curvature. In my judgment the best way to study an astigmatic cornea is to consider it as made up of a spherical and a cylindrical surface, each having its own radii of curvature. There is no point of such a cornea but that extending from it are two radii, one of spherical and the other of cylindrical curvature. The radii of spherical curvature in this model will all come to a common point six inches behind the circle. The radii of cylindrical curvature will be in planes parallel with the plane of the meridian of greatest curvature, and the radii of each plane will converge to points in a line which is in the same plane with the meridian of least curvature. The two sets of radii for the meridian of least curvature are in the same plane; while the two sets for the meridian of the greatest curvature are also in the same plane. Each of these two meridians is an arc of a circle and therefore has a focus. This is not true of any other corneal meridian, for the reason that all other meridians are parts of an elliptical curve. If the astigmatism be vertical, and according to the rule, parallel rays of light in the horizontal plane will be so refracted by the meridian of least curvature as to be brought to a focus. Parallel rays of light in the vertical plane will be so refracted by the meridian of greatest curvature as to be brought to a focus in front of the other. The rays of light refracted by each of these meridians will be in the same plane after refraction as before. By revolving the model as to bring the meridian of greatest curvature to 45 degrees the horizontal meridian of such a cornea has its radii of spherical curvature necessarily in the horizontal plane. If the eye be the right one, the radius of cylindrical curvature for the outer extremity of the horizontal meridian will rise above the horizontal plane, while the radius of cylindrical curvature for the inner extremity of the horizontal meridian will point below the horizontal plane. Parallel rays of light in the horizontal plane will not be in the same plane after refraction as before. The ray corresponding to the visual axis will pass through the cornea and will strike the yellow spot of Soemmering, not having deviated any from its original course. An axial ray striking the temporal extremity of the horizontal meridian of the cornea will be bent, in obedience to the law of refraction, toward both the radius of spherical and the radius of cylindrical curvature. Striking the radius of cylindrical curvature above this ray, after refraction, rises above the horizontal plane. Passing across to the nasal side of the retina it would impinge above the horizontal meridian of the retina. Another axial ray, in the horizontal plane with the other two rays, striking the cornea at the left extremity of the horizontal meridian, beneath the radius of cylindrical curvature would be refracted beneath the horizontal plane. Passing across to the outer part of the retina it would strike it beneath the horizontal retinal meridian. These three rays of light come, one from the middle of a horizontal line and one from each extremity. Connect the points of impingement on the retina by these rays and the image line must necessarily be oblique, the nasal extremity of the image being above the horizontal meridian, the center of the image on the yellow spot of Soemmering and therefore in the horizontal meridian, the outer extremity of the line beneath the horizontal meridian. In obedience to the law of direction the object would be made to appear to incline to the same extent that the image itself inclines, therefore the object would appear to be leaning down and to the right. The reverse would be the case if the meridian of greatest curvature should be at 135 degrees; the model also shows the relationship that exists between the radii of cylindrical and radii of spherical curvature for all corneal meridians. In the two principal meridians they are always in the same plane. In all other meridians it is not possible for them to be in the same plane. It is not absolutely true that every point of an astigmatic cornea has these two radii of curvature, but it is true that there is a resulting radius for every such point, or, more correctly speaking, a resultant vertical. So far as the refraction is concerned, however, it is exactly the same as if every corneal point had the two radii.

Discussion

A. W. Stirling, Atlanta—Dr. Savage has said that the anterior and posterior surfaces are parallel and has founded his argument on that. With due respect, I submit that that is not correct. The cornea increases in thickness from the center to the periphery, and when the pupil is dilated the rays of light pass through a thicker part of the cornea than when it is contracted. His would be an argument against mydriatics.

C. M. Hobby, Iowa City—The surface of the cornea is the surface of an ellipsoid of three axes, how then can we speak of radii of curvature? How can there be two radii to one curve?

B. A. Randall, Philadelphia—The clearness of some parts of Dr. Savage's demonstration is due, unfortunately, to the neglect of some of the essential factors of the problem and the reduction of some others to too simple terms—as when he makes his so-called "astigmatic curve" no curvature at all and its "radii" parallel. Were the Doctor to work out these problems in the smoke-filled chamber with proper curvatures to refract actual rays of light and a screen to receive the actual results, he would be relieved of many of his misapprehensions and could turn his abilities to more profitable fields.

Dr. Savage, closing—In the model the two principal meridians of the astigmatic cornea are represented by straight lines, but they could have been as easily represented by curved lines. What is correctly shown in the model is the radii of curvature. The radii of spherical curvature all point to one common center. The radii of cylindrical curvature are in planes parallel with the plane of the meridian of greatest curvature, each plane coming together in a line which is in the same plane with the meridian of least curvature and of the same length. While I am sure that astigmatism can be better understood and studied in this way yet I am free to say that we have not these two sets of radii, but for every point there is a resultant radius or rather resultant vertical.

CONCERNING MEDICAL EDUCATION IN THE UNITED STATES; A BRIEF HISTORY.

By FRANKLIN STAPLES, M.D.

WISNIA, MINN.

In ancient times a knowledge of the art of medicine was held by its possessors as secret, membership in the order of physicians being restricted and obtained only by initiation under the conditions and in the manner prescribed. In ancient Greece the right of the healing art was held by the order of the Asclepiad; and the Hippocratic oath, among its solemn requirements and incitations of virtue and morality, has the following: I will impart a knowledge of this art to my own sons, to those of my teachers, and to disciples bound by a stipulation and oath according to the law of medicine, but to no others." In times still more remote, among the Hindus the right of the
knowledge of medicine was hereditary, confined to the higher class, with physical and moral purity as requisites for initiation.

In the progress of events in modern times changes have occurred. Family succession and caste have ceased to be the requirements necessary for admission to the orders of the profession. This would seem to be an advance; the question as to how much advancement has been in the way of virtue and professional righteousness may be considered separately.

The matter of the advancement of the standard for the amount of scientific knowledge and practical ability requisite to the practice of medicine has been a troublesome one in this country for many years; but that real advancement has been made in the last decade and further improvement in the future is assured, is notable.

In 1877, the year following that of our great Centennial Industrial Exposition, the general condition of things in special educational lines in this country was ably set forth in an anniversary address by an eminent professor in one of our foremost universities. After alluding to the evidences then shown of the country's great progress, the speaker observed: "Surely candor compels us to acknowledge that in regard to many things which are essential to a lasting and elevated civilization, we are still far behindhand.

One common thought must be entertained, which is, that among the influences that have led to the present state of affairs, one of the most powerful has been the want of thorough special training and preparation on the part of those to whom important duties are intrusted."

This was the view expressed concerning the condition of affairs in general at the time of the observation, and the need of improvement and reform in general service. It was further observed: "Few persons who are at all familiar with the subject will be willing to express even the smallest satisfaction with the present state of the medical profession in this country."

The status of medical science and education, and in part the causes of the same were mentioned as follows: "The ranks of the medical profession are overstocked; only a small percentage of those engaged in its practice are able to earn a living thereby, and worst of all, the profession has failed to elevate its standing and repute with the public, or to exert the powerful influence upon sanitary legislation, upon public and private hygiene, upon education and upon similar subjects, which is at once its duty and highest prerogative." This was said by eminent authority in the year 1887, and the truthfulness of the representation will hardly be denied by those who have given the subject any considerable attention.

The history of medical education in the United States from colonial times to the present is voluminous; only a few facts concerning conditions and concerning causes and results may be noticed. The beginning of medical colleges in this country was in Philadelphia in 1765. Dr. John Morgan and Dr. William Shippen, natives of Philadelphia, were the pioneer professors. Both had been students of Cullen of Edinburgh, and returning to Philadelphia began the work of teaching. The College of Philadelphia was for a time endowed with two professorships, which comprised all the branches; the one "Theory and Practice of Physic," held by Dr. Morgan; the other, "Anatomy and Surgery," filled by Dr. Shippen. This College of Philadelphia afterward became the Medical Department of the University of Pennsylvania. This institution is, therefore, the pioneer medical college of America.

The College of New York was founded in 1767. This became King's College, now the College of Physicians and Surgeons, Medical Department of Columbia.

A third chair in the Philadelphia school was formed in 1768, Dr. Adam Kuhn being made the professor of materia medica and botany. In the same year Dr. Thomas Bond of Maryland was elected professor of clinical medicine. Dr. Benjamin Rush in 1789 was elected professor of chemistry. These five professors constituted the faculty of medicine in the college of medicine until 1777, when the city was occupied by the British army.

The Medical Department of Harvard College was organized and lectures began in 1782; that of Dartmouth College, N. H., in 1797. These four were the schools of America up to the close of the eighteenth century.

The following appears as a summary of the rules adopted for admission and for examinations:

1. Such students as have not taken a degree in arts must give evidence of a competent knowledge of Latin and of certain branches of natural philosophy.

2. Two years after matriculation an examination for the Bachelor's degree will be allowed to students who have taken one complete course of lectures.

3. One year after taking the primary degree the student will be admitted to the Doctorate, if he shall be 22 years of age, shall have attended two full courses of lectures, and have published and publicly defended a treatise upon some medical subject.

4. The mode of examinations shall follow that of the most celebrated universities of Europe.

An announcement of the College of Philadelphia was made in 1781, signed by Benjamin Franklin as President of the Board of Trustees, and by William Smith as Provost of the College, in which the requirements for the degree of M.D. were somewhat extended, specifying that the candidate must have been the pupil of some respectable practitioner for the space of three years; also specifying the departments in which he must have received instruction in the college, and providing for the written or printed thesis, in Latin or English at the student's option. At this time a requirement was also made for "attendance upon one course of clinical lectures, and on the practice of the Pennsylvania Hospital one year," this being the first of clinical instruction in the required curriculum.

The first medical degrees conferred were of Bachelor of Medicine. The first of these were granted in Philadelphia in 1768 and in New York in 1769. The first degree of Doctor of Medicine was conferred in New York in 1770 and in Philadelphia in 1771.

Such, in brief, were the means of medical education and the requirements for graduation in medicine from the early colleges and for admission to the profession in the American colonies before the war of the Revolution.

At the time of the beginning of the revolutionary war in 1775, the general situation is given as follows: There were in the colonies about three million people, who were distributed over a vast extent of terri-
M ajor Edward T. Devitt, a distinguished veteran of the anti-terror campaign in Europe, has emulated her courage; so that after six discouraging years of steadily diminishing classes, she sorrowfully abandoned her advanced position. We thought, too, alas! of the long and painful controversy lasting almost five years over the proposition to again elevate our standard of medical education, and of how the end had been attained only at the cost of old friendships and of the allegiance of valued associates whose convictions remained as to the injury that would be worked to the university by the proposed advance. This was said by the learned professor with reference to experience in the past, in full view of a far better state of things at the then present, and of still better prospects for the future which is now at hand. General and professional public opinion has been slow in coming to its present understanding and position. The more important causes of the slow progress in medical education, with suggestions for their removal, medical education, a little of the pathology and indications for treatment, are contained in the following words of President Eliot of Harvard University, said in an address, I think, in 1892, and published in the British Medical Journal. The points made were as follows: 1, that it is a clear disadvantage in medical education that the degrees given by the faculty, a teaching faculty, should admit to membership in the profession and to the legal right to practice medicine; 2, that the standard for membership, giving right to practice, should be made by law outside the teaching powers; 2, the President Eliot further observes: "The salary of a full professor in the medical school is lower than in any other department of the university." This, he thinks, is not as it should be and speaks of it as our English inheritance. He says "From England we have inherited a lower standard of general education in the medical profession, a lower standard for admission to that profession and a lower standard of training for the entering upon the duty of medicine. On the continent they do things far better, and it is to be regretted that we have not substituted the continental for the English standard." This was from the eminent president of Harvard in 1892. His conclusions and practical suggestions were summed up as follows: "We have obtained for the medical profession a higher standard in the community, but we have still to make proper the standard of preliminary requirement for admission to the medical schools, so that they may be equal to the schools of law and theology."}

**THE SLOW PROGRESS.**

During most of the long period since the beginning in colonial days and until quite recent years, no enlargement of requirements in studies and time were made by the schools. This the most of us now in practice know from our own observation. Comparing the curricula of comparatively recent years with those of the early times, we see but slight difference. Moreover, the competition instituted and maintained especially by the lower grade of schools, effectually rendered null some of the requirements that were effective in the beginning. This was seen, for instance, in the total disregard for any standard of qualification for admission to the college. An unavoidable evil existed in the fact, that a diploma from the school of the lower grade was just as good, legally, as that obtained at greater expense and better application at the higher institution.
This condition of things in free America causes the United States to be the nation with the largest proportion of physicians and of medical colleges to the number of inhabitants, of any in the world. It is not asserted here that continual progress has not been made in this as in other countries in the arts and sciences pertaining to medicine. The reverse is known to be true, and the discoveries and inventions of the period have been an important means in promoting the more recent advancement in the higher medical education. The following language of a late professor in Harvard University is expressive of the truth: "It is not an extravagant assertion to say that in all this turmoil, change and progress, medicine has kept abreast of the other natural sciences, of politics, and of theology; and has made equal conquests over authority, error and tradition. If this statement seems extravagant, it is to be recollected that the brilliant discoveries in natural sciences and the arts, the great political changes, and the vaccinations of long established faiths to which we have referred, influence so obviously the fate of nations and the aspects of civilization, that they force themselves prominently upon our attention: while the process of medicine is silent and unobserved. Yet the progress and changes of the latter are not less real than those of the former, and, perhaps, affect more profoundly than they the development of civilization and the welfare of the human race. During the past century, medicine has been enfranchised from superstition, quasi-charlatanism, bald empiricism and speculation, and has developed into a symmetric science, affiliated with the other natural sciences, studied by the same methods and the same appliances as they are, and, like them, has been planted upon the solid basis of facts and demonstration; pathologic anatomy, starting from the "de Sedibus" of Morgagni and the labors of Baillie, and illustrated by the later researches of Rockitansky and others, has become a fundamental branch of medical science; obstetrics, rescued from the hands of ignorant midwives, has been raised with its allied branch, gynecology, to its legitimate position as a science; preventive medicine and hygiene, cultivated to an extent previously unknown, have prolonged the average of human life; organic and physiologic chemistry have been substantially created, and achieved important and brilliant results; physiology has grappled with the abstrusest problems of the structure of life, and has revealed so much as to make timid people tremble at the audacity of its efforts." This was said in the year 1876. The great discoveries and advances in scientific research since that time, especially in bacteriology, asepsis, antiseptic means, the modern possibilities in operative surgery, and in the great field of preventive medicine, are not unknown to us.

STATE LEGISLATION AND ITS RESULTS.

The State of Illinois has the credit of first establishing by law a standard of requirements for practice in the State. In June, 1880, the Illinois State Board of Health appointed a committee to formulate a scheme of educational requirements and characteristics by which to determine the good standing of medical colleges. This step was taken in order to enable the Board the better to discharge the duty devolved upon it by the act to regulate the practice of medicine in the State of Illinois: and by which act the Board is directed to "issue certificates (entitling to practice) to all who furnish satisfactory proof of having received diplomas or licenses from legally chartered medical institutions in good standing." A schedule was prepared by the committee, and subsequently formally adopted by the Board, as the standard entitling to recognition as the basis for legal qualification for practice in Illinois.

The first act regulating the practice of medicine in the State of Minnesota became operative in March, 1883. It was the form of legislation in force in Illinois. Five years later this law gave place to the present law, which requires an examination by the State Board of all persons commencing the practice of medicine in the State, and, as now amended, the minimum requirements demand that all graduates of later date than 1898, furnish evidence of having attended at least four courses of lectures in different years, of not less than six months each. Other states have enacted laws with similar requirements, and so large a number of the States of the Union now have medical practice acts, defining the requirements for admission to practice in the respective States, that such medical schools as would otherwise refuse to advance, must be compelled to come up to the higher standard or go out of the business. This movement shown in the passage of state laws to such an extent throughout the country, is ominous in that it speaks of advance in public opinion and knowledge in scientific matters. It is this that has made state medicine what it now is in this country.

With the educational prospects which we now have, with the present advanced pathology, with our able teachers thereof in the medical schools, laboratories and hospitals, in Philadelphia, Baltimore, New York, Boston and Chicago, with the world's present knowledge of the means and importance of cleanliness in medicine and surgery, and with our rapidly increasing knowledge of the means of prevention of disease in the land, as medical men we are able to rejoice in the present and hope well for the future.

The literature of medical history and medical education is important. The English writer, Dr. Edward Berdoe, speaks of the works of Sprengel, Hasser, Baas, Puschmann, and observes, that "many others of the same class sustain the claim that Germany has created the history of medicine, while the well-known but incomplete treatise of LeClere shows what a great French writer could do to make thisterra incognita interesting." Of English writers, we have the works of Drs. Berdoe and Withington, and other English contributions in special departments. In this country are published the works of Joh. Hermann Baas, translated into English by Dr. H. E. Handerson of Cleveland, Ohio; and the "History of Medicine from the Earliest Ages to the Nineteenth Century," by Robley Dunglison, is still extant.

A Rachitic Chest Deformity in Twins, With Exhibition of Casts.

Presented in the Section on Diseases of Children, at the Forty-seventh Annual Meeting of the American Medical Association, held at Atlanta, Ga., May 5-8, 1896.

BY W. J. BELL, M.D.

EX-ASSISTANT RESIDENT PHYSICIAN OF NEW YORK INFANT ASYLUM.

ATLANTA, GA.

These cases are presented because they are unique. They were twins, the mother being a hunchback. The deformity is very nearly alike in the twins. They died of atelectasia and pneumonia at the age of fifteen months. In the case of Sarah Coy, we found a small strip of lung tissue on the left side, the other being of an atelectic character. The other lung was slightly encroached upon. This child just previous to death weighed eight and one-quarter pounds. Its breathing in best physical condition was eighty to ninety per minute, and the respiration during the last illness ran up as high as one hundred and twenty per minute, practically panting. A line drawn through the chest, directly from the central portion of the sternum, would have pierced the inner angle of the cartilages of the ribs as they were bent in, in each case. The other case is of a boy, weight seven and one-half pounds at the time of death. The two cases were almost exactly parallel. They were each subject to frequent bronchial attacks. The respiration in the boy was a little more rapid than in the other; the last illness gave a respiration that could hardly be counted.

Dr. B. V. B. — How about the limbs?

Answer: There were no evidences of rickets about joints. The head of the girl showed a slightly rachitic square shape, and the sutures were only partially closed.

Question: Was the chest born that way?

Answer: It was slightly deformed. I did not see the children until about the third month and there was a slight sinking in at that time, which seemingly increased until their death.

Question: Is there any such thing as congenital rickets?

Answer: I have heard reports of such cases, but never saw a case. These cases occurred in the New York Infant Asylum. I made molds for these casts over the bodies of the children, so they are exact reproductions of the chest.

Society Proceedings.

Southern Surgical and Gynecological Association.

Abstract of the Proceedings of the Ninth Annual Meeting, held in Nashville, Tenn., Nov. 10-12, 1896.

First Day—Morning Session.

The association met in the auditorium of the Nicholson House, and was called to order by the President, Dr. E. S. Lewis of New Orleans, La.

An Address of Welcome was delivered by the Hon. John Bell Keeler of Nashville, which was responded to by President Lewis.

There were fifteen new members elected, after which the reading of papers was proceeded with.

The first paper was read by Dr. W. D. Haggard, Jr., of Nashville, Tenn., entitled "Vaginal versus Abdominal Section for Pus in the Pelvis."

He recounted the transitional periods in the treatment of pus in the pelvis: Vaginal puncture superseded by abdominal section, the removal of pyosalpinx and total uterine evacuation, done by the French and through the abdomen by the American school. They have reluctantly given way to modern vaginal section and evacuation as a means of drainage. It is a distinctly American innovation and will revolutionize the results in pus disease. The abdominal route affords visual inspection of the field. The attack on morbific masses can be made with safety to visceral integrity. If the abscesses are multiple, rupture and peritoneal seeping are inevitable; that is the supreme disadvantage of abdominal incision. He had often seen the pelvis deluged with pus with impunity. He had also seen patients die within twelve hours from fulminating sepsis, from peritoneal contamination. The cases passing from sepsis on the third day are classical. There is no way of distinguishing these cases clinically. All should be regarded as vaginal. The writer referred to a mortality of 15.5 per cent in a series of collected cases of laparotomy for pus, done in five metropolitan hospitals in the last year, and asked what must it be in the "unheard from precints" and in the hands of the general practitioner? The abdominal approach in tuberculous inflammation of the ovaries and tubes and in small unilateral pus tubes.

He alluded to the advantages of exploring the pelvis for retroperitoneal tumors, inflammatory, and adnexa by vaginal section. The geography of pus in the pelvis in most cases makes vaginal incision extraperitoneal, a minor procedure giving major results; no shock, no risk, no disturbance in convalescence. Patients will submit to it who will refuse more formidable procedures. We can change the methods, but we cannot change the patient. In prolonged sepsis from huge posterior section and drainage of all pus, the special indications are: 1, early cases of acute suppurating salpingitis; 2, incipient post-puerperal peritonitis; 3, large pyosalpinx and true pelvic abscess. The first group is properly gonorrheal and is treated by a gonorrhreal a month's standing with pain, temperature and tenderness for three days. The opposite tube was normal. In a week that tube became similarly infected and was similarly treated. He believed those septic effusions in the Fallopiian tube were the preceding pathologic condition to pyosalpinx. The diagnosis is true and is the same as the subacute suppurating salpingitis in early gonorrhreal and other inflammatory cases, the prophylactic value of vaginal section will be the greatest soon yet given to infected woman. In puerperal cases, incipient suppurating salpingitis and pus in Douglas' section of posterior approach is indicated. It is then an active demand incision. Should simple pus letting in any of these cases not effect a cure, subsequent operation for removal of the relics of previous ravages can be done without the danger incident in the puerperal form. The field of operation is to prevent suppuration in early cases, to anticipate it in puerperal cases and to save life in desperate cases. It is simple, surgical and safe. Its application to the pelvic inflammatory processes and to pus in the pelvis is one of the greatest surgical triumphs of the age.

Dr. Joseph Tabor Johnson of Washington, D. C., said that while the vaginal method had a great many points in its favor, he still held to the belief that it was more practical to try large collocations in the pelvis, yet those who had been familiar for a considerable time with the abdominal route could operate more conveniently and dextrously by this method and with greater safety to the patient than by the vaginal method. He could not agree with the speaker that the vaginal operation may be done without any risk or damage to the patient. Sometimes it is going through the vagina for the purpose of removing the uterus and its adnexa, or for large pus collections high up in the pelvis, where it is necessary to manipulate the parts a good deal to do a thorough enucleation, the surgeon was liable to tear the intestine, the bladder, the uterus, or a large vessel which is out of sight. In such cases the abdominal is much safer than the vaginal route. However, the vaginal method had much to commend it in cases of pus collocations that are low down in the pelvis.

Dr. Charles P. Noble of Philadelphia believes we should practice a judicious eclecticism. He did not feel that either the abdominal or the vaginal method possessed all the advantages, but if restricted to one or the other he should choose the abdominal rather than the vaginal route. An objection form-