by John W. Francis (1858), and Francke Huntington Bosworth (1868). Early medical Chicago has been treated by James Nevins Hyde (1879) with subsequent material in the earlier numbers of the Bulletin of the Medical History Society of Chicago. The story of the Boston Society for Medical Improvement was given by the late Dr. James G. Mumford (1901). Old medical Boston is in the hands of Mr. James F. Ballard of the Boston Medical Library. Medical histories of all our important states and cities will undoubtedly appear in course of time, and it should be a matter of local pride and patriotism to have them completed and printed in each particular locality. We cannot engage to cover this extensive field, but we would particularly solicit such archival material as unpublished letters of great physicians and surgeons—particularly those of which
the content is of historical and biographical importance—brief autograph letters of medical celebrities for reproduction in facsimile, rare photographs of eminent physicians not heretofore reproduced, rare engravings and prints of the same description, and other medical curiosities which may stimulate interest in our subject or serve as basic material for future historians. We realise that this is a new departure, and in the absence of such old medical manuscripts as Europe abounds in, we solicit the help of our subscribers and contributors.

MEMORIAL NOTICE SIR MARC AMAND RUFFER

KT., C. M. G. (1859–1917)

Original investigation in medical history of late years has been furthered in remarkable ways by archaeologists, anthropologists, numismatists, antiquarians, collectors of engravings, sinologists, Egyptologists, and particularly by travellers and explorers. Indeed, the journey method of Sudhoff goes to show that he who enjoys the advantages of travel is much more likely to turn up new facts than the stationary investigator. One of the most prominent exponents of this new tendency was Sir Marc Amand Ruffer, late President of the Sanitary Council of Egypt, who died at sea during the spring of 1917 on his return from Salonika, whither he had gone to reorganize the sanitary service of the Greek Provisional Government. He made his mark in the medical history of ancient Egypt by his contributions to its palæopathology, in particular the palæohistology of the pathological lesions found in mummies of the XVIII—XXVII dynasties.

He was born at Lyons, France, in 1859, the son of the late Baron Alphonse Jacques de Ruffer. His mother was a German. He was educated at Brasenose College, Oxford, where he took his B.A. degree in 1883, and at University College, London, becoming bachelor of medicine and surgery in 1887 and M.D. in 1889. He then became a pupil of Pasteur and Metchnikoff at the Pasteur Institute, devoting special study to the then novel subject of phagocytosis. In his papers of 1890, he gave an early and timely exposition of Metchnikoff's concept of inflammation as a protective mechanism against infection, particularly in the intestinal canal. He described the diphtheritic membrane as "a battlefield," in which pathogenic bacteria
and ameboid leucocytes contend for mastery. In 1891, Ruffer became the first director of the British Institute of Preventive Medicine, his assistant being Professor Henry G. Plimmer. At Metchnikoff's instance, Ruffer and Plimmer took up the study of cancer and established the provisional status of the quasi-parasitic formations in cancer cells. While testing the new diptheritic serum at the Institute, both Ruffer and Plimmer fell victims to the disease, and Ruffer was so severely smitten with the paralytic sequelae that he felt compelled to resign his directorship. He then went to Egypt for recuperation and subsequently took up his permanent residence at the Villa Ménival, Ramleh.

Ruffer was one of the ablest organizers of medical administration in recent times. He did much to make the present Lister Institute what it is to-day, became professor of bacteriology in the Cairo Medical School (1896), which he reorganized, and was the president of the Sanitary, Maritime and Quarantine Council of Egypt (1901-17), in which office he was instrumental in ridding Egypt of cholera by rigorous hygienic policing of the routes of pilgrimage at the Tor Station and elsewhere. In this work, he enjoyed the confidence and support of both Lord Cromer and Lord Kitchener. He served on the Indian Plague Commission, was Egyptian delegate to sanitary conferences of 1903, 1907 and 1911, and from the outbreak of the present war, was highly efficient as head of the Red Cross in Egypt. He was the recipient of many honors and decorations, and was knighted in 1916. A man of the world in the widest sense, he was a remarkable linguist, a talented violoncellist, and an expert at his favorite game of billiards.

In December 1908, in connection with the excavations made in Nubia by Elliot Smith, Wood Jones and Derry prior to the flooding of the country by the raising of the Assuan dam (1907), Ruffer began to exhibit microscopic sections of pathological lesions in mummies at the Cairo Scientific Society. In this field, Fouquet was the pioneer (1889), but Ruffer made it his own by his expert skill in microtomic technique and staining methods. To overcome the hard, brittle and friable character of the tissues, before cutting with a Minot microtome, he softened them in a solution of alcohol and sodium bicarbonate, with subsequent hardening in alcohol. For this new branch of pathological histology he devised the term "palaeopathology." His "preliminary note" of 1909 (Brit. Medical Journal, 1909 I, 1909) was followed by a striking series of papers on the presence of Bilharzia hematobia in Egyptian mummies of the XX dynasty, 1250-100 B.C. (Ibid., 1910, I, 16), on a varioloid eruption in the skin of a mummy of the same period (J. Path. & Bact., Cambridge, 1910-11, XV, 1-3, 1 pl.), on arterial lesions in mummies of 1580 B.C.—525 A.D. (Ibid., 453-462, 3 pl.), on the osseous lesions in Egyptian skeletons, ranging from 2980 B.C. to the Greek period (Ibid., 1911-12, XVI, 439-495, 9 pl.) on dental, osseous and articular lesions in Coptic bodies of 400-500 A.D. (Ibid., 1913-14 XVIII, 149-162, 6 pl.) on a tumor of the pelvis from the catacombs of Komel Shougafa, 250 A.D. (Ibid., 480-484, 2 pl.) and a monograph on "Histological Studies in Egyptian Mummies" (Cairo, 1911). In 1910, Elliot Smith and Ruffer described a case of Pott's disease in a mummy of the XXI dynasty, circa 1000 B.C. (Giessen, 1910), perhaps the earliest landmark we have in the history of tuberculosis. In these studies, Ruffer showed the presence of calcified Bilharzia eggs in the kidneys of two mummies, a common cause of prehistoric hematuria, as shown in the hieroglyphs and medical papyri; also the common occurrence of arthritis, spondylitis deformans, dental caries, rarefying periodontitis, pyorrhoea alveolaris, Bouchard's nodes, malarial enlargement of the spleen,
biliary calculi and particularly arteriosclerosis (atheroma) which was found even in the aorta of Rameses II, and was as frequent 3000 years ago as it is to-day. Its causation Ruffer leaves an open question, since, in his view, alcohol, tobacco, meat diet, strenuous exercise and "wear and tear" could, none of them, have availed to produce it. His final studies of dental and osseous lesions in specimens dug up at Faras (100 B.C.-300 A.D.) and at Merawi (750–500 B.C.) in the Sudan (Sudhoff's Mith., 1914, XIII, 453) lead him to the conclusion that these people were short-lived, dying before 50. The war interrupted Ruffer's work, which was cut short forever by his untimely death, but he had already prepared a volume of antiquarian studies for the press which will probably be a permanent record of his unique and memorable discoveries in palæopathology.

F. H. Garrison.

ANTYLLUS ON ANEURISM

There are two kinds of aneurysm. In the first the artery has undergone a local dilatation; in the second the artery has been ruptured. The aneurysms which are due to dilatation are longer than the others. The aneurysms by rupture are more rounded. To refuse to treat any aneurysm, as the ancient surgeons advised, is unwise; but it is also dangerous to operate upon all of them. We should refuse, therefore, to treat aneurysms which are situated in the axilla, in the groin and in the neck, by reason of the volume of the vessels and the impossibility and danger of isolating and tying them. We should not touch an aneurysm of large volume even when it is situated in some other part of the body. We operate in the following manner upon those which are situated upon the extremities and the head: If the aneurysm be by dilatation, make a straight incision through the skin in the direction of the length of the vessel, and, drawing open by the aid of hooks the lips of the wound, divide with precautions the membranes which cover the artery. With blunt hooks we isolate the vein from the artery, and lay bare on all sides the dilated part of this last vessel. After having introduced beneath the artery a probe, we raise the tumor and pass along the probe a needle armed with a double thread in such a manner that this thread finds itself placed beneath the artery; cut the threads near the extremity of the needle, so that there will be two threads having four ends; seizing, then, the two ends of one of these threads, we bring it gently toward one of the two extremities of the aneurysm, tying it carefully; in like manner also we bring the other thread toward the opposite extremity, and in this place tie the artery. Thus the whole aneurysm is between the two ligatures. We open then the middle of the tumor by a small incision: in this manner all which it contains will be evacuated, and there will be no danger of hemorrhage.

To tie, as it has been advised, the artery on both sides the vein, and then to extirpate the dilated part which finds itself between, is a dangerous operation; frequently, in fact, the violence and tension of the arterial pneuma push off the ligatures.

If the aneurysm owes its origin to the rupture of the artery, we isolate with the fingers as much of the tumor as we can, including the skin, after which we pass underneath the isolated part the needle with the double thread and proceed as before; after which the tumor may be opened at its summit and the superfluous portion of the skin cut away.

Oribasius.
BOOK REVIEWS

FINCH AND BAINES, A SEVENTEENTH CENTURY FRIENDSHIP. By Archibald Malloch, B.A. (Queen's); M.D. (McGill); Temporary Captain, Canadian Army Medical Corps. Cambridge, at the University Press, 1917.

This is a large quarto volume well illustrated with nine full-page, halftone pictures of Finch and Baines and of things associated with them. Dr. Malloch, the author, has done an interesting piece of work, and made a contribution to medical history which will be much prized by those interested in the humanities of medicine. He has put Doctors Finch and Baines, so to speak, "on the map," for neither of them is mentioned in the standard histories of medicine.

Doctors Finch and Baines were two Englishmen born in the early part of the seventeenth century. They studied at Cambridge and graduated there—or at Oxford—in arts. Having formed a warm friendship, they then went together to Italy and took up the study of medicine at Padua at the suggestion, it is said, of Dr. Harvey, whose niece was married to Finch's elder brother. During the trip, and while at Padua, Finch kept a journal, and wrote frequent letters to his much beloved sister, Viscountess Anne Conway, a learned woman, who was an invalid, and a patient of Dr. William Harvey.

Finch, in his journal, gives some interesting notes of the hospitals and sanitary condition of Paris, whose streets were "more dirty" but better paved than those of London. (Finch could not spell.) "At the Hotel Dieu," he says, "there were eight in a bed, but at the Hotel Charite everyone has his own bed."

Finch and Baines finally reached Padua and began the study of medicine. This was about 1652. The letters of this period throw little light on the life and methods of study at that time. Finch is interested in his sister's headaches, and writes about a Universal Medicine and the cures of Van Helmont. He also sends his sister long discourses on philosophy and natural history, and incidentally does not think much of Descartes. He refers to only one of his teachers, Molinetti, who succeeded Vestigius in the chair of anatomy. Baines wrote a very laudatory poem on Molinetti's skill, much in the line of the canticles and eulogies to the anatomists of those and earlier days.

"Ne dissecas, Molinette, sed adornas corpora:

sic non Te Anatomicum

Praestas sed id quod abunde magis est,
Deum."

During the next years Finch was especially interested in anatomy. In 1656, he was made Pro-rector of the University and in 1657 the friends took their degrees in Medicine. Two years later they went to Pisa and Finch was made Professor of Anatomy in the University, although he had been graduated but a short time and was about 33 years old. At Pisa they had as associates Malpighi and Borelli, and they made studies in comparative anatomy and natural history.

In 1660 they returned to England, where Finch was made physician to the Queen and Baines a professor of music. Both became Fellows of the Royal College of Physicians and Finch was knighted, an honor which Baines received later.

In 1665 Finch with Baines attending resumed his lectures on Anatomy at Pisa. Three years later he was made ambassador at the court of the Grand Duke of Tuscany and began to get into politics.
Finch kept a note book and would now and then write in it some rather melancholy and entirely non-compromising poems.

About this time Finch took a trip to Rome and Naples with his nephew, leaving behind for the first time poor Dr. Baines, who was suffering from stone and also from a tremor which prevented his writing very much. In 1670, the doctors gave up Italy and returned to England, living at the Inner Temple with Sir John's elder brother, Chancellor Heneage Finch.

Most of the writing quoted in this book was done by Dr. Finch. We suspect that Dr. Baines was the cleverer man, and the more important of the two; but he did not have quite the social connections of Dr. Finch. Dr. Malloch thinks that perhaps he had paralysis agitans, as he had a tremor all his life, but this is unlikely for he could not have lived with it to such an age.

In 1673 Finch was made ambassador to Turkey, and he and Baines sailed for Constantinople. While there he wrote often to his sister; and his journal contains notes of persons met, and of discussions, mostly religious in character. The friends had dropped out of medicine.

Baines died in 1681, aged 57, of a tertian ague. Sir John Finch has a touch of superstition, and he makes this curious note regarding the demise of his friend:

"Two things I cannot omit. The first is that Sir Thomas and I sitting at table in our gallery at Pera, after supper, about a year before his death, there was a loud knocking upon the round table wee sat at, for near the space of a quarter of an hour. We called in three servants, my secretary, Derham, and Zacar, which last, astonished at the thing threw off the carpet (i.e. the table cover) and crept under the table; and then the knocking seemed to be above the table; as it seemed to us to be underneath it.

"The second was that about four dayes before Sir Thomas his sickness, one of my dentes incisores dropt out of my head without any pain whilst wee dined together; which seems to confirm the interpretation of those who make the dreaming of the losse of a tooth to be the prediction of the losse of a friend."

Sir John and Sir Thomas lived together for 36 years, and in very intimate friendship for 26 years. At the time of Baines's death Sir John wrote a "dedication" to him. It is a touching and eloquent tribute to his friend and to friendship.

"But lastly Sir when I consider that of the twenty-six years wee spent together since wee first left England, that wee never have been separated two months from each other unless it were in the exercising some act of kindnesse though two and twenty of them spent in foreign parts: . . . when I consider your inimitable as well as unrequitable friendship though you were wracked with stone and torment-ed by the gout, inspiring you with courage to accompany me in your declining years and strength all this length of time and voyage: the greatest temporall blessing could have befallen me—so that I may say as truly of you as Aneas did Anchises, and I doe say more affectionately,

*Ille meum Comitatus iter maria omnia mecum*  
*Atque omnes Pelagique minas coelique feretat*  
*Invalidus vires ultra sortemque Senectae.*

When dear Sir I consider all this, I find that under all the ties of honour, friendship, gratitude and justice, you are entitled to this dedication. . . ."

Finch did not long survive his friend. He died of pleurisy in 1682.

Charles L. Dana.

Dr. Lyman Spalding, the Originator of the United States Pharmacopoeia; Co-laborer with Dr. Nathan Smith in the founding of the Dartmouth College Medical School and its first Chemical Lecturer; President and Professor of Anatomy and Surgery of the College of Physicians and Surgeons of the Western District, at Fairfield, N. Y. By his Grandson, Dr. James Alfred Spalding. W. M. Leonard, Boston, 1916. 8vo, pp. 379.
This book tells the story of the life and achievements of an interesting character who lived a hundred years ago. The book is full of letters and reminiscences connected with the prominent physicians of New England, and of New York and Philadelphia during that time. To those who are interested in the customs and habits of life of medical men of America during this period, and in the teachings of the professors and in the development of medical and scientific education, the book will afford instruction and very great entertainment. The names and doings of Drs. Nathan Smith, Shattuck, Warren, Ramsay, Mitchell and Waterhouse are most frequently mentioned, but there is hardly a notable of that period who is not referred to. Dr. Spalding evidently mingled with and knew well the Fathers of American Medicine.

He gives many interesting notes of lectures by famous surgeons and physicians. Here is one:

"At a lecture by Dr. V. Physick a patient with unreduced dislocation of the femur was brought in for reduction. After counterextension and rotation, the neck of the femur broke to the confusion of the surgeons and the amazement of the class. 'I go next, said Dr. Physick without apparent interruption, 'I go next to speak of strangulated hernia in which a high enema of tobacco is better than tobacco smoke.'"

The book contains several illustrations including a portrait of the hero of the Pharmacopoeia, and reproductions of autograph letters by eminent physicians.

Chas. L. Dana.

We welcome with much satisfaction this second edition of Dr. Garrison’s popular “Introduction to the History of Medicine,” no doubt the best history of any substantial length, which has been published in English. Such a work, we need hardly say, of very solid labor, can only be accomplished by an exceptional combination of diligence and zeal. Indeed, the term “zeal” is too faint; we might substitute enthusiasm or self-sacrifice and yet not go beyond the mark.

The American physician has only just discovered as it were, new veins of gold, opened up by Sudhoff, Neuburger, Sticker, Wickersheimer, Allbutt, Curtis, Singer and others in the study of the history of medicine, and the mine is being eagerly worked. Dr. Garrison is a sympathetic writer who grasps the leading features of medical history and delivers his impressions with clearness and ease, never losing sight for a moment of his main theme. One is astonished to find within the covers of a single volume the exhaustive and rich amount of material given in such a brief manner.

In the preface he quotes from a private letter of Dr. Charles Singer (Oxford), who says: “The history of medicine is a history of ideas, and biography is only of value in so far as it bears on ideas. The history of medicine is not concerned with tattle about the lives of the great, nor with the absurdities of ancient error, nor with the quaintness of antique expression.” The time is not yet very long past when a historical work, especially an elementary and popular work, was scarcely anything but an endless series of names, dates and facts arranged in regular succession. Now, however, our conception is changed. We ask of the historian, not to load our memory with facts but to recall the dead past to life, to give us a vivid, animated, and truthful picture of the times that are no more. We require him to make us live the life of our medical forefathers; to initiate us into their ideas, their beliefs, their passions; to disclose to us all the motives good
or evil, on which they acted; to reveal to us their virtues and vices; and we thus say of the historian, what used to be said only of the poet, that he must be a painter. No small part of the charm of the literary excellence of the book is due to the character painting which our author indulges in.

Not only in the case of a long and detailed history, made as complete as possible, but even of a summary, an elementary book, the object of which is to narrate briefly in one short volume the whole history of medicine, we do not accept a simple record of dry and lifeless facts, but require the author to present us a picture addressing the imagination as much as the memory, and enabling us to understand what were at various periods the manners, the intellectual conditions, the character, the tendencies of periods, which is the subject of his work.

Such, then, is the end which the author of this "Introduction to the History of Medicine" has kept in view, and this end he seems to us to have attained. Drawing his inspirations from Osler, Baas, Pagel, Sudhoff, Neuburger, and other authorities, he has composed a scholarly and delightfully entertaining account of the development of medicine from the ancient and primitive period to the present. He has composed an attractive story, which, while easy reading, is fully adequate to instruct the readers for whom it is intended, and to prepare for more complete studies those who wish a more minute acquaintance with a special period or subject. For this purpose Dr. Garrison has added three appendices, viz., medical chronology, hints on the study of medical history and bibliographic notes for collateral reading.

The composition of such a book needs much art, and also really scientific knowledge; the author possesses both qualifications and has acquainted himself with the most recent works as shown in his account of Assyro-Babylonian medicine by Professor Morris Jastrow of the University of Pennsylvania. The medical features of the cuneiform inscriptions of the Assyrians and Babylonians have not been very generally studied and the first good account of Assyro-Babylonian medicine was given by Professor Jastrow. Although not a physician, he has paid much attention to the subject, and students of medicine are indebted to him for some clever discoveries therein. We admire his patience and learning displayed in collecting and arranging in an understandable order the facts which he has gleaned from the broken fragments of the clay libraries of Nineveh and Babylon. It is hardly necessary to say that this crude material needs interpretation of the kind Jastrow has given. Many other investigations not accessible in the first edition are also considered. In particular, the researches in ancient medicine of Erwin Rohde, Max Höfler and Max Wellman, those in mediæval medicine by Karl Sudhoff, Neuburger, Wickersheimer and Singer, the investigations in epidemiology of Georg Sticker, the history of pharmacy of Tschirch and Schelenz, the paleopathology of ancient Egypt of Elliot Smith and Wood Jones are very accurately rendered. These are only some of the points of interest touched upon in this entertaining and delightful book.

Dr. Garrison has been extremely fortunate in his position as Principal Assistant Librarian in the Surgeon-General's Office which enables him to take freely from its unlimited resources and treasures. Few English writers, moreover, are so well qualified in a scholarly way for the task of using these references. We are grateful to Dr. Garrison for having taken up and brought to so happy a conclusion the laborious work which he had begun in his first edition. It remains to say that in course of reading steadily through large consecutive portions of the book, we have been led to view it not only as an utilitarian book of reference but as a source of genuine literary pleasure.

Mortimer Frank.