THE IMPORT OF THE SALIVARY AND NASAL SECRETIONS IN HAY FEVER.*

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It is a fact long well known that products of secretion and excretion, through chemic analysis, afford the observing clinician a fair idea of what process is going on within the body. That the information thus obtained may at times be very imperfect is not, I think, a fault of the method, but rather because of the state of incompleteness at which we have allowed our investigations to stop. Thus during the eight years since my attention was first called to the importance of salivary and nasal secretions in their relation to health and disease, I have devoted considerable time in studying the chemistry of these secretions. When we consider the limitations of our knowledge of normal saliva, and add to this the altered chemistry associated with pathologic changes, we find ourselves in a field of organic chemistry so extensive and so barren of definite data as to become almost appalling; and while many observations thus far have been based on theory, yet from an immense amount of laboratory work and associated clinical phenomena, sufficient deductions have been worked out to prove of definite knowledge, with consequent benefit to the patients in many cases.

There is no question that under certain conditions, for example, when the secretions are acid or alkaline, that the chemic process taking place within the various secretory glands must vary and the product of such variation in these unknown quantities must be somewhat the same as the variations we would obtain in dealing in the laboratory with known compounds. In other words, the body is largely a chemic laboratory, having on hand a certain amount of material and having added to it daily other ingredients through the respiratory and alimentary tracts. Now, any perverted condition from what is known as the normal chemistry may bring about a series of changes giving rise to chemic products which may be harmless or productive of disease processes. On no other basis can we explain the various diatheses, or the precipitation of certain materials

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in the tissues of the body; for example, why uric acid should be formed and precipitated in so many and varied forms in certain individuals, while others under the same hygienic surroundings are absolutely free from such chemic compounds.

That cell nutrition depends upon the *chemistry* of its supply is illustrated in disease processes associated with any form of infection or rise of temperature. This opens up an enormous field for speculation and investigation. The amount of infection, the peculiar chemic change produced by temperature, the materials absorbed into the body from infective processes, or the auto-infection from the intestinal tract, would in each condition produce its own peculiar chemic compound and effect on the mucous membrane. Yet I believe a general basis or standard can be reached, at least sufficiently accurate from which to draw chemic and clinical deductions.

Michaels of Paris has done excellent work in studying the saliva from the standpoint of the dentist. (The literature on the subject is scant. I have been interested in this subject for several years and a part of my work is incorporated in a paper read in Boston at a meeting of the American Laryngological Association in 1902.) Before taking up the subject of *The Import of the Salivary and Nasal Secretions in Hay Fever* it is advisable to consider it from a general standpoint, and in so doing I take the liberty of quoting from my paper published in *American Medicine*, (Vol. IV., No. 2, July 12, 1902,) on *The Chemic Pathology of the Salivary and Pharyngeal Secretions (Sialo-Semciology)*.

I reasoned the matter out as follows: It is a well known physiological and therapeutic fact that certain drugs have a selective action on certain tissues or organs of the body, *e. g.*, belladonna with its selective action on the pharyngeal surface; sodium phosphate with its selective action on the liver, etc. It is also a physiological fact that the normal chemistry of the body controls the normal secretions from the various secretory organs; that any perversion from the normal, necessarily alters the character and chemistry of the secretion, and that the products of such alteration, act as irritants to certain parts of the body; the difference between this and drugs administered is that one is manufactured within the body, while the other is introduced from without.

I was convinced that from the study of the saliva we could determine to a great extent any variation in the chemistry of the body, as these various secreting glands receive from the blood the supply from which they elaborate certain chemic compounds. If an analysis be made of the composition of such secretion it would give a good

index to the general condition of the individual, and while in many cases the deductions were based on or rather associated with clinical observation, I soon found them to be of immense value from a standpoint of diagnosis.

As the tissues and secretions depend upon the blood plasma, any dyscrasia would modify the chemic composition of the body and produce local or general manifestations. According to Ducloux, hypoacidity favors chemic changes in the tissues, oxidation processes are exaggerated, and there is an increase in the quantity of organic acids. By the ordinary litmus test, blood is normally alkaline, but, as Douin and Gautrelet have shown, if we study the distribution of the acids and bases of the blood plasma, we see that the reaction is really acid, and if waste products are not eliminated this acidity is increased. The secretions and excretions then become of an acid reaction.

The functions of saliva are physical and chemic. Its physical function is to moisten the food and thus facilitate tasting and deglutition, and also as an aid in articulation. Its chemic action depends upon its ferments, the most important being ptyalin, which converts starch into sugar. The proteolytic and lipolytic ferments are not important. It is possible that any other fermentation save the amylolytic is due to bacteria.

The administration of drugs for the relief of, for example, an infective process, probably effects such relief by changing the chemistry of the secretions and blood constituents, thereby producing a chemic compound which either prevents the formation of infectious material or alters the nidus of infection to such an extent that it is not suitable for the growth of bacteria.

The altered chemistry of the saliva presents many possibilities from an etiologic standpoint. It is quite possible that many forms of indigestion and diseases of the stomach and intestines may be brought about by the altered chemistry of the saliva. A great many morbid processes are traced to uric acid in some of its many forms, but I believe that many other substances equally important are deposited and eliminated, which substances act as irritants, causing mucous membrane lesions. This may also explain many of the so-called reflex neuroses, *e. g.*, hay fever.

The numerous theories as to the etiologic factor in hay fever proves conclusively that as yet there has not been established a definite cause. It may be that different conditions act as etiologic factors; in fact, it is my belief that not all cases which we call hay fever, or hyperesthetic rhinitis, are due to any one cause; or if to

any one factor, that factor is found in the altered chemistry of the secretions of the individual.

I am persuaded, after making a series of examinations of the saliva in certain individuals afflicted with hay fever and those not afflicted with the disease, that in many cases the local irritation in the nasal mucous membrane is brought about by some chemic change in the constituents of the secretion of the mucus-secreting glands. Sensitive areas within the nasal cavity or irregularities of formation of the cavities are factors in some cases; yet such areas or irregularities instead of being etiological factors, are merely more susceptible to the irritant from within.

It is a well known fact that in many cases of hay fever the irritation is not limited to the nasal mucous membrane; the conjunctival, buccal, pharyngeal and laryngeal, with even the mucous membrane of the stomach and bladder may be markedly irritated. This could scarcely be explained on the basis of a reflex neurosis. In such cases the mucous membrane suddenly becomes engorged, and is exceedingly sensitive, with profuse, watery, irritating discharge. This comes on suddenly, often without any apparent external irritant, and at times looks very much as though there was an effort on the part of the mucous membrane to rid the system of material which had just reached a certain point of accumulation. Or, as was alluded to in another connection, the human body is nothing more than a chemical laboratory performing its daily function and manufacturing and liberating certain normal chemic ingredients and constituents, and that under certain conditions the chemistry of these secretions is altered, and the manufactured product, instead of performing a physiologic function, serves as an etiologic factor in producing a pathologic process. This may be in the form of a secretion or in the form of an infiltration or deposit. We have such a condition exemplified in uric acid diathesis, but I believe in many cases in which we attribute the symptoms present to uric acid, that instead of uric acid we have some other organic compound formed, due to perverted chemistry, and which product is deposited on or within the tissue. I have been able to demonstrate this in a number of cases in diseases of the nose and throat.

I think there is quite a field for investigation in this line to determine if there is not in many cases manufactured within the system the irritating material which brings about the attack, and that it can best be determined by a study of the saliva.

The question may be asked: "Why does hay fever come on at certain times of the year?" That climatic and atmospheric condi-

tions produce changes in function and secretion, that certain diseases are prevalent at certain times of the year, and that under certain climatic and atmospheric changes, individuals are more susceptible to disease, has long been observed. This may be due to some condition of the individual which renders him susceptible to disease, owing to lowered cell-resistance and altered chemistry, since temperature and climatic changes do affect the chemistry of the secretions. As to the effect of pollen in certain cases, is it not possible that, owing to some peculiar constituent of the secretion of the mucous gland, there is deposited in or on the nasal mucous membrane certain materials which, when brought in contact with certain extraneous materials as pollen, through some chemic action, produces a material which brings about the irritation and causes an attack of what is known as hay fever; or that the extraneous material merely acts as a stimulant to the mucous glands, and causes a flow of mucous, which, owing to its altered chemistry, acts as an irritant. This is exemplified in the cases in which the ammonium salts bring on an attack identical with that produced by the rag-weed pollen. If the administration of the tincture of rag-weed produces immunization to hay fever, it must do it through the secretory function and the chemistry of the secretions would be such as to contain no materials which, when coming in contact with the pollen of the plant, would produce any irritating substance. I have seen cases illustrating this point. There is no question that the irritation is caused by some product of chemic action. The question involves organic chemistry, and any one familiar with the work recognizes the time and labor necessary to work out such chemic formulæ. However, I have done sufficient laboratory work in the past eight years to convince me that on this basis we can relieve many cases of hay fever. That the chemistry of the secretions has to do with the causal factor, I have illustrated in a number of cases by rapidly changing the reaction of the secretion either from acid to alkaline or from alkaline to acid, or rendering it neutral, and in many instances I have been able either partially or wholly to cure the attack.

I use the word "cure" in the same sense that one would say that he "cured" a "cold," yet would not mean by the expression that the person would never "catch cold" again. I think if we would give more attention to the secretions we would find less occasion to do certain surgical operations on the nose. I have known a teaspoonful of salt, swallowed at a dose, to result in almost immediate control of more than one attack of hay fever. This I consider to be an ex-

ample of what might be accomplished by changing the chemistry of the secretions.

Owing to the fact that the mucous membrane of the nasal and nasopharyngeal cavities is supported by bony structures, and that the blood supply comes largely through this bony structure, there is a greater tendency to congestion, deposit and infiltration in this locality, which may explain why so often the irritation is limited to the nasal coats.

It has been clinically observed that very few children suffer from hay fever. Is it because the sensitive areas within the nasal cavities are not fully developed, or is it because in children we have rapid elimination, open lymphatic system and rapid metabolic change, thereby enabling the system to get rid of irritating material and with less chemic change in the secretions? Another interesting clinical observation is that hay fever never manifests itself in an individual who is suffering from atrophic rhinitis, and in this condition the atrophic process not only involves the sensitive areas, but also the mucus-secreting glands.

Certain individuals will have at any time in the year an attack which is quite similar to hay fever. The individual may be sitting comfortably at home, subject to no draughts or exposure whatever, when he is suddenly seized with congestion of the nostril, followed rapidly by the thin watery discharge of a decidedly irritating nature, free lachrimation, with burning and itching in the nasal cavities, eyes and nasopharynx. Frequently associated with this is a slightly asthmatic tendency. It cannot be cold, it is something in the nasal secretion, and when the secretion comes to the surface and in contact with the air there is liberated some material (chemic) which acts as an irritant to the vaso-motor system (peripheral terminal nerve filaments), and causes sudden congestion. Such attacks are quite like inhaling ammonia fumes and in such cases there is present an excess of ammonium salts in the saliva. Owing to some chemic change in the secretions of the individual there is accumulated within the system, which in the point of accumulation reaches that period in which it overflows, and the secreting glands liberate on the surface this material, which when exposed to the air undergoes a chemic change. In many instances on examination of the saliva and nasal secretions there has been found an excess of the sulfocyanids and the ammonium salts. When this secretion is exposed to the air there is liberated free ammonia, which I believe to be in many cases the cause of the attack. The symptoms produced are identical with those of the inhalation of ammonia fumes.

In a healthy condition of the saliva the sulfocyanids and the ammonium salts are in about equal proportion; in hyperacid conditions the sulfocyanids are in greater proportion than the ammonium salts, and the secretion is less irritating. In the hypo-acid state the ammonium salts are in excess of the sulfocyanids and the secretion is decidedly irritating, and in many cases in which I have been able to examine the secretion of hay fever patients this hypo-acid condition has existed. This is not true in all cases, as I believe different irritants may be the cause in different individuals, and it is for the physician to study and determine the irritant present or produced by the chemic alteration of the secretion.

It is a clinical and chemic fact that where there is an excess of nitrogenous material the ammonium salts are always in excess.

Any altered condition of the excretory or secretory glands causing altered products can be demonstrated in the saliva, or in other words, altered chemistry of the secretion can be traced to faulty digestion, faulty elimination from the kidneys or liver, or intestinal tract, when there is thrown into the system materials which at once alter the chemistry of the saliva and as the saliva is taken back into the system we have produced certain reactions. This is unquestionably true as the salivary glands derive their constituents from the blood.

The sudden onset of hay fever, coming on as it does in certain individuals at a certain day and even hour of the day, is difficult to explain, except upon the clinical observation that season and climate affect the individual as well as his secretion; and since the majority of hay fever subjects are of the neurotic type, they are more subject to impressions. In such individuals it is also a well-known fact that any nerve strain or mental tension rapidly affect and alter their secretions.

While the investigations I have made are somewhat fragmentary and incomplete, yet I do believe that I am justified in the statement that physiologic chemistry of the salivary glands, in fact of the mucus-secreting glands of the upper respiratory tract, does and will play an important part in medicine from the standpoint of diagnosis and treatment. Since the nasal secretion and the saliva give practically the same results, the experiments were largely confined to the saliva.

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