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CHANGES IN COLOR OF HAIR AND FEATHERS.

THE question of change of color of the hair is an interesting one both from a physiological point of view and from the practical one of pathology. The physiological aspect embraces the question of how a change of color takes place, —whether in existing hairs, or produced by shedding of the hair and a new growth taking its place of a different color.

It has been doubted by good authority (Hebra and Kaposi) if the hair, after being once developed, can change except by a very gradual process. This doubt is based upon the theory that the hair has no vascular or nerve connection with the general system, and must therefore be independent of nervous or systemic influence. This position is, however, not tenable. The clinical evidence is positive that the hair does change color under systemic influences, sometimes gradually, and sometimes suddenly. We hear frequently of the hair turning white in a night from violent emotions, as fright, great grief, or great joy; and it has come to be a method of expressing extreme emotion to say, "It was enough to turn one's hair white." I say it is not an uncommon thing to see mention of such cases in popular literature, but well-authenticated cases are not so often found. It is recorded in history that the hair of Marie Antoinette and Mary Queen of Scots became white suddenly from the horrors to which they were subjected. Poets have not failed to avail themselves of the idea. Byron, in the "Prisoner of Chillon," says,—

> "My hair is gray, but not with years;
> Nor grew it white
> In a single night,
> As men's have grown from sudden fears."

A short time since, in conversation with an eminent microscopist and pathologist,[1] I asked how he would explain from the basis of minute anatomy the sudden change in color of the hair. He replied that he did not explain it; that he did not believe it happened; that the reported cases were not authenticated. He further said, that, from the structure of the hair and its relation to the skin, he considered it impossible.

Duhring (third edition) is authority for the statement that Hebra and Kaposi discredit sudden canities. There is nevertheless no doubt of the fact that such change does sometimes occur; and, to set the matter definitely at rest, I looked up the subject in the Library of the Surgeon-General's Office. The following are some of the references found:—

Dr. William P. Dewees[2] reports a case of puerperal convulsions under his care. From 10 A M. to 4 P.M. fifty ounces of blood were taken. Between the time of Dr. Dewees's visits, not more than an hour, the hair anterior to the coronal suture turned white. The next day it was less light, and in four or five days was nearly its natural color. He also mentions two cases of sudden blanching from fright.

Dr. Robert Fowler[1] reports the case of a girl sixteen years of age, apparently in good health, hair black, who found one morning in combing her hair that a strip the whole length of the back hair was white, starting from a surface about two inches square around the occipital protuberance. Two weeks later she had patches of *Ephelis* over the whole body.

In the *Canada Journal of Medical Science*, 1882, p. 113, is reported a case of sudden canities due to business worry. The microscope showed a great many air-vesicles both in the medullary substance and between the medullary and cortical substance.

Dr. Graves[2] says most authors are of the opinion that the hair, once formed, is independent of the organism, with which opinion he disagrees, instancing *Plica polonica* as opposed to such a theory. He gives the following cases:—

1. A British officer in India, forty-eight years old, fell into bad health, and became prematurely gray. He returned to England, regained his health, and in four years his hair returned to its original brown.

2. In a man sixty-seven years of age, hair white, chest covered with long white hair, the chest was blistered; and when hair grew out over the blistered surface, it was black.

3. In a man, aged thirty-five, bald, a small blister the size of a crown piece was applied to vertex for congestion of the brain. Growth of hair followed over the blistered surface.

4. A lady, hair of vertex gray and very scanty, applied tar-water. Hair grew, and was of natural color.

5. The same occurred in another case after application of citrine ointment.

In the *Boston Medical and Surgical Journal*, 1851, is reported a case of a man thirty years old whose hair was scared white in a day by a grisly bear. He was sick in a mining camp, was left alone, and fell asleep. On waking, he found a grisly bear standing over him.

A second case is that of a man of twenty-three years who was gambling in California. He placed his entire savings of eleven hundred dollars on the turn of a card. He was under tremendous nervous excitement while the cards were being dealt. He won. The next day his hair was perfectly white.

[1] Dr. Gray of the Army Medical Museum.
[2] Philadelphia Medical Museum, 1807, vol. iii. p. 219.

[1] London Lancet, 1853, p. 556.
[2] Dublin Quarterly Journal of Medical Science, 1847.

In the same article is the statement that the jet-black hair of the Pacific Islanders does not turn gray gradually; but when it does turn, it is sudden, usually the result of fright or sudden emotions.

The following cases are of change of color from white to black:—

Dr. Bruley,[1] physician to the Fontainebleau, reported to the Society Médicale, Paris, in 1798, the case of a woman sixty years old, whose hair, naturally white and transparent as glass, became jet-black four days before her death (phthisis). On examination after death, the bulbs of the black hairs were of immense size and engorged with dark pigment. The roots of white hairs that remained were dried up, and two-thirds smaller in size.[2]

Dr. Alanson Abbe[2] mentions the case of Dr. Capen, who had become gray, but, on recovery from disease, his hair became quite dark.

In the *St. Louis Medical and Surgical Journal*, 1845, p. 310, there is reported the case of an old man eighty-one years of age, robust and hale. His hair, from being perfectly white, became black, and the same of the beard. This man also presented the phenomena of second sight. He could read readily without glasses. The text-books on skin-diseases also mention cases. Several cases of sudden canities are referred to in Ziemssen.

Brown-Séquard, in his own person, noticed one day a white hair in his beard where there was none the day previous. He pulled it out, and the next day others appeared. This was observed repeatedly, and there was no doubt the hair in its entire length turned white in one night. Under the microscope these white hairs showed small air-bubbles in place of the normal pigment. In a case of hemiplegia the hair became white on the paralyzed side. The same has been reported in cases of neuralgia. Other anomalous cases have been noted where the hair became white in patches, and where individual hairs have been seen alternately white and black at different stages of its growth, to which condition Karsh and Landois have given the name of "ringed hair," and ascribed it to an intermittent trophic disease affecting the hair-follicle. Wilson[3] mentions a case where the hair was gray in winter, and regained its normal color in summer.

Alibert[3] and Beizel relate cases of women with blond hair which all came out after severe fever, and when new hair grew it was black. Alibert also relates the case of a young man who lost brown hair during illness, and that which replaced it was red. In the case of an epileptic girl of idiotic type, with alternating phases of stupidity and excitement, during the stage of stupidity the hair was blond, during excitement it was red. This change of color took place in two or three days, the change always beginning at the ends of the hairs. Pale hairs showed an increased number of air-spaces. It has been frequently observed, that, when the hair changes color gradually, the change begins in the end, and extends toward the bulb. In conversation with an eminent ornithologist on the change of color in the plumage of birds, he said, "I have lately been watching hairs in my mustache turn gray, and they always begin at the ends, and it extends to the roots."

[1] Boston Medical and Surgical Journal, 1852, p. 406.
[2] Wilson, Skin Diseases, p. 377.
[3] Drocker, Diseases of the Skin, 1888.

Speaking on the subject with a lady, she mentioned the case of the physician who attended her at the seashore last summer. The doctor's hair was long and quite gray. One day he came in to see her after having his hair cut, and she was surprised to notice that the gray hair had given place to black. Examination showed that his hair towards the ends had been white, and that nearer the skin black. The white portion had been removed by the cutting.

The cases here collected are only a few in comparison to what might be found; but they are sufficient to prove beyond all reasonable doubt that the hair does suddenly change color under certain circumstances, and that the change takes place in existing hairs.

Analogous to changes in the color of the hair in man are the changes which occur in the lower animals. In animals and birds such changes are often periodical, as in their summer and winter coats. This occurs to a very marked degree in a great many species. Thus the ermine in summer is dark brown, in winter is pure white. Among birds the ptarmigan is white in winter, and brown in summer. So with our familiar bobolink, yellow in fall, in spring black and buff. As to the question whether, in birds and animals, this change takes place in individual feathers and hairs, or whether all the old plumage and fur is shed by moulting, recent investigations favor the view that it is due to both. Dr. Elliott Coues[1] says it may be either or both. Mr. Robert Ridgway (Smithsonian Institution) inclines to the opinion that in birds it is accomplished by moulting. Dr. Louis Stejneger (Smithsonian Institution) was formerly of the same opinion, but recent studies have inclined him to the belief that there is also a change in the color of existing feathers. He was led to this change of belief by a critical study of the changes in color of the black and white fly-catcher of Europe, and especially from an examination of a series of twenty-seven specimens of the narcissus fly-catcher (*Xanthophygalia narcissina*) of Japan. His studies in full will appear in the "Proceedings of the United States National Museum, 1889." Dr. C. Hart Merriam, ornithologist of the Agricultural Department, in a letter dated June 12, 1889, says, "The change from fall to spring plumage in birds is due to moult—without exception, as far as I am aware. In the case of mammals the matter is now in dispute. Probably in the majority of cases it is due in part to moult, and in part to actual change in the color of existing hairs. . . . The change in color from immaturity to maturity is always due to the growth of new hairs or feathers."

That the change in birds and mammals is due in part, at least, to change of existing coats, seems established. Sometimes this change is almost sudden, as where the change of season is very abrupt. In such case, of course, there would not be time for the growth of new hair or plumage.

In the golden plover (*Charadrius dominicus*) the black belly of summer changes to white in winter. While this change is taking place, individual feathers, part black and part white, may be seen. In Bonaparte's gull, a common gull of our coast (*Larus Philadelphia*), the black of the head of summer changes to white in winter, principally by change in color of existing feathers.

Another interesting feature of this question, as bearing on the change in the color of the hair by drugs, is the influence

[1] Fur-Bearing Animals.

of certain substances administered as food, in changing the color of tissues in some of the lower orders. In orange canaries it has come to be an established fact, that, by feeding the parent bird with a certain kind of food the active ingredient of which is cayenne pepper, the offspring will be of an orange color; and orange-colored canaries may be seen in the stores of most bird-fanciers. A food for producing orange canaries is extensively advertised by a bird-dealer in Baltimore (Bishop). It is reported that the Indians of the Amazon cause green parrots to change to yellow and red by feeding them upon the fat of a certain fish allied to the shad.[1] Dr. Merriam, in the letter previously quoted, says, "It is well known that food affects the color in birds. Red purple finches and pine grossbeaks invariably turn yellow when caged. This is due undoubtedly to the absence of some important food-element. In some of the zoölogical gardens of Europe it is the custom to send white spoonbills and flamingoes to Amsterdam Garden to be recolored. The particular food by which Mr. Westermann accomplishes this end is a secret, but it is believed to be a kind of shrimp or small crustacean which has a quantity of red pigment in its shell."

In the same direction are the changes of color in other tissues by particular foods. It has long been known that when pigs are fed on madder their bones become red. This fact has been taken advantage of by physiologists in studying the structure and development of bone. The phosphate of lime acts on the coloring matter of madder as a mordant. When given intermittently to a growing animal, the bone presents alternate rings of red and white.[2]

Darwin[3] mentions that pigs in Virginia eat the paint-root (*Lachnanthes tinctoria*), and their bones are colored pink, and it caused the hoofs of all but the black varieties to drop off. "From facts collected by Heusinger it appears that white sheep and pigs are injured by certain plants, whilst dark-colored individuals escaped. . . . On asking some farmers in Virginia how it was that all their pigs were black, he was informed that the black members of a litter were selected for raising, as they only had a chance of living."

Fleurens (1824) made use of madder for coloring the semicircular canals of pigeons, to outline the canals more distinctly (see also Ferrier on "Functions of the Brain," and the writings of Vulpin, the French physiologist). Mr. Lucas, osteologist of the National Museum, informs me that the bones of the crow are made purple by feeding on pokeberries. Ridgway says the bones of the Western fox-squirrel are red, while those of its Eastern brother are white. No cause has been assigned for the difference. See experiments by Marci Paolini in 1841 ("Specimen quorundam experimentorum de vi Rubiae ad ossa ovorumque Gallinarium putamina calcariæ coloranda," No. 1 of Miscellanii Medichi, Pamphlet Vol. 1149). He gives a very good plate of the colored skeleton of a fowl, and also of its colored egg after four months feeding *Rubia tinctorium*. He also gives references to other authorities, the most satisfactory of which is Belchior ("Philosophical Transactions," vol. ix., 1732–44), who gives an account of feeding hogs and fowls with madder-root and wheat-meal. A rooster so fed died in sixteen days, and showed the condition admirably. Other writers take up the subject after him in the same publication.

[1] Wallace's Amazon.

[2] Todd's Cyclopædia of Anatomy and Physiology, vol. iii. p. 853.

[3] Origin of Species, p. 9.

It is reported that among workers in cobalt and indigo the hair becomes blue; also, in artisans working with copper, the hair takes a greenish hue.

The color of butterflies can be changed according to the food upon which the caterpillars are fed. More remarkable still, perhaps, is the change of color in the chameleon and in many insects, according to the color of the substance with which they are in contact.

The environment undoubtedly has a powerful influence upon the coloring of animals and birds. This is clearly illustrated in every museum of natural history. Specimens from arid desert regions are uniformly of a dull appearance, compared with those from regions of luxuriant foliage.

M. G. Pouchet,[1] in his work "Mechanism of Change of Color in Fishes and Crustaceans," says that change of color in fishes is due to the size of contractile colored cells placed in the skin. These are under the influence of the nerves. The author found that the particular nerves controlling them (in the turbot) were nerves of the sympathetic system. By cutting the nerve supplying a particular area of the skin, he had been able to retain that area unchanged in color, while the rest changed as the fish found itself on a dark or light surface. That the eye is the means by which this change in its condition is communicated to the fish or crustacean, and that then reflex action takes place through the sympathetic nerves on the color-cells of the chromatophors, is proved by the fact, that, when the animal experimented on is blinded, no further change of color occurs when it is removed from light to dark or the opposite (see also *Monthly Microscopical Journal*, 1871, vol. vi., M. G. Pouchet on "Study of Connection of Nerves and Chromoblasts," principally in fishes and batrachians).

The reasons assigned by naturalists for periodical change in color of plumage or fur are twofold: (1) sexual selection; (2) as a protection against enemies.

1. Sexual selection. The male takes on a brighter and more attractive appearance to facilitate the business of courtship and the securing of a mate.

2. As a protection against enemies. In Arctic regions birds and mammals are usually white in winter, the color of the snow; so that they are with more difficulty found by their enemies. Darwin supposes that originally only a few individuals took on this change; and, these being better protected, gradually, by a process of natural selection, only the white variety was left.

It is apparent, from what has been said, that there is very much concerning the changes of color of the hair and other appendages of the skin in man and the lower animals that is not understood. In its normal condition, the color of the hair is dependent upon the hair-bulb. It is here that the melanine is secreted from the coloring-matter of the blood; and from this point, as the hair grows, it permeates its cells, the intensity and shades, from black to blond, depending principally upon the amount of the coloring-matter. In black hair the hair-bulb is larger, contains a greater amount of melanine, and the hair itself is coarser and of more vigorous growth. In those cases where the hair has turned from white to back, and minute examination has been made, this has been found true.

[1] Transactions of the British Association for the Advancement of Science, 1872, p. 152.

In the case reported by Bruley, already referred to, of a woman aged sixty, whose hair, previously white, became jet-black four days before her death, the bulbs of the black hairs are described as being of immense size and engorged with dark pigment, while the roots of the white hairs that remained were dried up and two-thirds smaller in size. So, on the other hand, in change from dark to white, the hairis finer in texture, less vigorous in growth, and the hair-bulbs smaller.

The sudden change in canities, when due to violent emotions, can be explained in no other way than through the bulb. It is true that there is no direct vascular or nerve connection between the bulb and its hair after it emerges from the skin, but it is also undoubtedly true that there is communication by osmosis between the cells of the papilla and those of the shaft and different layers of the hair.

Wilson' ascribes the cause of sudden whitening of hair to insufficient nutritive power of the skin, and also suggests that there may generate a gaseous fluid in the hair in place of its normal constituents. He says, further, that the fluids from the blood-vessels of the skin permeate the hair, and thus change in fluids may alter the color.

In all of the cases of sudden change to white, where the hair has been examined, the coloring-matter has disappeared, and in its place is found an accumulation of minute air-globules. The same is true of gray hair of advancing age. How the air gets into the capillary structure has never been explained. Two possible explanations are offered: one is, that in the destruction of the coloring-matter a gaseous substance may be developed; the other is, that air may find entrance from without, through the sides or end of the hair. It is possible to suppose a condition of the bulb producing a vacuum in the hair-shaft that shall cause, by suction, a drawing-in of air. The view that the air finds entrance through the end of the hair is supported in the fact that the change of color begins at the extremity.

Erector pili muscle has an important influence on pathological changes which take place in the hair-bulb. This minute muscle has its origin in the true skin, and, passing downwards, is inserted into the base of the hair-bulb; so that when it contracts it lifts the hair outwards, and compresses its papilla. The effect of sudden fright causes the hair to "stand on end" by contracting this muscle. Temperature has its influence with animals and birds. In cold weather (winter) the change is to white; in summer, to black. Cold, we know, contracts the skin, and thus probably causes pressure on the hair-bulb. That the hair is easily influenced by external causes, as well as those which come through its bulb, is fully demonstrated. The mere fact that it can be so readily dyed and bleached artificially, shows that the agents used for this purpose penetrate its substance. Bleaching-agents, such as chlorine, peroxide of hydrogen, and strong alkalies, act by removing the coloring-matter, and not by adding any whiteness of their own.

It remains to say a few words upon the subject of changing the color of the hair by substances taken internally.

1. In the human subject the only agent, as far as I am aware, which has been charged with changing the color of the hair, when taken internally, is jaborandi.

2. Cayenne-pepper food changes the color of canary-birds to orange. This is a well-known fact to bird-fanciers. I tried in Washington to get a specimen, but was told it was not the season for them, that they came in the autumn; also that they soon relapsed to their original color unless the cayenne-pepper food was kept up.

3. The change of color in parrots by the Indians of the Amazon, from green to yellow or red, is produced by feeding the fat of a certain kind of fish (Wallace's Amazon).

4. The restoration of certain birds to their original brilliant colors at the Zoölogical Garden, Amsterdam, is the result of feeding a kind of shrimp or small crustacean.

5. As analogous to the above, is the effect of madder in staining the bones of pigs red, and of poke-berries coloring crows' bones purple.

It might be of interest to study the influence of diet and habit upon the color of hair in different nations of men; as, for instance, why the Saxons have light hair, and the Gauls black hair. It is within the bounds of possibility, also, that discoveries may be made in the future by which the color of the hair in the human race may be modified by judicious treatment of the parents.

Some colors of hair are not popular, especially with ladies, and it is not likely that cayenne pepper will ever become popular to produce the orange hue; but if its antithesis should be discovered, and the orange changed to black or blond, then perhaps the gentle maiden with auburn hair will disappear, and the white horse be left in melancholy solitude.

In the *Philadelphia Medical Times* of July 2, 1881, I published a case entitled "Remarkable Change in the Color of the Hair from Light Blond to Black in a Patient while under Treatment by Pilocarpin,—Report of a Case of Pyelo-Nephritis, with unusually Prolonged Anuria." This was a case of a lady twenty-five years of age, and the drug was used to relieve the uræmic symptoms resulting from the anuria, which latter was extreme. On Dec. 16, 1880, treatment of pilocarpin hydrochlorate hypodermically was commenced, the dose given being one centigram (one-sixth of a grain). The effect of this was very prompt; and the sweating and salivation produced, most profuse. The relief to the uræmic symptoms was complete, the patient falling into a quiet sleep as soon as the effect of the drug ceased, and sleeping all night, awakening in the morning bright and refreshed. The pilocarpin was thus used twenty-two times from Dec. 16, 1880, to Feb. 22, 1881, requiring thirty-five or forty centigrams. As the patient became accustomed to the medicine, it was found necessary to give two centigrams at a dose. After Feb. 22 she began to improve, and no more was required. All her life up to November, 1880, the hair was a light blond. Four specimens of the hair were sent to the editor of the *Philadelphia Medical Times*, with the report of the case, for his inspection, and were as follows: (1) November, 1879; (2) November, 1880 (on this and the preceding date the color was the same, a light blond, with tinge of yellow); (3) Jan. 12, 1881, a chestnut-brown; and (4) May 1, 1881, almost a pure black. The growth of hair was also more vigorous, and individual hairs thicker. I believed at the time, and still believe, that this change of color was caused by the pilocarpin. The lady is still, at this date (March 10, 1889), under my observation. Her hair is now dark brown, having returned to that color from black. The full report of this case can be found in the *Philadelphia Medical Times* for July 2, 1881.

The following case is reported as adding another to the evidence that jaborandi will produce the effect mentioned under favorable circumstances. Mrs. L., aged seventy-two years, was suffering from Bright's disease (contracted kidney). Her hair and eyebrows have been snow-white for twenty years. She suffered greatly from itching of the skin, due to the uræmia of the kidney-disease; skin harsh and dry. For this symptom fluid extract of jaborandi was prescribed, with the effect of relieving the itching. It was taken in doses of twenty or thirty drops several times a day, from October, 1886, to February, 1888. During the fall of 1887, it was noticed by the nurse that the eyebrows were growing darker, and that the hair of the head was darker in patches. These patches and the eyebrows continued to become darker, until at the time of her death they were quite black, the black tufts on the head presenting a very curious appearance among the silver-white hair surrounding them.

At the time the first of these cases was reported, the facts as stated were received with considerable incredulity, the editor of one well-known Western medical journal openly refusing them credit. Others preferred the charge that the lady had formerly bleached her hair, and that when this was no longer possible her hair returned to its original color. In reply to these "suggestions," I will only say that the facts are known to scores of people at her home in Washington, D.C., and are entirely beyond question.

As illustrating the ubiquity of the daily press, and the ease with which all sorts of nostrums, valueless or otherwise, may be brought into notice through the newspapers, and how easy it is to make such a matter profitable to the advertiser, I mention an incident in connection with the case just reported.

It seems that some enterprising newspaper-man became cognizant of the case, and put a short notice in a New York daily paper to the effect that a drug had been discovered that would turn white hair black, and make hair grow on bald heads, giving my name as being connected with the Smithsonian Institution. This paragraph must have been extensively copied in newspapers both throughout this country and abroad. The first intimation I had of its existence was an avalanche of letters from all parts of the country wanting information, some offering money for the receipt, others enclosing money in advance; which latter, be it known, I at once returned. One from London, England, enclosed the half of a two-dollar bill, with the information that the other half would be speedily forthcoming on receipt of the formula or medicine.

These are the only cases thus far reported in which pilocarpin has been supposed to change the color of the hair.

In 1879 Dr. G. Schmitz[1] of Cologne reported two cases in which pilocarpin stimulated the growth of the hair in alopecia. One patient, aged sixty, was completely bald. Pilocarpin was injected subcutaneously for disease of the eye. After three injections, within a fortnight the head became covered with a thick down, which grew rapidly, so that in four months no trace of the baldness was left. No mention is made of the color. In the second case the patient, aged thirty-four, had a bald patch on top of the head the size of a playing-card. There was total restoration of the hair after two injections, in a short time.

[1] Berliner Klinische Wochenschrift, No. 4, 1879; Medical Bulletin, Philadelphia, 1882.

Schöller[1] tells of similar results in animals in which alopecia had been produced by injections of bacteria.

Oscar Simon[2] relates the case of a woman, aged thirty, who had general baldness,—head, eyebrows, eyelashes. In a few weeks, after twenty injections of pilocarpin, the hair of the whole body was restored. In other cases so treated there was no effect whatever.

Landesberg[3] of Philadelphia says that in more than a hundred cases of eye-disease treated by pilocarpin he observed no effect whatever upon the growth of the hair. The dose and mode of administration are not mentioned.

In 1882 Julius Pohlman[4] experimented on white rabbits by hypodermic injections of pilocarpin. The dose used was large,—one grain three times a day. No change in color was noted in pure white rabbits. In party-colored animals, white and brown, in one a brown spot on the back of the head deepened, and spread to a remarkable degree down the back and sides of the animal to the legs. In other individuals no change was noticed. Post-mortems in these animals showed enlarged spleen and altered suprarenal capsules.

D. W. PRENTISS.

POISONING BY MUSSELS.

IN the *Lancet*, July 26, 1890, Sir Charles A. Cameron of Dublin says, "On June 30, Mrs. O'Connor, her five young children, and her maid-servant, residing at Seapoint, County Dublin, partook of a meal of stewed mussels. In about twenty minutes after the ingestion of the mussels, some of the children stated that they felt a prickly ('pins-and-needles') pain in their hands. Graver symptoms rapidly supervened, and in less than an hour one of the children died, the mother and three other children succumbing within two hours after eating the mussels. The chief symptoms were vomiting, dyspnœa, swelling of the face, want of co-ordination in movement, and spasms, principally in the arms. The patients appeared to have died asphyxiated, their faces being intensely livid. One of the children and the maid (the latter had eaten but few of the mussels) suffered very much, but recovered. Medical assistance came rather late, and was not of much use. The mussels had been procured from a small sheet of water to which the sea had access, but which received fresh water and some sewage. Examinations of the water at low and high tides showed that its saltness was twice as great when the tide was in,—a proof that land water drained into it when the tide was out. This land drainage would necessarily, from local conditions, be impure.

"It was deemed necessary for judicial purposes, that the cooked mussels, and the matters vomited by the patients, should be examined for ordinary poisons. This was done, with negative results. The uncooked mussels, compared with mussels of the same size from the open sea, appeared to have much larger livers, and their shells were very brittle. An attempt to extract an alkaloid was made. The generic tests applied, clearly proved the existence of a leucomaine, which, indeed, was obtained in crystals visible under the microscope, and corresponded to those described by Brieger as existing in the poisonous mussels which he examined. The quantity of material available did not, however, yield a sufficient quantity of the leucomaine for a thorough examination. I have procured a supply of mussels from the pond in which the poisonous mussels were found, and hope to be able to extract from them a substantial quantity of the leucomaine, which will probably be found identical with Brieger's mytilotoxine ($C_6H_{15}NO_2$). The mussels are mixed with mud having an offensive odor.

"The Seapoint case is another instance of poisonous mussels be-

[1] Klebs's Archiv, 1879.
[2] Berliner Klinische Wochenschrift, 1879.
[3] Medical Bulletin, Philadelphia, 1882.
[4] Buffalo Medical and Surgical Journal, 1882, p. 441.