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JOSEPH FRIEDERICH PIRINGER: HIS METHODS AND INVESTIGATIONS.*

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"Joseph Freiderich Piringer was born, March 31st, 1800, in Klein-Zell in Upper Austria. He studied medicine in Vienna; he afterwards turned his attention to ophthalmology in 1824. He was at first an assistant of Jaeger, then for three years of Rosas (beginning in 1825). He next obtained the extraordinary professorship of ophthalmology in the medical school at Gratz. Here he founded a much-needed eye hospital, an institution out of which the ophthalmic department of the Allgemeines Krankenhaus gradually developed through his energy. Here he held a high position and was active as a teacher until 1860. His clinical and experimental studies on blennorrhœa were made at this hospital. He wrote a work on blennorrhœa which was awarded a prize by the German Society of Physicians in St. Petersburg. Piringer has the merit of having shown that intentional infection of blennorrhœic secretion in pannus leads to clearing of the cornea. He founded a reputation upon this which extended far beyond the boundaries of Germany. He was for many years attached, as visiting physician, to the Elizabeth Hospital and to the City Asylum for the Aged, and published several other articles up to the time of his death, Sept. 22nd, 1879, including: Ueber Veratrinbehandlung des acuten Gelenk-Rheumatismus; Die Behandlung der Variola mittelst Iodtinctur; Die richtige Pflege der neugebornen und kleinen Kinder; Studien ueber die Mortalitäts-Statistik in Graz."†—(From Hirsch's Biographisches Lexikon, 1886, vol. IV, p. 575.)

Piringer's work on blennorrhœa‡ was awarded a prize, and the earlier works in ophthalmology refer to his studies, especially to his investigations in the treatment of pannus.§ Arlt

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*Read before the Johns Hopkins Hospital Historical Club.

† I am indebted to Professor Wm. H. Welch for having called my attention to this account of Piringer's life.

‡ Die Blennorrhoe am Menschenauge. Graz, 1841.

§ Oest. Med. Jahrb., 1838, and chapter 8 of the monograph.

presented by the author

devotes some space to a summary of the work on blennorrhœa.* But more recent works in ophthalmology make no mention of these important studies and their no less important results; in works on bacteriology I do not find his name, nor even in works on gonorrhœa, such as that of Finger. Piringer's work was of such importance that it does not deserve to be thus forgotten.

The absence of any other references in ophthalmic literature leads me to believe that Piringer's studies in ophthalmology were confined to the subject of inquiry contained in the work above mentioned. This is the more readily understood when we read in his preface "that his untiring efforts during fifteen years were given up to the solution of the natural laws governing blennorrhœas of the eye, as far as this lay in the limited powers of a single individual." We may aptly apply to Piringer the words, "therefore by their fruits ye shall know them." Judged by this standard, Piringer stands out boldly as one of the greater luminaries of medical science in the first half of this century.

In order to properly estimate the importance of his investigations it will be necessary to examine into the state of knowledge of the subject previous to 1840.

In 1780 a treatise on diseases of the eye appeared, written by George Chandler, surgeon, of London, in which he gives this account of "venereal ophthalmy." He divides it into two varieties, the translative and the symptomatic.

"The translative ophthalmy begins with a copious discharge of a sebaceous humor of a yellowish white color, and is known by the tumor, lividness, sharp and lancing pain of the sclerotica, the cornea at the same time being as it were depressed within a pit. It frequently follows soon after an injudicious stoppage of a gonorrhœa, the venereal virus being translated into the eye. It has also been observed that a gonorrhœa which before seemed incurable has, upon the coming on of this ophthalmy, suddenly vanished; and in like manner the ophthalmy has gone off upon the return of the gonorrhœa . . . The symptomatic remits towards morning, never turns into a chemosis, the morbid matter does not change place, the pains are milder, it is removed when the lues is cured, and is also attended with less danger."

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* Klin. Darstellung d. Krankheiten d. Auges. Vienna, 1881, pp. 35–37.

He admits that "sometimes a venereal ophthalmy has been produced by the immediate application of the virus to the eyes."

Concerning the treatment he tells us that—

"The venereal ophthalmy in general is subdued and its poison extinguished by mercury, but it should never be applied to the eyes. The patient should be bled and purged, and his eye washed continually with brandy and water, etc. It is necessary also to evacuate the virulent matter collected in the cellular texture of the sclerotica and eyelids by slight incisions of each membrane; an ichor, very like that of gonorrhœa, will be discharged."

This was the older view.

About the beginning of this century a remarkable development occurred in ophthalmology. Beer and Schmidt in Vienna, and Himly, Langenbeck, Graefe the elder, and others gave a new impetus to the scientific study of this branch of medicine. This was followed by the publication of a number of important treatises and monographs in ophthalmology, principally in Austria and Germany, but also in France, England and our own country. I shall pass these by and take up the subject as we find it in the third edition of one of the most important and valuable treatises on "Diseases of the Eye" written in the first half of this century, that of William Mackenzie of Glasgow. I take the third edition as it appeared in 1840, one year before Piringer's work. Here we find under the section of ophthalmia in new-born children, that "there is reason to suspect that this disease is not unfrequently an inoculation of the conjunctiva," etc., and "that therefore it may often be prevented by carefully washing the eyes of the infant with tepid water," etc.; secondly, "that the purulent ophthalmia of infants in its worst form is the result of the application of gonorrhœal matter, is generally admitted."

Concerning gonorrhœal ophthalmia he tells us that—

"Different views have been entertained of the purulent inflammation of the conjunctiva which is frequently found to attend or succeed gonorrhœa. First, this ophthalmia has been ascribed to inoculation with matter from the urethra; secondly, it has been supposed to be metastatic; and thirdly, it has been considered, at least in certain cases, as an effect owing to irritation merely, without either inoculation or metastasis. It is quite possible that there

may be three such varieties of this ophthalmia. The existence of the first I consider beyond all doubt; but the second and third are somewhat problematical."

His description of the first form is quite clear, and in several cases which he reports the infection is definitely proved. He did not succeed in separating gonorrhœal from what was called Egyptian ophthalmia, excepting as differing in degree. This distinction was not definitely made until about ten years later (by Bendz). Mackenzie's criticism of the views entertained by some eminent ophthalmologists is so interesting that I shall quote the entire paragraph:

"Dr. Vetch tells us that in a soldier in a very advanced stage of Egyptian ophthalmia he attempted to divert the disease from the eyes to the urethra, by applying some of the matter taken from the eyes to the orifice of the urethra. No effect followed this trial. It was repeated in some other patients, all laboring under the most virulent state of the Egyptian disease; and in all the application was perfectly innocuous. But in another case, where the matter was taken from the eye of one man laboring under purulent ophthalmia, and applied to the urethra of another, the purulent inflammation commenced in 36 hours afterwards and became a very severe attack of gonorrhœa. From the result of these experiments, Dr. Vetch, while he admits that gonorrhœal matter taken from one person and applied to the conjunctiva of another will excite a highly purulent ophthalmia, regards himself justified in no longer admitting the possibility of infection being conveyed to the eyes from the gonorrhœal discharge of the same person. He adds that the impossibility of this effect was rendered decisive by an hospital assistant who, with more faith than prudence, conveyed the matter of a gonorrhœa into his eyes without any affection of the conjunctiva being the consequence. It is remarkable that Dr. Guillie has fallen into the same error of reasoning as Dr. Vetch, only that his negative experiments have led him to the very opposite conclusion. He applied the matter taken from the conjunctiva of one patient to the urethra of another; no effect followed, and hence he concludes that the notion of some regarding the propagation of puro-mucous inflammation from one mucous membrane to another in different individuals, is unfounded."

Mackenzie, however, devotes considerable space to the discussion of gonorrhœal ophthalmia from metastasis, though nothing could be better than his statement that writers had adopted these views "with too little hesitation and appear not to have sufficiently investigated the probability of the ophthal-

mia arising rather from inoculation than from metastasis." He goes on to enumerate "the causes of the suppression of the gonorrhœa, to which the rise of metastatic gonorrhœal ophthalmia is attributed," and cites an illustrative case from a French writer. It is evident that Mackenzie had little confidence in the existence of this form of gonorrhœal ophthalmia.

A third form of gonorrhœal ophthalmia without inoculation or metastasis is described: "an alternation has been observed between the two diseases; that is to say, when the gonorrhœa came, the ophthalmia went, and *vice versa*." Mackenzie says that the cases reported "show the diversity which exists in opinions entertained regarding the ophthalmiæ which in some individuals are found to attend gonorrhœa, or to alternate with this disease"; and that "it is quite evident that the ophthalmiæ which have been observed to do so are far from being uniform," that some are probably ophthalmia tarsi, others catarrhal ophthalmia. What is most important is his statement that "it may fairly be doubted whether there is any connexion between diseases of urethra and that of the eye, farther than that they occurred in the same individuals, while the occurrence of both might be attributed to a susceptibility for disease arising from peculiar or debilitated constitutions." We are somewhat surprised to see this statement followed by such a one as this, that "Swediar's hint to employ the bougie in cases of ophthalmia alternating with gonorrhœa may probably be found of use; it is evident, however, that this remedy cannot be trusted alone, but that the ophthalmia must be treated according to the particular symptoms it presents, not according to the conjectural notions entertained regarding its origin."

Concerning Egyptian ophthalmia Mackenzie says:

> "I think it probable that the ophthalmia which attacked the British and the French armies in Egypt was an atmospheric puro-mucous conjunctivitis [described at another place as "excited by exposure to atmospheric alternations"], but that it afterwards degenerated into a contagious, perhaps infectious disease; that is to say, that it was propagated by actual contact of the discharge, and perhaps by miasmata from the eyes floating through the air."

Mackenzie's views may fairly be taken as the most advanced of this period and will serve as the proper point from which to view the investigations of Piringer.

It should be mentioned here that many subsequent writers held on tenaciously to these and older views for many years after Piringer's discovery had been made.

We may first direct our attention to Piringer's experiments in curing pannus by producing acute purulent ophthalmia. This method, we are told, was first suggested by Friederich Jäger* some time during the second decade of this century, but little or no attention had been given it before Piringer's experiments were made. He tried the method in more than sixty cases, using the pus of various kinds and stages of purulent ophthalmia of both adult and new-born. All of his cases were improved and not one was injured by the treatment. In the great majority of cases the cure was complete, so that no sign of the former disease could be discovered, and permanent. He therefore recommends this method of curing pannus in these words: "After so many highly successful experiments and observations, the inoculation of the blennorrhœa for the cure of pannus is no longer a doubtful measure which requires great courage, but an excellent method (ein grossartiges Mittel)." This method remained in use for many years and is still being applied in a modified manner. The modification consists in the use of jequirity to produce a purulent ophthalmia instead of blennorrhœic matter.

It was in the study of this method of treatment that Piringer made his investigations as to the nature of blennorrhœa and the contagious property of the secretion. For this purpose his experiments were varied in every conceivable manner. Most of the experiments were made upon eyes which were already diseased, but these were controlled by other experiments upon amaurotic eyes with perfectly healthy conjunctiva, or by the accidental infection of normal eyes.

After describing the various forms of purulent inflammation of the conjunctiva he takes up the causes. Under this

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* In Hirsch's History of Ophthalmology, p. 441, we read that Ludwig reported the successful use of this method at the hands of a friend, probably Friederich Jäger.

Wharton Jones (in a manual on Ophth. Med. and Surg. published in 1847) states that Dr. Henry Walker was the first to suggest the method (Edinburgh Medical and Surgical Recorder) in 1811. I am unable to verify this citation.

head he discusses the question as to the production of gonorrhœal ophthalmia by metastasis. In the course of fifteen years he had never seen a case of suppression of a gonorrhœa with an outbreak at another point, excepting in the neighboring tissues. Many physicians of great practice had likewise never seen true metatastic gonorrhœal ophthalmia. He denies the occurrence of such a form of disease, and characterizes it as a very pretty fable which one after the other has been telling in the best of faith. Gonorrhœal ophthalmia is always due to the transference of infectious material directly into the conjunctiva!

In a similar manner he disproves the existence of a consensual form of gonorrhœal ophthalmia, supposed to be due to a sympathetic connection between the affected parts.

Gonorrhœal ophthalmia is known to be more common toward the end of the primary affection than during the period of its greatest virulence. He explains this very properly on the ground that when the discharge is great much care is used in cleansing the fingers. It is after the discharge has become scant that patients become careless. The right eye is usually the one first affected, because most patients are right-handed.

His experiments proved that the generally accepted view that the transference to the eye of gonorrhœal pus results in a simple conjunctivitis or a mild purulent ophthalmia, and only rarely in a severe inflammation, is false. On the contrary, he asserts that the result is always a purulent ophthalmia of a severe degree. The only exception occurs in those cases in which early treatment is successfully applied.

The contagious character of the secretion of ophthalmia neonatorum had been looked upon as ridiculous;* when Juengken stated that a nurse had developed severe purulent ophthalmia during the night of the same day when she had infected them with a sponge that had been used to cleanse the eyes of an infant with ophthalmia, it was laughed at. No one can deny the infection in his own cases, because the material was carried

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*The faith with which this opinion has been held can be measured by the much-quoted citation of Dr. Vetch, referred to above. Piringer likewise quotes Adams, who rubbed his eyes with a finger smeared with purulent matter without producing ill results, as did Van Sevenoeck and Kriebel. Morburgo smeared the eyes of 300 soldiers without effect.

across the street into another house and yet the result was always the same.

His experiments on the production of purulent ophthalmia embrace almost one hundred eyes, and this does not include a number of accidental infections which were observed with the same care. The matter with which infection was produced was obtained from eyes affected with different forms of purulent ophthalmia as well as from genital blennorrhœa. All ages and both sexes were found to be equally predisposed.

One of the most interesting chapters is the one on the character of the blennorrhœic contagion. Though the pus from the conjunctiva causes infection when applied to the eyes of human beings, he was unable to produce any result when he applied it to the eyes of such animals as dogs, cats, hogs, and various birds. Others had claimed that they had produced effects in such cases. Our present knowledge of the immunity of animals to gonorrhœa shows that Piringer was not deceived.

The granulation from which the pus is secreted carries the contagious property with it, as was shown in 1823 by Werwick, who experimented upon two nurses. Piringer never made any experiments with granulations because it lacked any practical bearing.

The pure lachrymal fluid of a blennorrhœic eye was found not to possess contagious properties. An experiment is related in which lachrymal fluid collected upon a camel-hair brush did not produce infection, while the purulent secretion gathered a few days later did.

The question of contagion *par distance* (per miasma) was studied in his hospital, where numerous blennorrhœic patients were placed beside those unaffected, in small wards. He was able to prove definitely that such contagion does not occur and that the cases in which it is suspected can always be traced to direct infection.

The vapor of drying secretion has no power of infection. Even those secretions which are perfectly serous leave a residue when evaporated, and it is this which still retains the contagious properties.

The fluid secretion when kept for three or four days, even without evaporation, is no longer contagious.

If a finger is covered with blennorrhœic secretion and washed

immediately in clear fresh water and well dried, it will cause no infection if rubbed over the conjunctiva.

Blennorrhœic matter may be smeared over the eyelids if the palpebral fissure is kept firmly closed by adhesive plaster, and no infection will occur. In order to produce infection the secretion must reach the conjunctiva.

The secretion of acute blennorrhœa of a moderate degree is just as contagious as that of the most severe. Such pus is capable of producing infection even when diluted with 50 or 100 parts of water. The pus of a very mild purulent ophthalmia and of chronic ophthalmia has much less power of infection.

As long as there is any secretion in any case of purulent ophthalmia, whether mild or severe, so long the case is contagious. When the secretion ceases, though there may be considerable congestion and photophobia, the infectious properties are lost.

The properties of infection inherent in the secretion do not vary in different seasons of the year nor under changed atmospheric condition, whether exposed to the glare of the sun or to the cold of the winter. Experiments to determine this may appear meaningless to us, but we must not forget the opinions prevalent in Piringer's time.

Numerous experiments were made to determine the effect upon the contagious properties of the pus when separated for varying intervals of time from the human body. Thus the secretion was collected upon a camel-hair brush and allowed to become as dry as possible ("dry as glass") in from three to six hours. If then applied to the conjunctival sac, but not allowed to soften in the tears, no infection occurred; if softened in the tears, or previously in water, infection was sure to occur.

In seven cases the secretion which had been allowed to dry for thirty-six or forty hours in the open air had lost all contagious property, but in two in which the secretion had been allowed to get dry thirty-three or thirty-four hours in the room and was then softened it produced very severe ophthalmia blennorrhœa. Pieces of linen smeared with fresh blennorrhœic matter and given to a pannus patient to wipe his eyes produced infection, but if the cloth had been dried in the air for several days, the patient could use it about the eyes without harm, and the

secretion when scraped off the cloth and inserted into the conjunctival sac produced infection only when it was less than thirty-six hours old. On the other hand, if the secretion was placed in a vaccine case and hermetically sealed it retained its contagious property for forty-eight hours, but lost it entirely when kept for three days. The pus from a case of ophthalmia neonatorum produced infection when kept in this way for two and a half days. Piringer therefore concludes that "*blennorrhœic pus loses its contagious properties as it becomes older, and gradually dies in from twenty-six to forty-eight hours, possessing no more organic life when three days have passed.*" It is upon the discovery of this fact that Piringer bases important rules of prophylaxis, and explains the relative infrequency of gonorrhœal ophthalmia among the common people.

Piringer studied carefully the length of time intervening between the entrance of the infectious material and the first signs of the developing disease, the period of incubation. This he found to vary according to the manner and the amount of the infection, as well as according to the individual peculiarity of the patient. The higher the degree of inflammation, the more rapidly did its pus infect. Thus the pus from a very severe ophthalmia produced infection in from six to twelve hours, or at most in thirty-six hours; while that of very mild blennorrhœa might require sixty to seventy hours, and that of a case of chronic blennorrhœa seventy-two to ninety-six hours.

The secretion of the second stage of acute ophthalmia acts more slowly than that of the first; thus the pus from a case of very acute blennorrhœa in which the secretion was markedly diminishing may take sixty hours to produce the first symptoms.

If the secretion while still warm is immediately transferred from an acute blennorrhœa, but six or eight hours are required for the first signs to show themselves, and in twelve or eighteen hours the disease is fully developed. In this respect the conjunctiva responds more rapidly than the genital mucous membrane. The longer the secretion is kept before it is placed in the conjunctiva, the less rapidly does it act. The rapidity likewise varies with the amount of secretion brought into the eye.

Piringer gave the prophylaxis of gonorrhœal ophthalmia his careful attention and the results were very important. Can

the inflammation be aborted after the infectious material has once reached the conjunctiva? Several cases in which the very early and continued application of ice compresses produces this effect are described. In order to determine whether the infectious material can be removed and the outbreak of the disease prevented, several series of experiments were made. The method which required the application of very strong solutions of bichloride of mercury, concentrated acetic acid, etc., appeared to him too severe, and in the few cases in which it was tried the desired result was not obtained.

On the other hand he found that washing out the eye with water after the contagious material had been inserted prevented the development of the disease, provided that it is done sufficiently early. These experiments were made on three patients. In the first case he touched the eye with a large quantity of matter from a newborn babe, cleaned it out after a minute with a sponge dipped in cold water, and had cold water applications made for ten hours. No inflammation resulted. Four days later he varied the experiment by allowing the matter to remain two minutes and again no inflammation occurred. After another interval of four days the experiment was again repeated, the pus remaining in the eye for three minutes and the result was again the same. After another interval of five days pus was inserted and allowed to remain in the eye for five minutes; no cold applications were made; the result was a violent inflammation. This patient had pannus, which was cured by the treatment.

In order to try these experiments upon a perfectly normal conjunctiva he selected the eyes of an amaurotic beggar whom he paid for these privileges. In this case he found that no disease resulted if the blennorrhœic matter was washed out within three minutes after its entrance into the conjunctival sac and cold water applied. In three minutes any one who has accidentally infected his eyes can obtain fresh water with which to wash them!

In order to determine whether the washing out of the conjunctival sac would accomplish the same result without the use of ice applications, he infected the eye of a girl suffering with pannus with blennorrhœic matter and washed out the conjunctiva in three minutes. Ninety hours later a severe

ophthalmia developed. And in a second case the experiment again resulted in the development of a purulent ophthalmia, but not until the fifth day, and in this case the ophthalmia was of a milder character. For these reasons he considers the cold water application as essential to the prevention of conjunctival blennorrhœa after infection has occurred. Many other questions are considered by Piringer, but this review embraces the essential points, and will, I trust, suffice to show its importance.

The care, the true scientific spirit, the accuracy of observation and experiment, the unbiased search for truth, form marked characteristics of Piringer's work. And yet he is so modest as not to claim that his results are "the absolute truth," though they are his own firm convictions; experiments and observations, he tells us, by other physicians at other times and places, made with care and without prejudice, are needed to confirm them as well as to clear away any errors. His experiments were arranged carefully and judiciously to determine the character and the attributes of the contagion, the time during which it acted, the gradual diminution of its powers to the point when they were entirely lost, the intensity of the contagion, and the degrees of dilution which could be borne without loss of all contagious properties. Many of these questions were given their final solution by Piringer. He separated the fluid portions of the pus which could be evaporated, from the more solid matter which contained the contagious quality. He proved that the unknown cause of contagion was a something which had to be transferred in substance from one mucous membrane to the other, and which never acted at a distance, thus disproving the old miasmatic principles which were still current in those days.

In what is our knowledge to-day greater than that of Piringer, excepting that the active agent, the living micro-organism, the gonococcus, has been discovered, a discovery only made in 1879? That it was a living organism even Piringer surmised, for, as we read above, he speaks of it as "growing older," and "dying," and "possessing organic life." Let us not forget when it was that Piringer worked. Though micro-organisms had been discovered toward the end of the seventeenth century, and micro-organisms were assigned as the

causes of numerous diseases during the eighteenth century, it was not until 1840 that Henle first established the germ theory of disease upon the solid foundation of logic and fact.

One aspect of Piringer's experiments still deserves mention. Others had likewise made experiments with a view of transferring the disease which we have been considering; but most of these were unsystematic, few in number, and led only to confusion. Piringer's work was such as to give a definite solution to important questions, results which have stood the tests of time. His work was not in vain. His hopes were fulfilled that "the medical world would read not entirely without pleasure a number of results, whose collection in the field of practice had been made at the cost of much strain, great pains and many a sleepless night."