This man's grandfather on his mother's side was subject to severe nose bleedings.

Personal History.—In March, 1893, at the age of 6, the patient had an attack of epistaxis lasting ten weeks, which was not treated, "for fear of threatened meningitis." In November, 1894, at that year, after measles, he was operated on at the Royal Ear Hospital, Soho Square, for adenoids. Bleeding continued for several days after the operation, demanding special means for its control. In 1896 there was a profuse epistaxis lasting three days. It stopped spontaneously. Slight cuts are always attended with a loss of blood out of all proportion to the size of the wound. Free bleeding from the gums followed the removal of loose milk teeth at different times. He is easily bruised. There is no history suggesting effusion into the knee or any other joint.

Attention is directed to two points in this case: first, the clear history, hereditary and personal, of the hæmorrhagic diathesis; and, secondly, the instantaneous effect of suprarenal gland extract after the other remedies had failed.

NOTES AND REFERENCES.

¹ BRITISH MEDICAL JOURNAL, November 3rd, 1900, p. 1308. ² *Centralblatt f. die gesammte Therapie*, Wien, December, 1900. Epitome of Weil's article in *Klin.-Therapie Wochenschrift*, No. 15, 1900.

THE DIETETIC VALUE OF SUGAR.*

By H. WILLOUGHBY GARDNER, M.D.LOND.,
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MANY of us can remember that when we were young sugar was considered more a luxury than a necessary or even useful article of diet. It was looked upon with disfavour; was thought to ruin the teeth, to conduce to worms, to be constipating, to be watery, and to be "flatulent." It was not only the lay public who thought thus badly of it. Even as late as 1884 we find a well-known specialist for diseases of the nose and throat asserting that the fundamental error responsible for the catarrhal diathesis and a host of evils consequent thereon was the excessive use of sugar. "Sugar," said he, "is the unrecognised bane."

Now the pendulum has swung far in the opposite direction. Sugar has come to be looked upon almost as a necessity, and certainly as one of the most valuable articles of diet. Even when we were boys it used to be said that at some public school an ascetic head master once placed the tuck shop out of bounds and forbade hampers and luxuries of all sorts, and that the results were so disastrous to the boys' health that the school doctor intervened, and the tuck shop was reinstated. Such was the story. We boys hardly believed it, yet probably it was true. Now opinion has completely changed, and we hear of Dutch and Berlin rowing clubs using sugar when in strict training—"sugar training" they call it; and we find Continental armies increasing their rations of sugar.

Now that the Government have reintroduced the sugar tax, it may be interesting to review briefly our knowledge of the subject. Sugar comes from two great sources—the sugar cane and the beetroot. In 1900 the world's total production of sugar was 7,933,000 tons, of which 5,523,000 tons were beet and 2,410,000 cane sugar. The early history of the sugar cane is very obscure. It is said to have been grown by the Chinese from time immemorial, but the first country in which it was definitely known to have been cultivated was the Indo-Chinese peninsula. Thence it spread to India, where it was found by Nearchus, one of the generals of Alexander the Great; thence gradually through Persia and through Egypt into Europe. Practically, however, the ancients were unacquainted with sugar as we know it. There was another form of sugar which they knew and greatly valued, namely, honey, and we know that both in Rome and in ancient Greece much time and thought was devoted to the keeping of bees. Palestine, it will be remembered, was described as a land flowing with milk and honey.

In the Middle Ages Venice was the great centre of the sugar trade. It was apparently first introduced into Great Britain about the end of the thirteenth century. In 1319 we find that 100,000 lbs. were shipped to London from Venice, and curiously enough in the same year we find a note that the price of sugar in Scotland was one shilling and ninepence half-penny a pound. That does not sound so much, but it would have purchased in this town of Shrewsbury, at the prices settled by order of the bailiffs in the preceding year, six fat geese, six hens, two chickens, four pigeons, and three dozen fresh eggs. The

* Read before the Shropshire and Mid-Wales Branch of the British Medical Association.

Spaniards carried the sugar cane to the West Indies at the end of the fifteenth century, and from that date the trade expanded with great rapidity.

Beet sugar has a far more recent history. Its production is entirely due to the work of scientific men. It was discovered by a German chemist named Maggraf in the year 1747, but it was not until 1800 that the first beet sugar factory was established in Silesia. Its cultivation in France was due to the genius of Napoleon Bonaparte, who realised its importance and stimulated its production by means of bounties.

It was not until the last century that the use of sugar really became at all extensive, and it is during the last quarter of the century that the great increase has taken place. During the last fifteen years it is said that the world's consumption of sugar has nearly doubled. The following figures show the increased consumption in our own land:

In the year 1700 the total amount consumed in Great Britain was 10,000 tons.

In the year 1800 the total amount consumed in Great Britain was 150,000 tons.

In the year 1864 the total amount consumed in Great Britain was 600,000 tons.

In the year 1885 the total amount consumed in Great Britain was 1,100,000 tons.

In the year 1900 the total amount consumed in Great Britain was 1,627,000 tons.

Another and perhaps more interesting way in which to consider it is to take the increasing amount consumed per head of population:

In 1863 this was 30 lbs. per head.

" 1866 " 38 " "

" 1884 " 70 " "

" 1890 " 86 " "

That is, nearly 28 ozs. per head per week; or an allowance of 4 ozs. a day to every human being in the British Islands. This is, however, more than is actually consumed, for a certain quantity is exported in the form of jam and biscuits, and some of it is used for the feeding of animals; 3 ozs. per head per day is probably nearer the mark. As the price of sugar is now 1½ lb., this means, roughly speaking, 2d. a week per head—or, say, a man with a wife and four children would spend a shilling a week on sugar. The tax of ½ lb. would therefore add 4d. a week to his expenditure.

This great increase in our consumption of sugar is due to its cheapness, and is one of the results of Free Trade. People still living can remember when sugar was 7d. a pound, at which price it was a luxury. The duty on sugar was reduced by Mr. Gladstone in 1864, and again in 1870 and in 1873, and was finally abolished by Sir Stafford Northcote in 1874, more than a quarter of a century ago. It is claimed that this steadily-increasing consumption of sugar has been the main cause of the greater height and weight and health and vigour of the English people which has been so specially noticeable during the last thirty or forty years. In this relation it is interesting to compare the consumption of sugar by other countries, which is given in this table:

In the year 1896:

Great Britain consumed 86.15 lbs. per head of population.			
The United States	65.50	"	"
Denmark	43.60	"	"
Switzerland	42.90	"	"
France	28.14	"	"
Germany	27.14	"	"
Holland	25.90	"	"
Belgium	22.00	"	"
Austria	16.80	"	"
Russia	11.25	"	"
Italy and Spain	7.00	"	"

It will be noticed that the Americans are the only other people who eat sugar in anything like such large quantities as we do. In fact, the Anglo-Saxon may be distinguished as the sugar-eating race. The characteristics of that race are its energy, robustness, and vigour, its pluck, and its power of endurance; and again we must notice that it is especially during the last half century that that race has multiplied so enormously and has spread over the earth, and we have seen that it is during this same half century that its consumption of sugar has so greatly increased. In looking down the list we notice that the Germans consume but little sugar; we must not forget, however, that they drink vast quantities of beer, which contains a very similar sugar, namely, maltose. Very nearly at the bottom of the list we find the Russians. A short time ago there was an article in the *Spectator* on the Slav characteristics, in which it was said: "One deficiency is a certain want of energy. The Russian has energy, it is

Classification of the Carbohydrates or Saccharides.

I. The monosaccharides formula $C_6H_{12}O_6$	{ Dextrose or grape sugar Levulose found in honey }	{ Readily soluble, crys- tallisable, sweet }	These substances are digested as such.
II. The disaccharides $C_{12}H_{22}O_{11}$...	{ Cane sugar (saccharose) Milk sugar (lactose) Malt sugar (maltose) }	{ Soluble, crystallisable, sweet }	These substances are split up in the process of digestion into the monosaccharides { Cane sugar into { dextrose levulose Milk sugar into { dextrose galactose Maltose into ... { dextrose dextrose
III. The polysaccharides $(C_6H_{10}O_5)_n$...	{ Starch Cellulose Dextrin Glycogen }	{ Not crystallisable, generally insoluble in cold water, non-diffusible, not sweet }	These substances are converted in the process of digestion into the disaccharide, maltose, and finally into the monosaccharide dextrose.

true, but not of the true Western kind, which goes on whatever the obstacle, determined not to stop till one is at the other side. The energy of the Russian is that of the undervalued man, who does not stop and does not change, but who advances languidly with halts, and with a proclivity to dying before his work is finished. Russian armies ordered beyond the frontier melt away imperceptibly, their own generals cannot say why. The cause is want of 'stamina,' that is, energy in the reservoir, more than want of supplies." I hope to be able to show that it is this very vitality, this same stamina possessed by the Anglo-Saxon, lacking in the Russian, which sugar helps to supply. It is interesting to note that the Boers are said to be particularly fond of sugar. They drink large quantities of coffee, and are accustomed to load up the cup with it, or else to eat it in the form of sugar candy while drinking their coffee.

It will be well briefly to review the chemistry of sugar and its physiological relations. Sugar is a carbohydrate, that is, a compound of carbon, hydrogen, and oxygen, in which the hydrogen and oxygen are present in the proportion (H_2O), in which they exist in water. The carbohydrate group contains the starches and sugars. The table given above shows the relation of the more important carbohydrates to one another. They are divided into three groups, the monosaccharides, disaccharides, and polysaccharides.

The great feature in the metabolism of all these carbohydrates is that they are completely oxidised in the body into water and carbonic acid, without any waste, and leaving no residue.

We must next consider the way in which cane sugar is digested and assimilated, and the use to which it is put by the tissues. Taken in by the mouth it is not acted upon by the saliva, except in so far as it may be dissolved or further diluted. In the stomach it is partly changed by the gastric juice into dextrose, and to a small extent absorbed. The greater part, however, passes into the small intestine, where it is rapidly changed into grape sugar (dextrose) by the succus entericus and by the cells of the mucous membrane. It is then quickly absorbed into the portal blood, and is carried by it to the liver, where it is stored as glycogen (a polysaccharide) in the hepatic cells. This glycogen is again turned into grape sugar when it is required for use, and in this form undergoes oxidation in the tissues, splitting up into CO_2 and H_2O , liberating kinetic energy in the process. This kinetic energy may be utilised either for the production of heat or for mechanical work.

Hence it will be seen that the chief points about sugar as a food are these, namely:

1. It is easily digested and absorbed.
2. It is readily stored up as glycogen, forming a reserve of force-producing material.
3. It is in this form readily available when required.
4. It becomes completely oxidised without any waste and leaving no residue.

But this is not all. It has been amply proved that it can under certain circumstances be converted into fat, in which form also it can be stored up in the body and be so capable of producing heat and force in the future. It is also what is called a proteid-sparing food, that is, it will save the wear and tear of the proteids of the body, being used up instead. Then, again, it is pleasant to take, and thus acts as a relish, stimulating the activity of the digestive processes. So it should be an admirable food, not indeed for building up tissues, but for producing heat and energy. It has the additional advantages

that it can be stored in a very small space, and that it will keep for a practically unlimited time. Theoretically, at least, it seems to be a very desirable article of diet. Let us see what experiments and practical experience have told us about it.

Many years ago Lawes and Gilbert showed, by fattening pigs on carefully-measured and carefully-analysed food, that fat could be and was formed by animals out of the carbohydrates. Fisk and Wislicenus showed by their mountain ascents that the carbohydrates of food are the chief source of muscular energy. Pettenkofer and Voit showed that when a man is doing muscular work he must be provided with more non-nitrogenous food than when at rest. The practice of the Japanese rickshaw carriers is a good example of this. During their periods of rest they consume large quantities of meat in order to build up strong muscles, but while actually working they subsist mainly on rice—a food consisting chiefly of an easily-digestible form of the polysaccharide starch. Pettenkofer's dictum was that for good work there is needed a muscular system well developed by the aid of an albuminous diet, and supplied by a circulation enriched with sugar derived from non-nitrogenous food.

In 1893 Mosso made careful experiments upon men with his ergograph. He found that much less muscular deterioration occurred under a sugar diet, and also found that when the muscles were fatigued and incapable of further work, a sugar diet quickly rendered them fit again. In Berlin in the year 1895 Staff-Surgeon Schumberg experimented upon various men, both of weak and of strong muscular physique, taking special care to exclude all possible influence of suggestion. He found that in half to three-quarters of an hour 30 grams of sugar restored the power of work to muscles so tired that they had previously given hardly appreciable results. His practical conclusion was that sugar, being so easily absorbed and so soon available as a source of energy, forms a veritable and most valuable muscle food, and in small doses is well adapted to help men to perform extraordinary muscular labour; and he also made the remarkable discovery that sugar is able, through its influence on the nervous system, to overcome the feeling of fatigue. Many other experiments have since been made with similar results.

So much for the results of laboratory experiments. What can we learn from the experience of mankind—Nature's own experiments—in different parts of the world?

We find the Arabs subsisting to a large extent upon dates, which contain 58 per cent. of sugar. "All live on dates—men, women and children, horses, asses, and camels, and sheep, fowl, and dogs" are the words of an old traveller. We are told that the Sumatrans go for week-long voyages in their rowing boats, taking only rice and sugar cane with them; and most valuable of all, we have the experience of the negroes on the sugar plantations in the West Indies. Mr. Root, in his valuable work on the sugar industry, says:

There is a general consensus of opinion that sugar cultivation is the healthiest in the tropics. The sugar itself is not only the most nutritious, it is also the most popular of foods. The labourer sustains himself during his exhausting toil by sucking a piece of sugar cane; a section taken home after his day's work provides the evening meal for his family, and it is during the cane harvest that the negro—man, woman, and child—is the sleekest and fattest.

Horses are now fed with sugar in Paris. It is said that a cab company in that city gives 1.22 kilograms a day to their horses with satisfactory results. In England it appears to be given to cattle more as a relish to make them consume inferior fodder. At the same time that the experiments on sugar

which we have mentioned were being carried on, men who were actively engaged in athletic pursuits were beginning to find out its usefulness. The ever-increasing army of cyclists discovered its value, not merely as a muscle food, but also as a potent and speedy recuperator in case of fatigue. Alpine climbers, too, gave up their old custom of relying on alcohol as a restorative and stimulant, and took to sweet stuffs instead—principally in the form of jam and chocolate. The Swiss chamois hunters are said also to have discovered its usefulness. A Dutch army surgeon in Sumatra placed it on record that during an expedition he had found the best means of maintaining the vigour and freshness of his soldiers, especially during long marches, was to serve to each man a generous allowance of sugar. In Holland itself Birnie advocated "sugar training" for athletes. It was tried by several rowing clubs, and it was found that the young men who took large quantities of sugar bore the training better than their fellows, and did not become "stale" or overtrained. Their example was followed by the Rowing Society of Berlin, but I have not yet heard of its being tried in Great Britain.

In December, 1897, the question of the usefulness of sugar as a food for soldiers was raised in the German Parliament, and in consequence of the discussion that ensued a further investigation took place at Metz during the autumn manoeuvres of 1898. Twenty men were selected from each company. An extra ration of 100 grams of sugar was issued to 10 out of each 20 selected. The results were conclusively in favour of the sugar eaters. They increased in weight, which their comrades did not, they enjoyed better health, and were able to support the hard work with much less distress. None were overcome by exhaustion, and their pulse-rate and breathing were less affected by exertion. They relished the sugar too, and did not get surfeited by it. The use of a lump or two was described as acting like a charm, not only against fatigue, but also in quenching thirst. As a result of these experiments it was resolved that the sugar ration for the German soldiers should be raised to 60 grams per diem. The French soldier gets 10½ grams during peace time, 21 grams during manoeuvres, and 31 grams during active service. The English soldier gets 37 grams.

I have just spoken of the unexpected stimulating properties of sugar. In practical confirmation of this fact I have already noted that Alpine climbers have abandoned the use of alcohol, and that they use sweet food instead, and we find Dr. Fridtjof Nansen saying that he considered brandy drinking in northern regions injurious, and stating that during his voyage its place was supplied by fruit and various kinds of sweets, of which there were large supplies on board the *Fram*. So it would seem that the theoretical considerations derived from a study of the chemical and physiological properties of sugar, the experiments upon animals and upon men in the laboratories, the general instinct of mankind leading it to increase its consumption of sugar wherever it can, the experience of different races in widely different climates, the energy and vitality of the great sugar-eating races, the experience of athletes, and, lastly, the experiments conducted upon a large scale in the German Army all point to the same conclusion—all tend to show the great value of sugar as an article of diet. And it does not seem improbable that the increasing height and weight and the improving health of the English people during the last half century are at least to some extent due to that greater consumption of sugar which has been rendered possible by its cheapness.

Is there any practical lesson that we medical practitioners may learn from all this? Surely there is. If sugar is such a valuable food we ought to keep the fact in mind. In the numerous cases in which nutrition is at fault we should think of it as likely to be of value—more especially in simple marasmus, in phthisis, and in that condition of malnutrition in those who inherit a predisposition to phthisis with which we are all so familiar. For growing boys and girls it is also needed, and we often find their nutrition suffering owing to a popular prejudice against it.

Dr. Clement Dukes says, "Sugar so frequently denied is an indispensable requirement for them, forming as it does their main heat-forming food, as well as the most important factor in the growth and work of muscles." In cases of anæmia I believe it is also very valuable. For the aged it is probably one of the best of foods; it is liked by them, it produces that

heat which old people lack, and as it is completely oxidised in the body it does not in any way tax the kidneys nor overload the system with waste products. For convalescents, too, it is valuable, especially for those who are wasted after a long illness. We too often forget this. We are all in the habit of giving the disaccharide maltose in the form of malt extract, and we all believe in it. Now how does this differ from the disaccharide cane sugar? Maltose is turned into dextrose in the process of digestion, cane sugar into dextrose and levulose. There is an important difference certainly; the best malt extracts contain free and active diastatic ferment, which acts upon and helps the digestion of other carbohydrate foods, helping to turn that, too, into dextrose. This is an advantage, no doubt; but if the sugar given is itself easily digested probably the advantage is not so great as it appears. On the other hand, sugar has one great point in its favour. Malt extracts cost about 1s. 6d. a lb.; sugar costs 1½d. So for our poorer patients when we cannot order malt let us at least think of sugar. And, again, when we wish any richer patients to take more sugar, and they refuse, we may diplomatically get over the difficulty by ordering malt.

During the past year I have been strongly recommending sugar to patients who I thought would be benefited by it, and I have been greatly pleased with the results. The following case is rather a striking one:

A farmer, aged 25, who formerly weighed 11 st. 4 lbs., had for four or five years been gradually wasting. Last spring his weight, before his illness, had sunk to 8 st. Then he had influenza, followed by bronchopneumonia. In April when I first saw him, he was extremely emaciated and weak, and looked as if he had advanced phthisis. When the pyrexia had abated, I still kept him in bed, and ordered that he should be given as much sugar as he would take. The amount was carefully weighed. He took 4 ozs. a day of pure cane sugar, not counting jam and cakes, which he consumed freely. He rapidly gained weight, about half a stone a week. In June I sent him away to the seaside. He then weighed 11 st. 4 lbs., but his muscles were soft and flabby. He now weighs 11 st. 10 lbs., is strong and active, hunts regularly, and works hard on his farm.

What objections are there to the use of sugar? Some are real, some imaginary. It is said to be bad for the teeth; that is an old objection. In 1598 Hentzer, a German traveller, thus describes Queen Elizabeth: "Her nose is a little hooked, her lips narrow, and her teeth black—a defect the English seem subject to from their great use of sugar." The chief answer to this objection is that the West Indian negroes, who consume sugar in huge quantities, have invariably perfect teeth—perhaps the best in the world. It is probable that sweets often do harm the teeth, but it is on account of their impurities, not on account of the sugar itself.

Then there is alimentary glycosuria to be borne in mind. If given in too large quantities, sugar can no longer be assimilated, and appears in the urine. It is well, therefore, when giving it in such large amounts, to test the urine regularly for cane sugar as well as for grape sugar.

Then cane sugar is apt to cause an undue secretion of mucus, which may cause trouble. Hence care should be taken in the case of children with "mucous disease." But I fancy it is only harmful when taken alone, not when dissolved and mixed with other food. I do not think that malt extract has the same bad effect, but believe it may often be given in such cases with advantage. The point is one about which we could wish for further knowledge. It is important, for these children are generally badly nourished and nervous, and one is loth to cut off such a useful article of food. I am quite sure, however, that such children must not be allowed to eat sweets or raw sugar. Of course, in diabetes or glycosuria from any cause no one would allow cane sugar, though it is said that levulose is harmless. Those who are suffering from obesity must absolutely avoid it, and to cut off sugar is the first step in the dietetic treatment of that condition.

Then there comes the great question of gout and rheumatism. As to rheumatism pure and simple, I have as yet an open mind. One has been accustomed to countermand sugar, but I am not sure that this is not merely a prejudice. In gout the indication is more clear. Those who are gouty and fat must avoid it like poison—they suffer from an inability to utilise fats and carbohydrates; but those who are gouty and thin—who are unable to utilise their proteid food—are in a different category. One must strictly limit their nitrogenous food, especially red meat, soups, etc., but one may give them the sugars and starches without much fear. Of course there

are many who do not fall definitely into either class. In these the diet must be determined more or less experimentally, and probably will have to be varied from time to time.

A PRELIMINARY NOTE ON THE HIBERNATION OF MOSQUITOS.

BY

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IN THE BRITISH MEDICAL JOURNAL of April 13th Dr. M. J. Wright records some interesting experiments concerning the resistance of mosquito larvæ to cold. It is truly a remarkable feature that larvæ, both *Culex* and *Anopheles*, are able to withstand a temperature of about 4° C. for a period of two weeks.

Early in December, 1900, Mr. T. V. Theobald, of Wye, Kent, sent a number of *Anopheles* larvæ to Major Ross, which have been kept continuously in a greenhouse at a temperature of from 15° C. to 32° C., and although they are often seen feeding on the green protococcal growth supplied, they show apparently very little increase in size, and none have as yet changed into pupæ.

Dr. Wright infers from his observations that the larval form is that in which "hibernation" takes place, never having found adult mosquitos during the winter months. Here his observations differ most markedly from ours, which we wish now to record in a short preliminary account. It may be mentioned that throughout the winter session a supply of *Culex* adults has been obtainable for class purposes at this school.

On February 17th, during a period of very cold weather, four *Anopheles* were caught at a farm some 13 miles from Liverpool, in North Cheshire. A large number of *Culex* (four species) were also captured here. The *Anopheles* were identified by Mr. T. V. Theobald as *A. maculipennis*. The mosquitos were found in the following situations: cellar, dairy, cheese room, pantries, lumber rooms, and in some disused bedrooms at the top of the house; also in the wash-house and whey-tankhouse abutting on the house, and in the coach-house, tool sheds, and privies at some distance away. No mosquitos could be found in the stables, cowsheds, pigsties, haylofts, and henpens. Many of the farmhouses of this district of Cheshire are old, and have no damp-proof courses. In the disused cellars the walls and the beams supporting the ground floor were soaking with moisture, and small ferns grew in the crevices of the tiled floor, and patches of moss and mould on the surface of the walls. Here thousands of mosquitos, chiefly *Culex*, blackened the walls and rafters. In the dairies they were found on the damp areas, resting on and in the crevices of the plaster; very few were seen on the drier parts. Similarly, in the other places on the damp portions many mosquitos were observed, especially behind boxes, slates, boards, barrels, and other articles resting against the wall.

Since the date mentioned, *Anopheles* have been collected on four occasions from farms in the North and Mid-Cheshire. The Mid-Cheshire farm is at a distance of about 35 miles from Liverpool, and here *Anopheles maculipennis* occurred in about the same number and in similar situations as in the North Cheshire farms. About 20 *Anopheles* were collected at each farm.

In all these sites it was noted that the majority of the mosquitos of the genus *Culex* were found on the parts of the damp walls near the ground, while *Anopheles* were generally caught near the ceiling.

During the coldest weather the attitude both of *Culex* and *Anopheles* was peculiar and characteristic. The under surface of the thorax and abdomen was applied closely to the walls, while the legs were stretched straight out, almost at right angles to the body. The absence of the characteristic attitude of *Anopheles* (at an angle to the surface), and the fact that both *Culex* and *Anopheles* assumed the peculiar outstretched attitude, made it difficult at first sight to distinguish specimens of the two genera, especially since among the *Culex* was a species having wings spotted somewhat similarly to *Anopheles*

(*Culex annulatus*); but on close inspection, even in the positions described, the characteristic angle, seen in side view, between the direction of the head and thorax, and of the abdomen of *Culex*, served to distinguish the genera. In this peculiar attitude the mosquitos were very difficult to rouse; the mouth of a bottle could be easily placed over them without disturbing them, and, in fact, one had to lift them up on to their legs by the rim of the vessel, and then no attempt was made to fly; they would crawl lazily along the neck of the bottle. How long these mosquitos remain in this position during the winter months is not very easy to determine, but it was noticed that many of the *Culex* on the damper patches were wholly or partially enveloped in a thick mould which had grown in and around their bodies, thus fixing them in the attitude described.

On very cold days this attitude was observed even in the cages in which the mosquitos had been kept. On warmer days at the farms, and on taking the caged mosquitos into a warm room, they reassumed their ordinary attitudes.

It has been mentioned above that mosquitos were not found, or only very rarely, in stables, pigsties, and henpens frequented by animals. Such places are generally comparatively dry, constantly disturbed, and warmed by the presence of horses and cattle at night.

A number of the *Anopheles* collected by us have been kept in a damp cage in the animal house of the Thompson-Yates Laboratories at a temperature of 5° to 10° C., no food having been supplied; only two of the number have died during the month we have kept them in this condition.

There can, therefore, be no doubt that mosquitos of both genera "hibernate" during the winter months in England, and it seems certain that not only the adults but, from Dr. Wright's experiments, the larval forms also provide for the continuation of the species during the cold weather.

It is of interest to note that among the numbers of mosquitos of both genera collected by us, a male was never found; and moreover that all the females with which we carried on a number of experiments, or which we dissected, had been fertilised (proved by the presence of spermatozoa in the spermatheca, or by the hatching out of larvæ from deposited eggs). A number of experiments relating to the bionomics of the English *Anopheles maculipennis* are at present being undertaken, and we hope to be able to communicate the detailed results at a later date. Some interesting facts may, however, be now recorded.

If these mosquitos be kept in a dry cage they die in a few days, whereas, as stated above, they can be kept probably for months in a damp cage in the cold, during which time they preserve what we propose to call the "hibernating" attitude. On introducing them into a warm room they quickly become active, and both *Anopheles* and some species of *Culex* eagerly feed on blood on inserting the hand into the cage darkened by covering with a cloth. They then feed eagerly every day for four or five days, but subsequently only occasionally. Eggs were laid on the fifth, sixth, seventh, and eighth days, which hatched out in 24 or 48 hours. It was noted that many of the *Anopheles* died after depositing a batch of eggs.

We have further observed that having once fed on blood it is necessary to continue the feedings at least every other day, otherwise the ovaries cease to develop and the insects die though water is supplied. This confirms our experiments made in West Africa,¹ with this difference, however, that there, by regular feeding, we were able to keep *Anopheles costalis* and *A. funestus* alive for a considerable period; while in the present case of *A. maculipennis*, which had been hibernating, most of them died soon after laying eggs.

REFERENCE.

¹ Report of Liverpool Malaria Expedition in Nigeria, 1901, pp. 37-45.

TRANSMISSION OF SMALL-POX BY LETTER.—An epidemic of small-pox at Saginaw, Michigan, is said in the *New York Medical Journal* of April 6th to have been traced to a letter. The official in charge of the quarantine squad traced the fact that the first patient was a young lady who had recently had a letter from her lover, a soldier of the United States army in Alaska, in which he stated that he was just recovering from small-pox. The epidemic, apparently started by this letter, is said to have had altogether 34 victims.