AN ADDRESS ON LANOLIN: A NEW BASIS FOR OINTMENTS.

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GENTLEMEN,—In presenting to you the substance lanolin as a new basis for ointments, I am far from declaring that all questions touching its pharmacological uses are entirely solved. Lanolin is so peculiar a substance, that its varied employment will doubtless bring many new qualities to light—qualities which, as can already be foretold, belong neither to glycerine-fats nor to mineral oils. However, the investigations I have made enable me to assert even now that lanolin is in every way a thoroughly efficient preparation for use in treatment by salves and ointments, and that it answers many requirements which the glycerine-fats and mineral oils (such as vaseline) at present employed have not been able to fulfil satisfactorily.

The use of plasters and ointments, which at different times was considered but a subordinate therapeutic method, has lately again been drawn into the domain of scientific research; treatment by local application being now esteemed of great value in various kinds of disease. If in what follows I speak of fats, these must be distinguished from the fatty substances so-called in a strictly chemical sense. To quote Kekule's admirably precise definition: "The group of fatty substances embraces all bodies in which we can suppose the carbon atoms to be arranged in the simplest possible manner;" while, in a closer sense, those substances are called fats which are separated into glycerine and fatty acids by chemical decomposition. It seems to me that, from the pharmacological point of view, this classification is too narrow, and that the qualities common to a series of substances formed in the animal organism can be better examined by the help of a different arrangement.

I would designate as fats all those substances—and they are chiefly ethereal combinations—the chemical decomposition of which produces fatty acids of the stearic acid group, or of the oleic acid group. Thus a series of substances that evidently have a close physiological connection with each other are brought under one head. According to this classification, protagon, the existence of which has been again clearly demonstrated, would be counted among the fats, as also would the lecithines, in spite of the nitrogen they contain. The group of substances known under the term wax (principally combinations of fatty acids and monatomic alcohols) are thus also to be classed among the fats, although their physical qualities differ from those of glycerine-fats, and though the lerotin acid won from wax is a special characteristic of these substances. Cetaceum, too, the fat of cetyl-alcohol, thus clearly belongs to the fats, though it differs widely from wax in its physical qualities.

A discovery made in the year 1868 by Fr. Hartmann¹ and E. Schulze² was of great value to me in my investigations. These gentlemen found that fatty acids, combined with cholesterol, occur as fats of a peculiar nature in the fat of sheep's wool; and, later on, E. Schulze was able, also, to demonstrate the existence of ischolesterine combined with fatty acids. We have here a series of fats previously unknown in connection with the animal organism.

It is well known that cholesterol is a substance very frequently found in the animal organism. It is the more remarkable, therefore, that little attention should have been given by physiologists to these observations of Hartmann and Schulze. I must not omit to mention that these combinations have been known as pure chemical substances since Berthelot's excellent researches in 1860. Berthelot succeeded in obtaining the most varied cholesterol-fats by heating cholesterol and fatty acids; and he even suggested that this fat might be found to play a part in the animal organism,³ though he brought forward no proofs in support of this idea.

¹ Hartmann, *Ueber den Fettschweis der Schafwolle in chemischer und technischer Beziehung*. Inaug.-Diss. Göttingen, 1860.

² E. Schulze, *Ueber die Zusammensetzung des Wollfettes*. (*Zeitschrift für Chemie*, 1870, S. 453.) *Bericht des deutsch. chem. Gesellschaft*, 1872, S. 1075.

³ Berthelot, *Chimie Organique*. Paris, 1860, Tom. I, page 161. "D'après diverses observations, il ne paraît pas impossible que quelques-uns de ces éthers, le composé stéarique notamment, existent soit à l'état normal, soit à l'état pathologique dans l'économie animale."

The discovery of ischolesterine made by E. Schulze leads at once to the supposition that the cholesterol-fats may possess the varied qualities characteristic of the glycerine-fats.

Their presence in sheep's wool having been demonstrated, the question arose whether this was to be considered an isolated occurrence, such as the presence of cetaceum in the skull of the physeter, and in the coccygeal gland of the goose (*glandula uropygii*), or whether the fats were as widely distributed as the glycerine-fats.

In tracing these peculiar fats in the animal organism, I was assisted by the reaction for cholestol (a substance closely related to cholesterol), discovered by Liebermann.⁴ The reaction is an exceedingly simple one. The fat to be examined (and but a very small quantity is needed) is dissolved in acetic anhydride (not to be confounded with anhydrous acetic acid). By an addition of concentrated sulphuric acid a pink colour is formed, which quickly changes to a decided blue and green. Great care must be exercised in pouring in the acid. The less acid is used, the clearer the reaction will be. My supposition, that the cholestol reaction would be found practicable for cholesterol-fats, was confirmed by experiment. Cholesterol-fats, in which no trace of free cholesterol could possibly be contained, showed the cholestol-reaction with perfect distinctness.

On the other hand, I proved by experiment that glycerine-fats of the most varied compositions do not show the cholestol-reaction. I must also mention that protagon, lecithine, cetaceum, and beeswax gave negative results.

The tissues containing keratin were first subjected to examination. I will mention human epidermis, hair, vernix caseosa, whalebone, tortoiseshell, horn-shavings (cow), the beak of the jay, feathers of geese, hens, turkeys, pigeons, of the fantailed pigeon, bristles of the hedgehog and of the porcupine, hoof and warty excrescence on the leg of the horse, horny substance of the sheep's foot, hair of the *Bradypus cuculiger*. In all these keratin tissues I was enabled, by help of the cholestol-reaction, to trace cholesterol-fat, which I obtained by extraction with chloroform. In the case of the penguin only no trace was found.

I did not rest satisfied with this reaction alone, but made use of the quality peculiar to cholesterol-fat to absorb above 100 per cent. of water. To this quality, which was first and exquisitely demonstrated in the fat obtained from wool, I have given the name "lanation," and I was able to show that almost all the fats won from the above-mentioned substances possess it. I also proved by experiment that a mixture of glycerine-fats and cholesterol did not lanolise.

If fat from superficial fascia be subjected to extraction, the fat either shows no cholesterol-reaction at all, or else one so transitory, that it need not be taken into account. On the other hand, a very decided cholesterol-reaction was obtained in the case of a fat obtained from the kidney and the liver, and in that of a fat obtained from the blood of a rabbit. Whether the fat belongs to the kidneys and other organs themselves, or whether its origin is in the blood, is a question that must be left to future investigation.

I then proceeded to examine the question whether the cholesterol-fats belong to the tissue as such, or whether, as is generally assumed, they are produced by glandular secretions. The most widely diffused theory on this subject is, that the feathers of birds are oiled from the *glandula uropygii*. In Chapter 21, De Peruncto, of the work *Kaiser Friedrich II*, we find the statement that the coccygeal gland serves to oil the feathers so that water may better flow off from them; and further, that the gland is supposed to possess poisonous qualities.⁵ This view, which, in the book of Frederick II, refers chiefly to hawks, has been maintained down to the present day, as can be seen by the investigation of Robby Kossmann "On the Sebaceous Glands of Birds."⁶ I will by no means deny that the secretion of the gland, when brought to the surface or the feathers and there dried, may possibly assist in rendering them supple. But, on the strength of my investigations, I can affirm with equal weight that the liquid secreted by the gland serves, on the contrary, to free the feathers from too great a profusion of fat, or, at least, to spread the fat secreted by the feathers evenly upon them.

⁴ De Jonge. *Zeitschr. für Phys. Chem.* 1879.

⁵ C. Liebermann, *Ueber das Chelidioterpen*. (*Bericht der Deutsch. chem. Gesellschaft*, 1885, page 1803.)

⁶ Reliqua librorum Frederici II Imperatoris, de arte venandi cum Avibus, cum Manfredi regis additionibus.—Cap. XXXI. De peruncto. "Juamentum enim hujus peruncti est recipere a reliquo corpore humiditatem virulentam, quam receptam et in ipso congregatam, auis cum opus fuerit, comprimendo cum rostro suo suget et cum eodem rostro pennas suas etungens perungit, quatenus pennae melius possint resistere madafactioni, aqua enim plenis super pennas perunctas minus adheret eis et integrus et lubricabilis descendit et pennae saniores servantur."

⁷ Robby Kossmann. *Ueber die Talgdrüsen der Vögel*. *Literatur und Kritik* (*Zeitschrift für Wissenschaft, Zoologie*, von Siebold und Kükler. 1871. P. 569 und 571).

There are some birds without any coccygeal gland, many species of parrot, and the fantailed pigeon.* The feathers of these birds have a far less shiny appearance, and it was of importance, therefore, to discover whether cholesteroline-fat were contained in the feathers of the fantailed pigeon. Experiment proved this to be the case; though, it is true, the quantities found were but small. The conclusion seems justified that these birds need no coccygeal gland, since the secretion of fat from the feathers themselves is insignificant. We even see that the columba militaris performs its flight in spite of rain; and, as it too possesses no coccygeal gland, it must be able to secrete from the feathers sufficient fat to protect it from "maefactio." Since birds are not furnished with any sebaceous glands in the skin except the coccygeal gland, I am justified in supposing that the fat is formed in the feathers simultaneously with the keratin.

As regards hairs, it is generally believed that the fat contained in them is secreted from the sebaceous glands. In the case of sheep, the sebaceous and sudoriferous glands are so numerous, that these animals cannot help the conclusion whether intracellular or additional fat ever occurs alone. However, cholesteroline-fat is also found in the bristles of pigs, and also in the prickles of the hedgehog; and we know that these animals only possess sebaceous glands in a stunted condition. An abundance of fat occurs in the quills of the porcupine. But, to my regret, I have not been able to ascertain whether here, too, the glands are defective.

In forming a conclusion, it was very important to select an animal the hair of which is furnished with absolutely no sebaceous glands. Such an animal is the sloth (*Bradypus cuculliger*); the few hairs from the fur of this animal, which I was able to obtain, showed the cholesterol-reaction.

No doubt, the sebaceous glands furnish fat for the surface of hairs, and are able to keep them supple; but this fat is very different from the fat contained in, and formed by, the keratin-substance. In support of this assertion, I may mention that Dr. Lassar has observed a case where, in spite of excessive secretion from the sebaceous glands, the hair was found dry and hard.

An experiment which I made with a goose is also in favour of my theory. The fat of its coccygeal gland was subjected to examination. The cholesterol-reaction was extremely slight, a result agreeing with the experiments of de Jonge, who found in this gland a cetaceum-like fat. In the fat of the superficial fascia surrounding the coccygeal gland, there was absolutely no cholesterol-reaction; whilst, in the fat obtained from the feathers, the reaction clearly showed the presence of cholesteroline-fat.

Another and more decisive proof of the occurrence of cholesteroline-fat in keratin-cells is found in the fact, that there is an abundance of cholesteroline-fat in the hoof and the warty excrescence on the leg of the horse, though here there are no glands to secrete fat.

Nevertheless, I am not prepared to deny the possibility that keratin-tissue containing another fat than cholesteroline may occur here and there; I can only say that the penguin is the only case of this kind I have met in the course of my investigations. Some other fat seems to take the place of cholesteroline-fat in the horny tissue of this animal.

According to the view expressed with much clearness in Virchow's *Cellular Pathology*,⁸ and which must be borne in mind for all investigations of fats, the fat of the animal organism may be considered either as the normal contents of the cells, or as transitory fat in the cells—for instance, in the intestinal-epithelium cells; or, again, it may be present as necrobiotic fat after the destruction of the cells, as, for instance, in the case of milk. It is extremely probable that cholesteroline-fat will be found to have its place in this classification. The ease with which it is made into an emulsion leads me to think that it would pass easily into the intestinal epithelium; the proof must be left to future investigation. I do not feel justified in assuming that cholesteroline-fat is present in the keratin-cells, or in the granular layer of the epidermis, from which the keratin-cells are produced. But if we assume that the keratin-cells which are destined to be exfoliated are destroyed through necrobiosis, we must consider cholesteroline-fat a necrobiotic fat—such as butter, for instance.

Eleidin,¹⁰ a peculiar substance, the chemical nature of which has not yet been clearly established, is present in the granular layer of Aufhammer, and was first described by Ranvier. Waldeyer supposes it to be related to the hyalin of Von Recklinghausen. Ranvier,¹¹ Zabudowsky, and Unna, on the other hand, suggest that it is connected with the formation of keratin; but the micro-chemical reactions stated by Ranvier, Waldeyer, and Unna speak more in favour of the albuminous nature of eleidin. I cannot feel as certain as Ranvier that we have not here a fatty substance. I think it probable that the substance described as eleidin by all these authors is made up of a mixture of albumen and cholesteroline-fat.

All these investigations were undertaken by me from the pharmacological point of view only. Of late, increased attention has very justly been given to treatment by ointments and plasters. The substances made use of up to the present are glycerine fats, and, of late years, mineral fats, such as vaseline, which is obtained from the waste products of petroleum-distillation. The *Pharmacopœia Germanica* has even admitted as a basis for ointments, paraffin ointment, which is produced by a mixture of solid and liquid paraffin. Well-founded objections have been raised to the employment of this substance.

Quite apart from the fact that the absorption of medicaments, when mixed with pure fat, is but imperfectly effected, fat-ointments are subject to decomposition, which may lead to irritation of the skin. It is true that vaseline does not decompose, but it prevents the entrance of medicaments into the skin, so that even poisonous substances, when mixed with vaseline and rubbed into the skin, produce neither local nor general symptoms of poisoning.

Paraffin ointment must be considered as still less efficacious than vaseline. Even when most carefully prepared, its component parts separate out after a time, and nothing is more certain than that the ointments, ointment of iodide of potassium, etc., in their present form of paraffin-ointments, are totally without effect. I have always advised the old-fashioned mode of preparation with fresh fat in the case of these ointments.

I was surprised to find the extreme ease with which cholesteroline-fat can be rubbed into the skin; since it has its origin in keratinous tissue, I think it likely that this absorption is in connection with the rapid passage into the skin. To the combination of this neutral fat with water, I have given the name of "lanolin."

I owe the pure material necessary for my investigations to the kindness of Messrs. Jaffé and Darmstädter, of Charlottenburg, who manufacture lanolin by transforming the wool-fat into a milk, and then subjecting it to centrifugal action. By this process a thin milk and a thick cream are obtained, just as when milk is subjected to centrifugal action; and the cream contains lanolin in a pure condition.

The pure fat (pure lanolin) has its place, as already described by Berthelot, between resin and fat; and it has a capacity of absorbing water unapproached by any substance known to me. More than 100 per cent. of water can be kneaded with it, the result being a light yellow very plastic ointment. Lanolin is not soluble in water; but, by the addition of soap and alkali, a decided milky emulsion is at once formed. One of its most important characteristics is its perfect neutrality. Lanolin is with difficulty decomposed by the action of alkalis; hence, its self-decomposition is impossible.

It is noteworthy also that this fat combines easily with glycerine, and that, in this combination, it can with ease be mixed with every other fat. In this way, a great variety of agreeable cream-like ointments can be produced.

Lanolin has a slight smell. Of therapeutic experiments, I may mention that, in contrast to fat or vaseline-ointments, a 5 per cent. carbolic lanolin-ointment rubbed on the hand produces, after one or two minutes, a numb feeling without irritation.

The absorption of lanolin-sublimate ointment (1 in 1000) is so rapid that, a few minutes after the application, the characteristic metallic taste is observed.

These observations clearly indicate the efficiency of lanolin as a basis for ointments.

¹⁰ Waldeyer: Untersuchungen über die Histogenese der Stirngebilde insbesondere der Haare und Federn. Beiträge zur Anatomie und Embryologie, Festgabe für Jacob Henle, Bonn, 1882.

¹¹ Comptes Rendus. 1879. Vol. i, p. 363.

A NEW POLISH HYGIENIC JOURNAL.—The first number of the Polish hygienic monthly, *Złrowie*, has just appeared in Warsaw; it is edited by Dr. Polak.

TESTIMONIAL TO A LADY-DOCTOR.—Dr. Victoria Antushevitch has received a testimonial from the Orel Zemstvo, Viatko Government, for her zealous and humane professional work at that locality.

⁸ System der Pterylographie, v. Christian Ludwig Nitzsch. Halle. 1840. P. 65. "Wohl aber fehlt sie (die Bützkehrlose) mehreren amerikanischen Papageien, vor denen ich frische Stücke zu wiederholten Malen untersuchen konnte, z. B. dem *Psittacus rufirostris* Illig. dominiensis, leucoccephalus, ochrocephalus Dufrenoy, menstruus, purpureus, was um so auffallender ist, da die meisten anderen Arten, unter denen einige den erwähnten sehr nahe stehen, eine recht vollkommene Bützkehr besitzen. Solche scheinbare Anomalien giebt es indess noch mehrere, und ich erwähne von mir bekannt gewordenen den Mangel der Drüse bei *Columba coronata* und *C. militaris*, sowie bei *Argus giganteus*, Vögel, deren nächste Verwandte mit derselben sehr wohl versehen sind."

⁹ Rudolf Virchow, *Die Cellularpathologie*, Berlin, 1871, p. 404.