The facts at hand, based on many counts of the circulating leucocytes before the injections of serum were begun, and afterward at regular intervals, show, as was to be expected, a fall, often very rapid and even critical, in the number of leucocytes in the general blood stream with which the disappearance of the diplococci and the clearing of the spinal exudate are correlated.

The obverse of the phenomena here mentioned is encountered in those cases not responding to the serum, or responding imperfectly, in which death is the result. Although the data bearing on this topic at our command are less numerous and perfect than the other, yet the general statement can be made that the diplococci, the spinal exudate and the circulating leucocytes are less influenced in the resistant cases, and that progressive increase in turbidity of the exudate and rise in leucocytosis, and greater persistence of the diplococci with retention of viability after several injections of the serum, are unfavorable indications.

The data at hand bearing on the meningeal phenomena that precede and attend the relapses so far as diplococci, exudate and leucocytosis go are also imperfect. Here, again, the general statement can be made that the relapse is attended or ushered in by increased exudation of leucocytes into the meninges, higher systemic leucocytosis, and reappearance of or increase in the numbers of diplococci, although the diplococci may not regain power to grow outside the body in cultures. Relapses in the course of the treatment are not very frequent and rarely has the case terminated fatally during relapse when the treatment with the serum has been resumed without delay and vigorously pushed.

There remains one more topic to be mentioned. The indications given by the first series of serum-treated cases were to the effect that in the great majority of instances recovery from the disease would be complete. The facts brought out by the far larger series of cases on which this article is based confirm the earlier view which we expressed. The number of complications which arose in them was small, and the only persistent defect noted was deafness. This lamentable condition occurred in a few instances only, and it was more often than not noted early in the disease before the serum injections were begun.

INJURIES OF CRANIAL NERVES FROM FRACTURES OF THE SKULL.*

JOHN JENKS THOMAS, A.M., M.D.

Assistant Professor Neurology, Tufts College Medical School;
Physician for Diseases of the Nervous System, Boston City
Hospital; Assistant Neurologist, Children's Hospital;
Consulting Neurologist Quincy Hospital.
BOSTON.

At most large metropolitan hospitals which lie near the manufacturing and business districts there are treated many cases of accidents. In the Boston City Hospital, with which I have been connected as one of the staff for diseases of the nervous system for nearly fifteen years, many cases of injuries of various kinds are treated each year. Over 700 patients of this class were admitted to the wards during the year ending Feb. 1, 1908, in addition to those treated at the Relief

Station, a branch hospital, and as out-patients at the Relief Station and the main hospital.

In many of the cases of injuries of the head the neurologic staff is called in consultation by the surgeon in determining the question of the nature and extent of the injury to the brain. In these cases I have been struck by the frequency of involvement of one or more of the cranial nerves when there has been a fracture of the base of the skull. This injury often enables one, in cases that are doubtful or in fracture of the vault, to make the decision that there is a fracture of the base. In looking over the neurologic and surgical literature I have found relatively little on this aspect of the subject, and it seemed worth while to call attention again to what is a well-known fact and to state my own experience in regard to the frequency and character of these injuries.

FREQUENCY OF COMPLICATION.

In the text-books on surgery these facts are usually mentioned, but I have failed to find any statement as to the frequency of the complication. This is probably due to the inherent difficulty in collecting reliable statistics about the subject. In conversation with Dr. Nichols, one of the surgeons of the Boston City Hospital, he has expressed the opinion that one case in seven of fracture of the base of the skull shows an involvement of the cranial nerves, and this estimate corresponds very closely with my results. Let me state at once that no one knows better than I the unreliable character of statistics drawn from records in which the point investigated has not been in mind at the time the records were made. This is especially true of hospital records, in which the house surgeon, in the multiplicity of detail in caring for large numbers of serious cases, often neglects to have notes made by his junior—who is responsible for the records—even of conditions which he himself has noted, and this, too, aside from the fact that in many of the more serious cases the examination necessarily must be incomplete, to say nothing of difficulties with unconscious patients in detecting involvement of nerves of sensation, or those subserving movements of the eyes. Still, while admitting these difficulties and sources of error, the figures I have obtained are striking.

I have taken from the surgical records of the Boston City Hospital only the cases of injury of the head in which a diagnosis of fracture of the base of the skull was made, or in which bleeding from the orifices of the head, ecchymoses of the conjunctiva, or the escape of cerebrospinal fluid from the ear or nose has made the diagnosis certain. Up to Jan. 1, 1908, I found 541 such cases had been admitted to the wards. Of these cases there were 69 in which the records showed peripheral involvement of one or more cranial nerves; that is, 1 in 7.8 cases, or a percentage of 12.75.

FREQUENCY OF INVOLVEMENT.

When we consider the frequency with which the various nerves are injured, either alone or in combination with others, we find the seventh, or facial nerve, by far the one most frequently involved. This, however, is very likely not only because it is actually more frequently injured, but also probably in part because affections of this nerve are more striking and can be more easily discovered in unconscious or partially conscious persons. I have found the facial nerve affected alone or in combination with other nerves in 44 cases, in 2 of which the trouble was bilateral.

* Read in the Section on Nervous and Mental Diseases of the American Medical Association, at the Fifty-ninth Annual Session, held at Chicago, June, 1908.

The nerve which is next in frequency of involvement is the sixth, or abducens, which was paralyzed in 12 cases, once bilaterally. The auditory, or eighth, nerve was affected 10 times, and of these cases 4 were bilateral. It is possible that this nerve was partially affected in more cases, but I have excluded all cases in which the deafness was moderate, and in which there had been rupture of the membrum tympani, or where it could have been due to the injury of the middle ear. It was, of course, impossible to differentiate between the cases of deafness due to injury of the nerve trunk and those from fracture through the cochlea. Dr. Bullard,¹ in 70 cases of fracture of the skull investigated, found deafness in 9 cases, in 2 of which it was slight, and in 1 was diminishing and in 1 bilateral. The fracture was at the base or showed in the bony wall of the ear in 6, was at the occiput in 2, and in the frontal region in 1, while tinnitus was found only twice and in both cases without deafness.

The third nerve was next in frequency of affection in our series, namely 9 times. Most often all branches were affected, but at times the trouble was only partial, as in 1 case in which the movements of the eye up and down were impaired. In another there was ptosis only, while in a third the superior rectus was the only muscle supplied by this nerve that was affected.

The optic nerve was the one next most often involved. This occurred in 8 cases, and here I have included only the cases of blindness in which the diagnosis was confirmed by the discovery of optic neuritis or optic atrophy on ophthalmoscopic examination. Of the remaining nerves the olfactory, patheticus, trigeminal and hypoglossal were each affected once.

FREQUENCY OF COMBINED INVOLVEMENT.

The combinations of nerves injured were not very frequent in this series. Once the second, seventh and eighth were affected together. Both eighth nerves twice. Both seventh nerves once, and both seventh and the left sixth once. Both olfactory nerves, with the left fourth and partial left third was another combination. The second, third and sixth on one side were involved together once. The third and seventh twice, once on the same side. The third and sixth occurred together once. The right optic nerve and both sixth nerves were affected once. The optic and auditory twice, once on the same side and once crossed. The seventh and eighth together appear twice. The seventh and sixth twice, and the seventh and twelfth once. In eight cases nerves on both sides of the skull were affected.

I will give in condensed form some of the histories of these cases in which it was possible to observe the patients for some time after discharge from the hospital. It should be noted, however, that in a number of the cases included in these statistics the affection of the nerve disappeared while the patient was still under observation in the hospital for the original injury. This was particularly noted in three cases in the hospital records, two being of the facial nerve and the other of the abducens. In other cases it was noted in the records that the paralysis was improving. In these histories the numbers in parentheses are those of the records of the neurologic department, and I wish to express here my thanks to my colleagues, Drs. Prince, Knapp and Bullard, for permission to use their notes.

ILLUSTRATIVE CASES.

CASE 1.—History.—John S. (13288), was seen first at the Out-patient Department on June 21, 1907. Four weeks before he had been struck in the left eye by the point of an umbrella, at the junction of the eye and nose, and was unconscious for half an hour, and dazed for two or three days.

Examination.—On examination there was slight divergent strabismus of the left eye, due to partial paresis of the third nerve, and also primary optic neuritis in the left, according to the report of the ophthalmic surgeon, and the left pupil did not react to light. Further examination showed paresis of the right extremities with ankle clonus but no Babinski's sign, and slight diminution of the sense of touch on the right side of the body. The palate, face and tongue were unaffected.

CASE 2.—History.—(This case is from my private records.) Grace T., aged 5, was first seen by me on April 8, 1903. Four weeks before she fell down stairs striking the head, though there was no open wound. She was unconscious, and remained so for five days, and it was nine days before she spoke. There was no bleeding from the ears or nose, but swelling and ecchymosis of the right eye. There was vomiting at the time of the injury. She remained in the hospital under the care of Dr. Conant, who referred her to me, for two weeks, and then returned home. During her stay at home, she had only complained of headache once, but she had been unable to open the right eye.

Examination.—On examination there was a slight depression of the skull in the neighborhood of the right occipitoparietal suture. The vision seemed fair in both eyes. There was complete paralysis of the right third nerve with ptosis, and dilatation of the pupil, and probably also paralysis of the superior oblique muscle. The fifth, sixth, seventh and eighth nerves were normal, as well as the extremities. The paralysis of the third nerve improved, so that by July the ptosis had almost disappeared, and the eye could be turned in nearly to the full extent, and somewhat up and down, her vision had failed in the right eye, so that she could not make out the form of quite large objects, and the disc showed beginning atrophy. The fourth nerve seemed to have recovered, as the eye could be turned down and out very well. The vision improved slightly from counting fingers only till when last seen on Jan. 18, 1908, it was 1/200, while in the left eye it was 10/10. The pupil was moderately dilated on the right, and there was partial ptosis on this side and the eye was not moved up, and in, with quite normal range.

CASE 3.—History.—E. I. (10969), was admitted to the Boston City Hospital, Oct. 24, 1903. He had been struck by a piece of a bursting emery wheel, and showed a lacerated wound of the bridge of the nose, extending towards the left into the forehead, into which a finger could be inserted three-quarters of an inch, and splintered bone felt. The lid of the left eye was ecchymosed. No paralyses were noted. Fragments were removed from the frontal bone, as well as a large part of the ethmoid, and the inner third of the roof of the orbit. He vomited blood and was unconscious. He was discharged from the hospital on Nov. 10, 1903, and for three weeks after this had severe headaches, but when seen in the out-patient department on Jan. 11, 1904, this had been gone for two weeks, and he was complaining of diplopia and loss of sense of smell.

Examination.—This showed the right pupil larger than the left, though both reacted well. There was paresis of the left superior rectus, and left superior oblique muscles only, with diplopia on looking up and in, and down and in, with the characteristic inclination of the images. The hearing, facial movements, sensation, and the condition of the extremities were normal.

CASE 4.—History.—Edward B. (13866), on Oct. 6, 1907, had his head crushed between two cars. When he entered the hospital the same day he was conscious and rational, and showed a horizontal scalp wound, seven inches long, over the right ear, which exposed the bone. There were loose fragments of bone in the wound, and much laceration of the brain, with moderate external and internal bleeding. A crack extended forward from the anterior end of the wound. Both

1. Permanent or Later Results of Fracture of the Skull, Boston Med. and Surg. Jour., 1897, cxxxvi, 404.

eyes were ecchymosed. On October 18 it was first noted that there was paralysis of the left superior rectus, and a paresis of the external rectus of that eye, while the fundi were normal. On March 25, 1908, when he was again seen after discharge from the hospital, at the end of nine weeks stay, he complained of some pain and vomiting till about six weeks before, disturbed sleep, attacks of vertigo, and tinnitus and diplopia.

Examination.—The sense of smell was not affected. Sensation was diminished over the area supplied by the first and second branches of the fifth nerve, there was paresis of the left levator palpebrarum superioris, and of the left external rectus. The examination was otherwise negative. He improved while under observation, but was not entirely well when last seen.

CASE 5.—History.—James B. (9654), entered the hospital March 23, 1899, having been injured while oiling the engine on a boat. He was conscious, but suffering from shock, and bleeding from the nose and both ears, and on examination it was found that the left eye could not be moved out, nor the eyelids closed, and he was somewhat deaf. There was a lacerated wound in the left temporo-occipital region, 5 inches long, with the bone exposed, but no fracture seen. He vomited several times, the vomitus containing blood. The next day it was noticed that both sides of the face had become paralyzed.

Examination.—Examination at the out-patient department on May 17, 1899, showed that the eyes and pupils were normal except for paralysis of the left external rectus, and slight nystagmus on the right on looking in. The watch was heard on the right side on contact only. Tuning fork air conduction better than bone, and about alike in the two ears. In the right ear there was a cicatrix in the anterior superior quadrant of the drum membrane, with some thickening and retraction. In the left ear there was deformity of the canal posteriorly in the region of the facial nerve, and the membrane was ruptured posteriorly. The aural surgeon reported that there was enough change in the middle ear to account for the condition of the hearing, and he thought the left facial nerve was injured in the canal, while on the right there was no evidence of this. There was some improvement and in November, 1905, it was noted that by a great effort he could wrinkle the brows a little, and could close both eyes completely though with very little force. The muscles of the lower part of the face on the right had very little voluntary motion, while on the left they moved fairly well. There was considerable fine spasm of the facial muscles after voluntary motion.

Both sides reacted to faradism, and galvanism without polar change, but with diminished irritability to both currents, this being slightly more marked on the right than the left side. There was still internal strabismus of the left eye with diplopia.

CASE 6.—History.—Albert L., (vol. 447, p. 214), entered the Boston City Hospital July 24, 1905, having been struck on the head by a falling timber. He was partially conscious, bleeding from ears, nose and mouth, and there was a hematoma on both sides in the frontal region, and above the left ear. There was no paralysis at that time, either of the face or elsewhere. Three days later a paralysis of the left side of the face, involving all three branches, appeared, and the next day this appeared on the right side also, and did not improve up to the time of his discharge from the hospital, when he was lost from observation, although he was told to report.

CASE 7.—History.—Joseph H., (12368), entered the Boston City Hospital, Feb. 1, 1906, having fallen from the seat of his cart. He was conscious but irrational. There were ecchymoses about both eyes, bleeding from both nares, and the right ear, and a lacerated wound 1½ inches long in the right parietal region, with no depression, and the bone not exposed. There was no paralysis till the eighth day when a slight right facial paralysis was seen.

Examination.—He was examined on February 19 at the out-patient department. There were then slight exophthalmos and slight greenish ecchymosis under each eye. The pupils

were equal and reacted, though a little sluggishly. Smell, taste, hearing, sensation and the eye movements were all normal. There was paralysis of the right side of the face, though the eyelid could be closed completely, with diminished reaction of the muscles to the faradic current, and some polar change to galvanism in both facial nerves. The aural surgeon reported that there was probably fracture of the superior meatal wall with effusion in the middle ear, while the auditory nerve was not markedly affected. He thought the facial nerve probably affected by a fracture through the foramen at its entrance into the attic. On March 26 he could move the two sides of the face nearly equally well, but there was still slight quantitative diminution on the right to electric stimulation by both faradic and galvanic currents.

CASE 8.—History.—John B. (12937), entered the hospital Jan. 13, 1907, having been knocked down and robbed. He was unconscious and had a hematoma on the right behind the mastoid, and there was blood in the right ear, and the nose, and also a discharge of cerebrospinal fluid from the ear. The left pupil was larger than the right, and there was a facial paralysis on the right.

Examination.—He was examined Feb. 13, 1907, and there was paralysis of the right side of the face, all branches being involved. The pupils and eye muscles were normal except for nystagmus on looking laterally. The watch was heard on the right at 4 inches and on the left at 20 inches. Fork (512) was heard on the right at 8 inches and on the left at 18 inches; air conduction better than that by bone in both ears. Weber, positive on right. The facial muscles on the right showed no reaction to faradism, and to galvanism the reaction of degeneration with slow contraction and CaCC greater than AnCC. The aural surgeon reported a fracture of the glenoid fossa into both external canals, also probably a fracture of the posterior wall of the external canal into the mastoid process, as well as a probable fissure of the Fallopian canal on to the seventh nerve. When last seen, March 27, there was a response to strong faradism in the muscles, but not on stimulation of the nerve, while to galvanism there was still a marked reaction of degeneration.

CASE 9.—History.—David G. (12993), was admitted to the Boston City Hospital March 7, 1907, with a lacerated wound 1½ inches long over the left eyebrow, bleeding from the left ear, where the drum was ruptured, but no note was made of any paralysis at that time. He had been struck on the head by a falling bale of cotton, and was dazed, but not unconscious. For twenty-four hours he had intense headache, and occasionally afterwards. On March 13, 1907, when he was seen in the out-patient department, one week after his discharge from the hospital, he complained of vertigo with a tendency to fall to the left. There was no nausea or vomiting, but on lying down there was a constant noise in the left ear, but not in the right, and pain in the left ear if he lay on that side of the head. He had also noticed deafness in the left ear and inability to close the left eye, while the mouth drew to the right.

Examination.—There was a facial paralysis on the left, complete in all the branches, while the left side of the face seemed slightly less sensitive to touch, pain and temperature stimuli, but there was no affection of the motor portion of the fifth nerve. The pupils were normal, and the vision equal in the two eyes. There was no diplopia, but a slight slow nystagmus on lateral movements of the eyes. Smell was normal, and taste was not affected. The watch was not heard on the left, but less plainly than on the right, while air conduction was better than that by bone in both ears. The tuning fork on the vertex was heard better on the right. The left ear showed an absence of the light reflex, and dull membrane with the landmarks obscured. On electrical examination the muscles of the face responded on both sides to faradism, but the left side required a stronger current than the right. To galvanism on the left the muscles showed a slowed contraction and diminished irritability, while CaCC was greater than AnCC. The muscles about the eye and forehead were most affected. The examination was otherwise negative.

THE COURSE OF FISSURES.

Walton² has studied the course of fissures of the skull, and Cushing³ of Baltimore gives an excellent sketch of the present knowledge of these bursting fractures. He quotes Bruns,⁴ who in 470 cases of fracture of the skull found it basal in about one-half the cases and the base involved in from 70 to 75 per cent. of fractures of the vault. Cushing shows that in bursting fractures of the skull the cranium is compressed and the fissures tend to run vertically in the direction of the meridians passing through the poles at which the pressure is applied, resembling the direction of the segments of an orange, and illustrated by the method of separation of the parts of the bulb of a urethrometer. As he states it, the fissure takes a direction parallel to the polar diameter and tends to follow one of the meridians of the sphere.

Other things being equal, it would begin in the equatorial zone of one of the meridians and follow the line of least cohesive resistance toward the pole of impact. As the base, however, is weakened by the foramina, no matter in what direction the polar diameter of the impact lies, the portion of the meridian which passes through the base will be the one to give way first, whether it happens to be near the pole or the equator, and most of the fissures cross the basal fossæ anterior, middle or posterior. He also quotes Hilton, who called attention to the fact that portions of the base are strengthened by processes such as the zygoma, and called these buttresses.

Felizet says that fissures pass down between the buttresses of Hilton to the nearest basal fossa, of which the middle is more often affected than the anterior or posterior. Cushing also states that it is a matter of dispute still whether the fissures avoid the foramina or not, and thinks this probably depends on the relative strength of the rim of the foramen and the neighboring bone, so that in cases in which the rim is thick, as at the foramen magnum, the base of the skull is not necessarily weak. He says that the posterior lacerated space, foramen ovale, facial and acoustic foramina are the ones most frequently involved. Later, in speaking of the relative frequency of involvement of the various cranial nerves, he says that the facial is the most often involved, the abducens next, or the third nerve, followed by the olfactory, optic, trigeminal, glossopharyngeal, vagus, spinal accessory and hypoglossal.

In my cases the order of involvement was nearly the same, namely facial, then the abducens and auditory. Cushing does not separate the injuries of the seventh and eighth nerves, which should be done, my cases showing that either nerve may be affected alone, the facial especially frequently without an involvement of hearing, only a deformity of the bony canal of the ear, or a rupture of the drum being present. Next in my cases come the third and then the second nerve, one of the most serious injuries, followed by scattered cases of affection of the olfactory, patheticus, trigeminal and hypoglossal. This series presented no cases in which injury of the glossopharyngeal, vagus or spinal accessory was observed.

COMBINATIONS OF NERVES INJURED.

In regard to combinations of the nerves which are injured Cushing speaks only of groups of the seventh,

eighth and sixth; of the fifth and third; and of the ninth, tenth and eleventh. In my series, though the number of combinations is too small to admit of any inference as to the frequency of any particular combination, the most frequent were seventh and eighth; both eighth nerves; both seventh nerves; seventh and sixth; second, seventh and eighth; second, third and sixth; both seventh nerves and one sixth; both first nerves and one third and fourth; the third and seventh nerves, both crossed and on the same side; second and eighth nerves, crossed and unilateral; and the seventh and twelfth nerves. The only inference which I think we are justified in drawing from these facts is that, aside from the combinations in which the nerves lie very close together, so as to be liable to injury by a single fissure, as in the case of the seventh and eighth nerves, and the second, third, fourth and sixth nerves, the frequency of multiple fissures makes the groups, both as to the nerves involved and the side affected, much more irregular than one would expect.

METHOD OF PRODUCTION.

In regard to the method of production of those paralyzes of cranial nerves, we probably have to deal with varying conditions. In some cases a meningeal hemorrhage may compress one or more nerves within the skull. In other cases we probably have to deal with the effects of increased intracranial pressure, such has been shown by the studies of Bullard, Cannon, Crile, Cushing and others to occur in cases of trauma to the skull. An analogy to this condition is seen in the frequency of affections of the optic nerves and the abducens from simple increase of intracranial pressure such as in cases of hydrocephalus and tumor of the brain.

It is quite possible that the fairly frequent involvement of the sixth nerve in fracture of the skull, which in most cases recovers, is due to this cause. The other and probably most frequent cause is undoubtedly the injury of the nerve by compression, or in rare cases laceration from the displacement of the walls of the foramen, such as has been seen in the deformities of the walls of the external auditory canal in some of these cases and those reported by others. In cases with no displacement of the bone of the foramen we probably find the more curable cases in which there is a more or less severe reaction of the nerve sheath to the bruising and laceration received at the time of the injury.

PROGNOSIS.

The prognosis for recovery differs very markedly in these cases. In a good many the paralysis had disappeared before the discharge of the patient from the hospital, which usually took place within two or three weeks from the time of admission. In these cases we probably had to deal with simple edema of the sheath of the nerves. In other cases the recovery was very slow, and in many incomplete. This is especially true of the affections of the optic nerve which seem to have all gone on to partial or complete atrophy. These results coincide with our knowledge of the difficulty of repair in the neurones of this nerve, which act in this respect like the central neurones rather than like the peripheral neurones of the other cranial and spinal nerves.

This is possibly true also of the auditory nerve, though the frequency of involvement of the internal

2. Ann. Surgery, 1904, xl, 642.

3. Keen's Surgery, iii, 68.

4. Beiträge z. klin. Chir., 1903, xxxviii, 192.

car in cases of fracture, and also in the cases of deafness following cerebrospinal meningitis, makes it difficult to make any positive statement in regard to this nerve. The severer cases of injury of nerves which pass through a long canal in the bone, which is more liable to show displacement of bone, as in the case of the facial nerve, are also much more unfavorable, and the same was true in a number of my cases of injury to the third nerve.

TREATMENT.

The treatment, aside from the use of drugs, such as strychnin, for the arrest of atrophy, as in cases of affection of the optic nerve, consists of the use of various forms of electricity and massage as in other forms of peripheral nerve injury, in which this can be used. In severe cases of injury, as of the facial nerve, which do not show decided improvement within a reasonable time, such as six months or a year at most, nerve suture with some other nerve such as the hypoglossal or spinal accessory, provided these nerves have escaped injury, seems to be the most promising method of treatment.

DISCUSSION.

DR. ALBERT E. STERNE, Indianapolis: I have an interesting case of what I deem a fracture of that portion of the base represented by the orbital plate. The patient was a heroine of the disaster in which the town of Fontanet was wiped off the face of Indiana by the explosion of the DuPont powder-mill last September. This young woman was a school teacher and the building in which she was teaching was completely wrecked. She had the presence of mind to tell her little charges (before seeking safety herself or thinking of seeking safety, although she was near the door) to get under their benches. They did so, but by that time the roof was practically down on them. The teacher was caught between the top of a bench and the roof. She was found in that position, unconscious, the right side of her face being down on the top of the bench. She was unconscious for several days at the hospital at Terre Haute. At the time the surgeon and the oculist first saw her there was great protrusion of the right eye, a cut over the forehead; the forehead was incised in the line of the brow, as it was supposed that a fracture extended into the frontal sinus. The outer plate of the frontal sinus was removed. The protrusion of the eye lasted several days, but I do not know whether or not the swelling was largely extra-orbital. When I saw the patient, two months after the injury, the vision on the right eye was reduced, there was total paralysis of the third and fourth nerves, but no paralysis of the sixth nerve on the right side. During her five months' treatment vision increased almost to normal, being about 15/20 at the present, and she has only a palsy, of course with double vision after she reaches a certain axis in the upper quadrant. She has very little motion of the superior rectus; she has absolutely good motion of the internal rectus, of the inferior, of the superior oblique and the inferior oblique, the only affected muscle now being the superior rectus. At the time I first saw her I was not sure that there was not a lesion of the nerves themselves in the orbit, but as time went on and distinct recovery of the function of the eye muscles occurred I felt that that was probably not the case. Instead of being protrusive, the eye was sunken in the socket, possibly between an eighth and a quarter of an inch; I concluded that there had been a hemorrhage which had left an adhesion which was holding the bulb back in the orbit. At this time the right eye is almost at a level with the left, and I feel sure that the lesion was one of pressure through hemorrhage with subsequent adhesion rather than a direct lesion and tearing of the third and fourth nerves themselves. In general health the patient has improved so that at the present time she is practically well, although she still has a little diplopia on the upper quadrant.

DR. J. J. THOMAS, Boston: I omitted to speak of the mechanism, which I think varies in different cases. In a good

many of the cases in the hospital the patient recovers completely from the paralysis, but usually it is obstinate, and those are the cases in which there is apt to be a bony deformity. Frequently there is hemorrhage into the nerve, and therefore degeneration of axis cylinders, while in other cases the increase of intracranial pressure following a blow may account for the degeneration of certain nerve fibers. In the more severe cases we have to do with bony deformity, and that has been shown in a number of cases in which this deformity was seen, particularly in the auditory canal. Prognosis with regard to lesions of the optic nerve is very poor, as the nerve does not regenerate easily and is usually followed by complete atrophy. The eyeground even immediately after the injury shows a swelling of the optic nerve. In a great many injuries to the optic nerve, whether due to pressure or crushing of the nerve fiber there is incipient neuritis and later we can always see optic atrophy on ophthalmoscopic examination. In the cases in which I have encountered lesion of the second nerve, the diagnosis has been confirmed by ophthalmoscopic examination, which gives important aid in both the later and earlier stages of the trouble.

DENTAL EDUCATION.*

M. L. RHEIN, M.D., D.D.S.
NEW YORK.

Does dentistry in this country retain the international pre-eminence for which it has been so long noted? Many Europeans of to-day are already making claims of superiority over Americans. Admitting that American dentists are still in the vanguard as regards the quality of their professional services, it must be admitted that the contrast which existed twenty-five years ago between the dentistry of Americans and that of their foreign colleagues is fast disappearing. This can be due to two reasons only: the advance of dental education abroad and the lack of the same at home. The controlling factor in this world is evolution. Consequently, a stagnation means nothing short of retrogression.

History shows that in no country has there ever been witnessed such a demonstration of inventive genius, especially in the line of everything pertaining to mechanics, as in the United States. This has made this country the world's leader in most of the arts, and by virtue of the same attribute has brought about the international superiority of American surgery and American dentistry.

The surgeon, whether of a general or a special field, comes to a great extent under the same influences which are such potent factors in the success of the dentist. His inventive faculties are brought into constant use in every operative procedure which he undertakes. To insure success, his technic must be constantly varied, not only in his operations, but in the designs for artificial replacement of lost or malposed portions of man.

On this account, it is not so many years ago that the surgeon was considered the inferior of his medical colleague. He was called a "bone-setter," just as dentists of to-day are spoken of as "tooth-carpenters."

If we go back to about 1840 we will find that the general physician with the narrow prejudice of that day looked on the general and dental surgeon with equal superciliousness. The practice of general medicine was so empirical and so replete with error that it was bound to stir a feeling of just resentment against the wise owls in medicine at that time.

* Read in the Section on Stomatology of the American Medical Association, at the Fifty-ninth Annual Session, held at Chicago, June, 1908.