Original Articles.

A REVIEW OF THE EVIDENCE IN THE MALLEY TRIAL

BY FRANCIS A. HARRIS, M. D.

THE interest of the medical profession as well as that of the general public has been excited to a greater degree in few cases of late years than it was in that of the alleged murder of Jennie Cramer by the cousins Walter and James Malley, and Blanche Douglass.

The facts of the case, sometimes embellished by imagination and interlarded with the hypotheses of amateur and professional detectives, were spread by the press before the public from one end of the country to the other. The local feeling, though divided, preponderated against the accused. The verdict of the jury "Not Guilty" was looked upon rather as legally and technically correct than as absolutely just.

Few were found to advocate the cause of the Malleys, and one who ventured to express a doubt as to their guilt exposed himself to the liability of harsh criticism.

At a time when men's minds were so warped with prejudice, and when a dispassionate consideration of the whole case was hardly possible, a review of the evidence would have proved a profitless undertaking, but now that many months have elapsed, and the excitement has died away and prejudice in a measure effaced by the attrition of other affairs, a discussion of the evidence may not be without value, and I believe not without interest.

In the preparation of this review I am met at the outset with an obstacle which must necessarily compel me to work at a certain disadvantage.

There was no stenographic report of the trial, consequently no absolutely reliable transcript of the evidence; yet, by availing myself of the reports printed in several of the principal newspapers and of notes taken on the spot by counsel, I hope to avoid serious mistakes.

It is impossible in this case to properly appreciate the drift and force of the medical testimony introduced, without a knowledge of some of the other evidence, in other words the history of the case is of great importance in determining the value of the post-mortem appearances.

The story in brief is this:—

Walter Malley, son of a prominent dry goods merchant in New Haven, was the *friend* of a young woman known as Blanche Douglass, a resident of New York. James Malley had formed the acquaintance of Jennie Cramer, a New Haven girl, young, pretty, and not altogether prudent. Blanche by invitation of Walter visited New Haven, and the four were known to have spent some evenings together in some kind of amusement, and Miss Cramer remained out as late as three and four o'clock in the morning.

On the evening of the 3d of August, 1881, the four went to the Malley house, the family being absent, and after some eating and drinking all spent the night there. Testimony varies as to the assignment of beds, the boys asserting that they slept together, while Blanche asserts that she passed the night with Walter, and that Jennie was with James.

At all events in the morning the girls left the house, apparently in the best of spirits, waving their handkerchiefs and kissing their hands to the young men, who remained at the house. The girls then went to a restaurant where they had among other things two porter-house steaks with mushrooms.

This was at ten o'clock in the morning. A little later they went to Jennie's home and there took place an interview with Mrs. Cramer in which she rebuked Jennie for remaining out all night and told her that she (Mrs. Cramer) must soon find her another home.

The girls soon left the house and separated. A little after twelve o'clock Jennie rode to Savin Rock on a horse car and at this place she was seen late in the afternoon. This was on Thursday, August 4th. On Saturday at five o'clock in the morning her body was found floating on the in-coming tide.

So much is not in dispute. It was testified to by the government witnesses, and was admitted or not controverted by the defense.

Public and professional opinion at first ascribed the death to drowning, but as the doings of the few days prior to the finding of the body leaked out, especially those of Wednesday night, suspicions were aroused.

An examination of the remains by two physicians resulted in an opinion that the girl had been feloniously assaulted only a few hours before death.

A post-mortem examination failed to show the presence of some of the appearances usually noticed in the drowned, and parts of the body were sent to a chemist who reported the presence of arsenic, and the medical opinion of the examiners in the case was that death was the result of arsenic poisoning, the further opinion being expressed that the drug was given in a very soluble form, probably Fowler's solution.

Witnesses were found to swear to the presence of James and Jennie at Savin Rock late on the night previous to the finding of the body.

An indictment was found charging all three of the party with the murder of Jennie Cramer by administering to her arsenic.

The defense naturally claimed that death was caused by drowning, or if caused by the drug, that their clients had no knowledge of the matter.

Of course the first question to be answered was, Has a crime been committed?

An answer to this question demanded first of all a determination of the cause of death.

Fortunately there were not a variety of hypotheses, neither was there allegation of "a cause to the jury unknown." There were but two theories, arsenic poisoning and drowning.

The State introduced not only testimony to show the presence of the drug in the body, and that it was the cause of death, but also testimony to prove that the death did not result from drowning, which from the place of finding the body was *a priori* the cause.

The testimony was peculiar in some respects, for witnesses were allowed to testify to both matters of fact and opinion, although there was nothing to indicate that their opinions were of value by reason of education or experience. Thus the clamdigger, Asa Curtis, and Marsden, manufacturer of electric machines, recorded opinions on drowning alongside the opinions of medical witnesses.

Asa Curtis found the body floating on its face, hips upward, a fact that went far to convince him that Jennie was not drowned. The water was as deep as his

¹ Read before the Section for Clinical Medicine, Pathology, and Hygiene of the Suffolk District Medical Society, February 14, 1883.

knees. He turned the body over and brought it ashore and laid it on the beach. When he turned the body over the jaw fell down. The condition of the body is described as "limp," or chiefly flexible. The hands were open and not clinched. The mouth and eyes were closed. The face was a "little reddish." There was no froth about the nose and mouth, "no water ran from the mouth," but a "bloody fluid" did run from both nose and mouth. The lips presented a fish-eaten appearance. There was no cutis anserina. (It may as well be remarked here that the body was not stripped at the beach, and whether cutis anserina was present on the anterior part of thighs, where it is usually found, could hardly be determined by an inspection of the hands and face.) The hands presented a water-soaked appearance, — so much for the external appearances, — and from these the non-medical opinion was formed, that death did not result from drowning, though whether this opinion was expressed till after further developments I have been unable to learn.

The autopsy was made by Dr. E. M. Prudden. How far it was really careful and accurate I cannot say, but in the reports at my disposal there is a serious deficiency of statement in regard to matters which would have been of much service in determining the cause of death.

The results of the autopsy are substantially as follows : —

Some stiffness (locality not stated). *The face of a dusky red color.* Decomposition had set in. No water in the lungs, none in the stomach. There was an overloading of the vessels of the membranes of the brain. All other organs normal and healthy, excepting one of the ovaries which presented a cyst. The stomach contained some fluid matter in which were fragments of fat and lean meat, *mushrooms*, and *whortleberries*. In the gullet were grains of sand. In the trachea as many as a hundred grains of sand, and also frothy mucus. In each pleural cavity a quantity described as "less than half a pint" of reddish fluid. No signs of any inflammation anywhere. No indications of any vomiting nor any purging. The lungs were well inflated but not congested, and the heart contained little blood, chiefly in left side. *There were no marks of violence externally.* The contents of the stomach, the lips, and the genital organs, were examined microscopically, but there is no report of any microscopic examination of the liver and kidneys, a pretty serious matter in a case of alleged arsenic poisoning. It must be admitted that from the above record are wanting many of the signs of death by drowning, or rather of death by asphyxia. The witnesses seem quite to have lost sight of the fact that asphyxia is by no means the only cause of death in drowning cases.

Medico-legal writers are substantially agreed that in death by submersion the cause may be either asphyxia, coma, or their combination comato-asphyxia, or by neuro-paralysis (syncope). In the appearances found in the Cramer case there is nothing to contradict the theory of coma, or coma with a certain amount of asphyxia. The question is, was the cause of this coma or comato-asphyxia submersion or some other remote cause.

The position in which the body was found floating was urged against the theory of drowning. Common sense ought to show that a body floating in tide-water, especially if rolled up on a very gently sloping beach by an in-coming tide, can furnish by its position no evidence as to the cause of death.

Two winters ago a man was seen to drown at Craigie's bridge in Boston, and when his body was found some time later it was floating face downward and hips out of water, exactly like the body of Jennie Cramer. The condition of the hands, eyes, and mouth, in the matter of their being open or closed, counts for nothing, as their appearance has varied in different cases.

It is true that cutis anserina is generally present in cases of death by drowning, but by no means invariably.¹ When present it may be confined to the front of the thighs or the flanks, and it may quickly pass away, especially with the advance of putrefaction.

That cutis anserina should not be manifest three days after death, or, as in this case is more probable, four days after death, when putrefaction had proceeded as it would naturally in the month of August, is not remarkable, and the report that none was found on autopsy should not militate against a theory of drowning. As to the examination at the time of the finding of the body, there is no evidence to show that goose-flesh was looked for where it is usually found, and we certainly have no evidence that it really was not present.

Froth at nose and mouth is often observed in drowning cases, but its discovery depends upon the amount of struggle that has taken place during the drowning and the early recovery and inspection of the cadaver. Its absence in this case proves nothing. Indeed if death had occurred, as is probable in this case, two days before the finding of the body which had been lying in shallow water in the first week in August, and if death had occurred from coma, with little if any struggle, the presence of froth would be more remarkable than its absence.

There was, however, a flow of bloody fluid from nose and mouth. This is an almost constant appearance in drowned bodies that come to the surface after a short submersion in the water in the summer, the fluid consisting partly of inspired water, and partly of the contents of the vessels overloaded by congestion, and this transudation has its further effect in masking, to a certain extent, the amount of congestion present ante-mortem.

The water-soaked hands and feet speak only for the length of time the body has remained in the water, and the appearance can be as readily produced in the bodies of those dying from any other cause as in the drowned.

It is a condition, however, more likely to be produced in thirty-six hours than in four or five. Some indication as to the length of time that had elapsed between death and the discovery of the body is afforded by the rigidity. "The jaw fell open," "the body was chiefly flexible," "some stiffness was present." Rigidity begins at the jaw, and it begins to pass away at the same place. Therefore, rigidity in this case had in all probability come on and to a great extent passed away. In a girl previously healthy a period of from twenty-four to thirty-six hours is not too long to allow for this occurrence where death was the result of violence. Certainly five hours is too short a time, and this must have been about the limit on the theory of the prosecution. Water is said to have been absent from the lungs. In this connection must be borne in mind the handling of the body, the position in which it was floating, the fact that a bloody fluid ran from nose and mouth, and also the fact that about half a pint of bloody fluid was found in each (healthy) chest cavity. It is true that

¹ Vide Casper Case, 293, et seq.

fluid is frequently found in the cavities of the body as the result of decomposition, but it is also recognized¹ that absence of water from the lungs in the bodies of the drowned is due to the transudation of the water in the air cells into the pleural cavities. Moreover, if the fluid in this case is to be attributed to decomposition, why is its presence reported in the pleural cavities alone? It should also have been found in the abdomen. If it be replied that decomposition had made greater progress in the lungs and upper part of the body the case for drowning is still further strengthened, for the progress of decomposition in cases other than those of drowning is the reverse of this.

There were particles of sand in the trachea. In a case of drowning this would be a thing natural and to be expected as a result of its inspiration during the death struggle. The State claimed that it washed in after death. If so, where is the water that washed it in? The report says no water; but dry sand did not tumble into the windpipe through a closed mouth.

The same remarks apply with greater force to the gullet. Here also the State claimed that the presence of a hundred grains of sand was not due to the natural process of swallowing, but to its being washed in. This in shallow water, with a closed mouth, and with only a few hours' submersion. It is one of the rarest things possible for sand to be washed into the œsophagus, the walls of which lie closely applied to each other, and it requires for the production of such result long immersion, great columnar pressure, at least an open mouth. Again, where is the water that came in with the sand? If sand was washed into the œsophagus there must have been free access to the stomach of a considerable quantity of water, yet the report says "no water in the stomach." Exactly how it could be determined that in the liquid contents of the stomach there was no water is not quite easy to understand. The probabilities certainly seem to be that the sand in both places came there in consequence of vital action, and, moreover, that there really was water to some amount in both stomach and lungs. The face, when removed from the water, was only "reddish," but on the following Monday it had changed to a dusky red; that is, decomposition had progressed in the *upper* parts of the body, a point to which allusion has already been made.

The place where the body was found was about midway between the end of Kelsey's pier and the shore on a diagonal line, and was found after a wind and tide which set in from the pier to shore in the same direction. This Kelsey's pier extends 1800 feet out into the water unprotected for long distances where the landings for steamboats are. The pier is very high, the bottom of the sea a hard sand rolled into almost a solid floor by the action of the tide.

A person who fell from this pier when the tide was low and striking on the head would be so stunned as probably to make little struggle and not rise to the surface at the time.

To recapitulate — the evidence in favor of death by drowning is: —

- (1.) The place where the body was found — a priori.
- (2.) The congestion of head and face.
- (3.) The flow of bloody fluid from nose and mouth.
- (4.) The progress of decomposition from above downward.
- (5.) Presence of sand in the trachea.

¹ Ogston, page 511.

(6.) Presence of sand in the œsophagus.

(7.) The quantity of fluid in the pleural cavities, none being present in abdomen, and following from the above, a fair presumption of the presence of water in both lungs and stomach at time of finding the body, even allowing that the mucous froth found in the trachea at autopsy was simply a decay product.

(8.) A congestion of the cerebral vessels and a general internal condition not inconsistent with death from comato-asphyxia.

On the other hand we have

(1.) Absence of signs of death from asphyxia pure and simple.

(2.) A not clearly proven absence of cutis anserina at time of the finding of the body.

(3.) A possible absence of water internally at time of autopsy.

Taking the picture as a whole, and bearing in mind that it is rare to get all the appearances of death by drowning in any one case, I think it may be fairly claimed that in the absence of any other cause for death Jennie Cramer died from the effects of submersion.

The State, however, claimed to have found another cause.

The purely chemical part of the case I pass by, as it is to be reviewed by a gentleman of far greater ability than myself. Certain features, however, come within the province of the physician, and of these I propose to speak.

The chemist, Dr. Chittenden, who made the examination in this case, claimed that there must have been a little over three grains of white oxide of arsenic in the body.

The method by which this result was obtained is worth consideration.

Dr. Prudden testified that he gave to Dr. Chittenden *about* two thirds of the liver, *about* two thirds of the lungs, *about* one third of the brain, etc. That he did not weigh the organs or parts but estimated the amounts by the eye. These "abouts" are a matter of considerable importance when multiplication in four decimals leads to the estimate of so small an amount in the whole body.

Not criticising the fact that Marsh's test was used, now I believe regarded as quite unreliable for quantitative analysis, let us look at the results reported.

In Stomach and œsophagus	.158
Liver	.109
Intestines	.314
Kidney	.029
Heart	.028
Lung and spleen	.1146
Brain	.0255
Trachea and tongue and larynx	.08
Diaphragm	.01
	<hr/>
	.8691

This was from the "abouts," but considering them as exact fractions, the chemist estimates that in the whole of these organs there must have been 1.1694 grain.

He examined various muscles and one bone, and finds in the bone none. In the various muscles examined he finds .852 of a grain, and estimates that if 22 pounds, 46½ ounces, including the bone, which was free from arsenic, contained the above amount, the whole body, 57 pounds, must contain 1.9498 grains, and this with that found in the organs makes a total of 3.1192 grains. But of this amount .472 grain was found in stomach and œsophagus. If this was there

unabsorbed it is clear that it must not be counted in its effect on life, for it is only the absorbed arsenic that does the killing. If this amount be subtracted there is left, even by this method of estimating, only 2.64 grains for the whole body, an amount but little larger than the smallest fatal dose on record.

It has been the habit of writers and experts to put the fatal dose of arsenic at two grains, but when we review the recorded cases we find only two cases of adults fatally poisoned by so small an amount, and one patient survived thirty-six hours, and the other five days, so the element of time becomes of importance in this case of Jennie Cramer. At all events she had about the smallest dose, even by estimate, ever known to be fatal.

How do the appearances at the autopsy support the arsenic theory? If there seemed a lack of complete evidence as to death by drowning, what shall be said of evidence of an irritant poison?

Every internal organ normal and healthy; not a trace of inflammation of the stomach, intestines, or rectum.

There could have been no vomiting or purging; as there was no water in the stomach, of course no excessive thirst. Whether there was a microscopical examination of the liver, kidneys, and heart I am not informed by the testimony. Certainly there is no mention of a condition which I believe to be inseparable from fatal arsenic poisoning, namely, fatty degeneration of the liver and kidneys. In short, there is not a single sign of the action of arsenic in this girl's body. So we have not only about the smallest fatal dose known, but also one that did its work without leaving a sign.

The government claimed that Jennie Cramer died of collapse without time for inflammation, and that, too, as the result of so small a dose. There certainly is nothing in the literature of arsenic poisoning like this, that I have seen. Moreover, the arsenic must have been taken under conditions unfavorable for rapid absorption, that is, with a full stomach.

Let us consider the matter of time.

It will be remembered that at ten o'clock in the morning she ate a porter-house steak and mushrooms. At the autopsy mushrooms and meat were found in the stomach. The State had in its employ detectives from the most celebrated corps in the United States. They could not obtain the slightest evidence that Jennie ever had another meal of mushrooms after Thursday morning. Had she done so it could have been easily ascertained, for the eating-houses were very thoroughly investigated. Admitting that mushrooms are somewhat difficult to digest, is it reasonable to suppose they would have remained in the stomach from Thursday morning till Friday night, a period of thirty-six hours? Would they not have been, by this time, digested, or have passed undigested, in one direction or the other, from the stomach, especially with the assistance of an irritant poison? Yet there they were. Government witnesses swore to Jennie's taking a hearty supper of chops, milk, etc., on Thursday night. Is it credible that an evening meal should be digested and assimilated, leaving the morning meal in the same stomach undisturbed? The witnesses were mistaken as to Thursday night. Indeed, the medical facts point to the girl's having died on Thursday night. For Thursday night speak the mushrooms, the water-soaked hands, the floating of the body on Saturday. The

body, being heavier than the water, would sink until the gases of decomposition caused it to float. In the summer, and in shallow water, twenty-four hours is enough to produce this result. For Thursday night speaks the rigidity of the body when found; that is, the limitations of the rigidity. If death occurred from drowning on Thursday night the absence of certain signs, the froth, for instance, is the easier to understand. To be sure certain witnesses swore to seeing Jennie alive on Friday, but this evidence was flatly contradicted, and a very good case of mistaken identity was established. None of the witnesses who swore to her presence at Savin Rock on Friday night had ever seen her, and only identified her from a photograph, a most uncertain and dangerous procedure. But for the government theory it was absolutely necessary that Jennie should have been alive on Friday night. Assume the testimony of the State witnesses to be correct, what must have been the case from a medical point of view?

James Malley and Jennie are at Savin Rock at 10.40 P. M. Friday, Walter and Blanche having left. At that hour Jennie, aside from saying she was "paralyzed," was apparently well and happy. The government claimed that she died of sudden collapse, so after that hour James must have administered the dose, graduating it so that it should be at the limit of the smallest fatal dose on record, a most unlikely thing for a murderer.

It is hardly fair to suppose that she fell dead at his feet on swallowing the draught. The shortest time on record, and from a very large dose, if I am not mistaken, is from two to three hours, and from the small dose at least five hours. So life could not have been extinct before two to three A. M. At this hour it was dead low tide, and we have to suppose that James carried the body out on to the beach alone and unaided, and that there, at night, on the sea-shore, with the body part of the time in water, rigor mortis came on, and largely passed away, putrefaction set in, sand washed into the air and food passages, the hands became water-soaked, and the face congested, all in two hours, and this after death from collapse from the smallest dose, and in the shortest time on record. It is manifestly absurd. Moreover, there is no reliable and uncontroverted testimony that Jennie was ever seen alive after Thursday night.

Some stress was laid on the localization of the arsenic as bearing upon the form administered, that is, that it was given in a soluble form, and the experiments of Scolossuboff were quoted to sustain the theory; but these experiments were shown by Ludwig to be insufficient and their results misleading, and he proved that, as had been supposed, the liver and not the brain was the great store-house of arsenic in whatever form it be taken.

One other portion of the medical testimony is worthy of comment. A motive for the murder was necessary. The story of Wednesday night's doings was known, and a theory of rape was formed.

The body was examined by two physicians, one of whom had been many years in practice, and the other had not practiced for twelve years. This examination was made in a cellar lighted only by a basement window. By examination with their eyes in such light and by "manipulation" (presumably digital examination) they were enabled to form and swear to an opinion that Jennie had been ravished within sixty hours of her death. (This would carry it back to Wednesday

night.) It will be remembered that no external marks of violence were found.

That the hymen of this unfortunate girl who was in the habit of staying out till two and three in the morning with James Malley, or who may have met any sort of an accident not necessarily implying a loss of virtue, even if she did pass a night at his house, may not have been entirely perfect is quite probable, but in view of the fact that the girl without any other sign of violence left the house of her alleged assailant the very morning after the alleged accomplishment of his hellish designs waving and kissing her hand to him and was able directly afterward to eat a hearty meal of steak and mushrooms, there seems to be a sort of moral presumption that she was not very much maltreated. Surely an opinion that the hymen had been forcibly ruptured during a felonious assault within sixty hours of her death must come from those who have greater experience with recently ruptured hymens than falls to the lot of the average practitioner.

There is little to throw light on the remote cause of death. Whether it was a suicidal leap taken in the dark of Thursday night after a day's reflection on her mother's rebuke and her outlook for the future, or whether wandering out upon the pier in the evening a misstep plunged her down where, stunned, a brief and trifling struggle ended her existence, is something which may never be known till after the bugle call of the angel of the Apocalypse, but this case seems to me to illustrate the danger and folly of looking too strongly at individual points, giving undue weight to the presence or absence of by no means constant appearances, instead of viewing the picture as a whole and arriving at a conclusion based upon the more reasonable probabilities.

The lives of two young men and of a young woman of more or less value to the community, certainly with possibilities of good in them, were jeopardized, State and individuals put to very great expense, and the public mind inflamed all because there was not sufficient care taken in deciding the primary question whether a crime had really been committed or not.

ON THE EXISTENCE OF SYPHILIS IN AMERICA BEFORE THE DISCOVERY BY COLUMBUS.¹

BY WILLIAM F. WHITNEY, M. D.

MUCH has been written to show that syphilis existed upon this continent previous to the coming of the Europeans. The early historians affirm that the aborigines suffered greatly from this malady, while the Indian traditions speak of it as the "white man's disease." This conflict of historical evidence can only be decided by the record which has been left upon the bones of the people themselves. But when employing this record there are two fundamental questions which must be answered in every case. First, are the bones those of Indians who died before the white man first visited these shores? and secondly, if there are lesions present, are they such as could only be caused by syphilis and nothing else?

The first belongs rather to the province of the archaeologist, but his evidence must be such as can be readily accepted, and the authenticity of the specimen proved

¹ A portion of a paper read before the Boston Society for Medical Improvement, March 26, 1883.

beyond doubt. It is for the pathologist then to determine the nature of the lesion. But a certain amount of special training must also be had in the appearances produced by the action of the soil and the roots of plants, which simulate quite closely the changes resulting from some of the pathological processes, especially those of a destructive character. And these latter, when present, are moreover very quickly effaced by the action above mentioned. Such being the case, any proof which rests upon ulcerative effects of syphilis must be received with the greatest caution, and as far as is known none has been presented as yet.

A new production of bony tissue could never have been produced after death, and it is to such lesions that attention has been chiefly directed. But every deposit of bone is not the result of syphilis, and especially is this true of the more or less nodular enlargements of the tibia, which have been brought forward as positive proof. This bone, from its position and subcutaneous situation, is more exposed to insult than any other in the body. And this must have notably been the case among the savage tribes inhabiting the forests and mountains, and the accidental blows which were received from logs or rocks are a sufficient cause to excite an ossifying periostitis or osteitis.

The Peabody Museum of Archaeology at Cambridge contains many striking illustrations of enlargements along the face or crest of the tibia of Indians of unquestioned antiquity. But taken by themselves they do not require any specific exciting cause beyond an ordinary injury. And those which are in the Army Medical Museum at Washington are capable of being explained in the same way.

In order to prove that these lesions are due to syphilis a skeleton must be found that presents such processes not upon a single bone, but upon the bones of the upper as well as the lower part of the body. Such examples are always to be seen in all large modern anatomical collections. There is a very fine example in the Museum at Washington in the skeleton of a woman (No. 6414) who had been a camp follower, the bones of which, near the articular ends, are affected in an unmistakable manner. Should such a skeleton as this be found in a mound of undoubted antiquity, there would be no question of the existence of the disease in ancient times.

But whole skeletons are found very infrequently in the old burial places, the long bones decaying, as a rule, much earlier than the skull. It is remarkable, therefore, that more attention has not been paid to searching for marks of syphilis on the cranial bones, since there is one form which is quite characteristic. This has received the name of *caries sicca*, and was first fully described by Virchow.² As is indicated by the name, it is a form of destruction of the bone without suppuration, and what is of greater value in the present case is the fact that such centres are usually accompanied by an induration about them. The cicatrices resulting from this are often very superficial, have a tendency to assume an irregular shape, and are surrounded by a slightly thickened zone of dense bone. The edges are very sloping, and the whole surface looks as if a thin glaze of bone had been spread over it. When the process is extensive, the diploë is replaced by compact bony tissue. A thin layer of new bone may be present upon the surface of the internal table. A marked example of this manifestation is

² Virchow's Archiv, vol. xv., p. 243.