THE DANGERS OF CALMETTE'S OPHTHALMO-REACTION.

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SOME two months ago I summed up my experiences of the ophthalmic-reaction, in a paper read to the Coventry Division of the British Medical Association, and published in this JOURNAL.¹

My conclusions were that the reaction, though sometimes obtained in the non-tuberculous, and sometimes not obtained in the certainly tuberculous, was a useful aid to diagnosis, and that if the eye used for the test were healthy there was no danger to be feared from a $\frac{1}{2}$ or a 1 per cent. solution of tuberculin. Three of the cases, however, which I quoted in the paper have since done so badly that I am now of the opinion that the dangers are very real, and that, as the reaction is by no means conclusive, it is hardly a justifiable method of diagnosis.

The history of the cases is shortly as follows:

CASE I.

R. S., aged 4, female, had been in the Coventry and Warwickshire Hospital for a month suffering from a disease of the ankle, which was regarded as tuberculous in nature. Both eyes were absolutely normal.

On March 6th a drop of 0.5 per cent. solution of Calmette's tuberculin was placed in the right eye. No change was noticed. On March 9th the instillation was repeated with a 1 per cent. solution. The next day there was a decided reaction. The caruncle was swollen and the eye injected. This conjunctivitis became rapidly worse; there was a copious discharge and intense inflammation. Later there was chemosis and some swelling of the right eyelids. The conjunctiva was turgid and thickened, and the condition of the lids was very similar to that seen in some varieties of trachoma. This intense conjunctivitis gradually yielded to treatment, but much photophobia and lachrymation persisted.

Early in April an elongated phlyctenule was present at the outer aspect of the corneo-scleral margin. This condition did not improve with yellow ointment, but gradually got worse. At the end of April, just inside the phlyctenule, there were three distinct patches of interstitial keratitis, and in the very centre of the cornea an ulcer appeared the size of a large pin's head, which stained deeply with fluorescein. The eye was put under atropine and tied up. This ulcer proved very chronic, but neither it nor the interstitial keratitis showed any tendency to spread. After a fortnight's treatment with atropine, yellow oxide of mercury was added to the ointment, and the condition gradually cleared up.

At the present time there is a small central nebula, the rest of the cornea is clear, and the eye is no longer injected.

As a result of the instillation of tuberculin, a typically tuberculous process was set up in a perfectly healthy eye, and the central nebula will considerably reduce the visual acuity of the eye.

This case is strictly comparable to one which has been published by Arnold Knapp.²

CASE II.

B. M., aged 7, was admitted to the hospital on March 2nd suffering from a disease of the knee, probably tuberculous in nature. Both eyes were absolutely normal. On March 9th a drop of 1 per cent. solution of Calmette's tuberculin was placed in the right eye. This was followed by a violent reaction.

The conjunctivitis developed rapidly and became very chronic with much thickening of the palpebral conjunctiva. Early in April a very chronic phlyctenule appeared, just as in the last case, which did not yield to yellow oxide. Only now, late in May, has the condition cleared up, and there is still some lachrymation and photophobia. Fortunately in this instance there was no implication of the cornea.

CASE III.

A little boy, with a tuberculous ankle. A drop of $\frac{1}{2}$ per cent. solution was used and no reaction followed. A second of 1 per cent. was given. The result was a violent muco-purulent conjunctivitis in both eyes which became chronic and resisted all treatment for two months. In fact there was no improvement till the weather permitted the boy to be out of doors nearly all day. In this case also there was no pre-existing eye disease.

Erlanger,³ of Berlin, has carried out a series of tests with a very weak solution (1 to 10,000) of tuberculin. He considers that when there is any pre-existing ocular disease whatever it is most dangerous to use a strong solution until the 1 to 10,000 solution has been tried and has failed. He has obtained a reaction in several cases with this dilute reagent.

The observations of Napier⁴ show that even when there is no reaction the instillation of tuberculin produces

certain changes in the ocular tissues. He has published two cases in which there was no reaction to Calmette's test, but when tuberculin (T.R.) was injected hypodermically ten and twenty-one days later, a local reaction was noticed in the eye which had previously been treated with tuberculin.

Considering, therefore, that the test is often deceptive and may do grave damage to the eye (for my cases are only an addition to what is now a fairly long list) it seems hardly justifiable to use it any longer. I personally have abandoned the method, and am now employing injections of old tuberculin (P.G.) to help to decide the question as to whether a disease is or is not tuberculous in nature.

In a recent case of interstitial keratitis and choroiditis which, upon clinical grounds, was considered to be almost certainly syphilitic, but which, in spite of full doses of mercury, was rapidly going from bad to worse, I obtained a typical reaction both general and local, and was able to decide that the disease was tuberculous, and that it should be treated with tuberculin. Calmette's reaction would have only decided that the patient was tuberculous; the injection of P.G. gave a clear local reaction, and pointed to the ocular lesion being tuberculous.

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THE TRAINING OF TEACHERS IN PERSONAL AND SCHOOL HYGIENE,

AS CARRIED OUT UNDER THE GLASGOW PROVINCIAL COMMITTEE.

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A very considerable amount of interest is being taken at the present time in the training of teachers in hygiene, and in England, where medical inspection of school children is now becoming general under the Administrative Provisions Act of last year, it is recognized that for the successful working of such an Act a good deal of help must be asked for from the teachers. Apart altogether, however, from the question of the inspection of school children, no educational system can be satisfactory where the teachers are ignorant of the laws of health. So definitely is this accepted that provision is now made in practically all training colleges for instruction in this subject, but the various syllabuses differ a good deal in the ground they cover.

I communicated to the International Congress in School Hygiene held in London in August, 1907, a short paper dealing with the subject of "The Practical Training of Teachers in School Hygiene," which elicited a good deal of discussion and was favourably received. It has occurred to me that it would be an advantage if now, towards the close of another year of work, some statement were made regarding the whole scheme of work in this department, as carried out under the Glasgow Provincial Committee. The course in hygiene is given in the first year of the student's training, whether that student be at the training colleges or studying at the university with a view to graduation in arts or science.

Two hours a week both in summer and winter are allotted to this subject, so that each student receives between 60 and 70 hours' instruction during an annum academicus. In the syllabus which I drew up last autumn at the request of our committee, arrangement was made for both systematic and practical work—the latter being regarded as a most important feature of the scheme. Forty hours, approximately, are devoted to systematic teaching, and twenty-five to meetings for practical work. For the lectures the students are divided into classes numbering as a rule from 70 to 80, while for practical work further subdivision into groups of about 25 is carried out, it being our experience that it is difficult to handle a larger subdivision than this. The whole work is carried out by a chief lecturer and two assistant lecturers.

I. *Systematic Teaching.*

It may be stated at the outset that we devote none of the time at our disposal to physics, chemistry, or elementary biology. Every student receives special instruction in science and mathematics, the time allowed for these at the training colleges at present being six hours per week in winter and five in summer. We spend no time, therefore, discussing the properties of matter, the relation of pressure and temperature to the volume of gases, the movements of liquids and the like, but proceed at once to deal with our own subject.

A good deal of discussion took place at the London Congress regarding the amount of elementary anatomy and physiology that should be included in such a course. It seems to us that every student should get a thorough grounding in the elements of these subjects, and we have always aimed at this, endeavouring to correlate the scientific teaching with the actual phenomena which are bound to present themselves to the teacher in the active work of his profession. Two lectures are given, in the first place, to the study of the bony framework of the body. An excellent articulated skeleton has been got for this department and is used for demonstration purposes. The bones and joints are considered in detail, and attention is directed to the differences between these structures in childhood and adult life, and to the bad effects which adverse influences (malnutrition, improper feeding, bad posture) may have on the bones of the young. We recognize that a good knowledge of the bones and joints forms the basis of all teaching of physical exercises. The third lecture is devoted to the circulation of the blood, with a full consideration of the heart, its chambers, valves and action, and of arteries, capillaries, and veins. We make use here of excellent models which were got from Berlin, of diagrams, and occasionally of dissections. The nature and composition of the blood are described, and attention directed to the part which its colouring matter plays as an oxygen carrier. The relation of this to anaemia is made clear, and a few words are added on the lymphatic system. In the next lecture this anatomical study is followed up by some teaching on the special need of healthy blood and an active circulation in childhood in relation to growth, tissue change, and bodily and mental exertion.

Certain differences between the circulatory systems of the child and the adult are pointed out, and the effect of undue physical exertion on the heart of a child is made clear.

In the fifth lecture the students consider the respiratory system. We go into this with some fullness, as it leads up to that most important practical subject—ventilation. A general statement is first made on the function of respiration, on the necessity of oxygen for all vital processes, and on the special needs for this body-food on the part of the actively-growing child. The composition of the atmosphere is detailed, and something is said about the pollution it suffers from in large cities. The respiratory apparatus—air-passages and air-cells—is then fully described, and the importance of discouraging mouth-breathing is insisted on. The circulation of the blood in the lungs and its aëration there are carefully discussed, and a few words added in conclusion on the action of the diaphragm and intercostal muscles—that is, on the mechanism by which respiration is effected. This leads up to a consideration in the next lecture of the importance of the development of a good shape of chest in the young and of the beneficial results of breathing exercises. Certain differences in the respiratory movements of the child and adult are touched on and then a precise account is given of the changes which air undergoes during respiration, and of the effects on health produced by breathing air vitiated in this way.

The seventh and eighth lectures are devoted exclusively to a study of the practical problem of ventilation, illustrated by the use of models and diagrams. The students receive all the necessary data for working out simple ventilation problems, and the question of natural *versus* mechanical ventilation is fully discussed. A considerable amount of time and detail is given to this subject, it being recognized that adequate ventilation of schools constitutes one of the fundamentals of successful education. In the ninth lecture a survey is taken of the chief methods of heating schools, and their advantages and disadvantages are duly weighed. Similar treatment is meted out to the systems of lighting, both natural and artificial, and in the

latter part of this lecture attention is directed to the question of dust in schools and its relation to infectious diseases, fog production, and so forth. Practical demonstrations on these points are given by exposing gelatine plates in the room during the lecture, and showing the students later on the colonies of organisms which have grown and by the producing of mist in a large flask filled with dusty and moist air, by suddenly reducing the pressure and so lowering the temperature.

At this stage, in order that practical work may be commenced, one lecture is given up to a detailed study of school structure, with special regard to the requirements of the English and Scottish codes with reference to floor-space, heating, lighting, desks, general fittings, lavatories, and so forth. In this connexion it is also advisable to say something very definite regarding the proper cleaning of the schools and on the use of sawdust well moistened with an antiseptic in sweeping operations. The eleventh lecture is the last which deals directly with practical sanitation, and in it some teaching is given on the importance of an abundant supply of good water for health, and on the ways in which water may become polluted. The principles which underlie efficient drainage are enumerated, and the effects of bad water and sewer gas on health are briefly stated. The students are taught that in any epidemic of typhoid, summer diarrhoea, or the like, all water and milk should be boiled.

We now proceed to give some account of the physiology of nutrition, and a lecture is devoted to a brief survey of the various classes of foodstuffs and their functions, with special reference to foods most suitable for the growing child. The proteid, fat, and carbohydrate values of some of the commoner foods are given, and the students are shown how dietaries are worked out. The next lecture is found all too short for an account of the physiology of digestion—mastication, insalivation, and gastric and intestinal digestion—and of the assimilation of food and its incorporation into the tissues. This lecture can easily be illustrated by simple experiments. This is followed by a lecture which treats in the first place of improper feeding in infancy and childhood, and the relation of this to the production of rickets, anaemia, scorbutic conditions, and skin eruptions. The latter part of this lecture treats of the waste of the body and how it is got rid of by the skin, lungs, kidneys, and bowels. A few definite hints are given as to the importance of the formation of regular habits in childhood in relation to the last-named organs.

In the fifteenth lecture we discuss the education of the present girl pupils—the future wives and mothers—in simple dietetics and plain useful housekeeping. It is then pointed out that the general nutrition and the progress of children may be gauged by careful periodical weighing and measuring, and each student is supplied with the standard averages for height and weight at school ages of the Anthropometric Committee of the British Association. A brief reference is made to the relation of the physical condition of children to the size and nature of the houses they come from, as brought out in the report issued last year by Captain Foster and Dr. Leslie Mackenzie.

Lectures XVI and XVII are entirely given up to the nervous system, commencing with the general anatomy and physiology of the brain, spinal cord, and motor and sensory nerves. The development of the brain in early life is touched on, and a little is said on the brain centres in relation to motion and sensation. Reflex and automatic action are not neglected, and we have something to say on the physiology of “restlessness” in young animals. In conclusion, we touch on the subject of the action of voluntary muscles, on their response to stimuli, and on their power of undergoing healthy hypertrophy. Lecture XVIII is chiefly devoted to a study of the important subject of fatigue, especially in relation to teaching; and the various intrinsic and extrinsic factors that contribute to it are carefully analysed. Something is told of the work of Waller and Mosso in this field, and the use of the ergograph is explained. The lecture concludes with some teaching as to the hours of sleep needed by young children.

In Lectures XIX and XX we deal with the skin, the teeth, the nails, and the hair. The importance of local cleansing and of regular general bathing is insisted on, and school baths are specially discussed. The question of clothing is also treated of here. In Lecture XXI

the question of the teaching of hygiene in primary and secondary schools receives consideration, and we discuss the scope of the work suited to different ages and classes. A little is said here, also, on the teaching of temperance in schools, and on juvenile smoking and its deleterious effects on the bodily, mental, and moral powers.

The important subject of vision receives the attention it merits, and the anatomy of the eye and the physiology of vision are entered into with all reasonable fullness. It is thus a comparatively simple matter to make the students understand what is meant by hypermetropia, myopia, and astigmatism, and the effect of these conditions on the eyes themselves as well as on the general health. The factors that contribute to the onset or development of defective sight during school years are adequately treated of, and the young teacher is instructed how to abolish or mitigate these factors. Two lectures usually suffice for systematic teaching on this subject, as this teaching is amplified by practical work. In like fashion the twenty-fourth lecture is devoted to the subject of hearing, to affections of the throat, such as enlarged tonsils and adenoid growths, and to the effect which these (especially the latter) exercise on speech, respiration, mental quickness, and general health. Then follow two lectures dealing with a few of the commoner non-infectious illnesses of a school age. To those who object that it is a mistake to turn teachers into amateur doctors, we reply that we do not attempt this any more than we try to turn them into plumbers. We are convinced, however, that it is a good thing for teachers in elementary schools to know something of the commoner ailments of childhood, for in many poor districts if the teacher does not interest himself in the health of the children no one else will. We say a little, in simple language, on such matters as headache, earache, and toothache; on habit spasm, nail-biting, and chorea; on chilblains and nose-bleeding; on indigestion, diarrhoea, worms; and lastly on rheumatism. Lecture XXVII deals with bodily deformities, their mode of production, and the ways in which they may be ameliorated by diet, posture, and physical exercises during school life. A little is said at this stage on the subject of the medical inspection of school children and the various modes in which the teachers may render assistance.

Lectures XXVIII to XXXI inclusive are given up to the important subject of infectious diseases in school life. All the ordinary infectious illnesses are treated of, and special attention is directed to such points as their early symptoms, their modes of spread, the quarantine time for each, and the earliest period of safe return after an attack. Another lecture has for its material the vegetable and animal parasites of the skin and hair, while in the thirty-third we are entirely concerned with the great question of tuberculosis.

It is felt that it is desirable the teachers should have some knowledge of ambulance work and be able to render first aid in case of accident occurring within the precincts of the school. Accordingly three or four lectures are profitably given over to this matter, and instruction is given on first-aid relief for sprains, dislocations, fractures, bleeding, burns, and drowning, or other forms of asphyxia. The course is concluded with two or three lectures dealing with the anatomical and physiological basis for the exercises of the physical code, in which we run over the great muscles of the back, loins, chest, shoulders, abdomen, and upper and lower limbs, giving the action of each, and thereafter the great general movements are considered, and the appropriate muscles for each are pointed out and classified. This brings us to the end of what is, I believe, a sufficiently comprehensive scheme of systematic work.

II. Practical Instruction.

No scheme of this kind, however, can be regarded as satisfactory which does not provide for practical teaching in hygiene, especially in that pertaining to school life, and our Provincial Committee properly makes it a *sine qua non* that every student shall receive instruction of this kind. Indeed some twenty-five hours are allotted to this part of the work, but a few of them are utilized for revision. It is not intended to detail our practical syllabus in great fullness, but to indicate something of the work we accomplish.

For the purposes of this work we divide up our students

into subsections of twenty-four or twenty-five each, and deal with about two dozen of such subsections each week through the session. We commence by visits to schools of various types, from the newest in design and equipment to those of the most obsolete pattern (though these are becoming rarer every year). The students are encouraged to use their eyes, and are instructed how to make practical observations. They will, for example, in an empty class-room measure the floor area, ascertain the ceiling height, and calculate the cubic space per child. The window area is measured and its ratio to the floor space ascertained. They are asked if the light is adequate, if it comes from the proper direction, and if it is properly distributed. In a room actually occupied the temperature is noted, attention paid to the freshness or otherwise of the room, and to the mode of ventilation actually in use. Schools are visited illustrating both natural and mechanical systems of ventilation, and in the latter instance the students visit the fans and see the whole apparatus at work. In the schools they inspect the desks, blackboards, walls, and general furnishings, and a kind of oral examination is kept up during the whole hour's visit. Two or three meetings are specially devoted to this kind of work, but in every school visited thereafter for other purposes, a few words are said on ventilation and lighting at least. Nearly all the subsequent visits for practical work are devoted to the study of the children. On one day it is muscular development and general nutrition that claim attention, on another it is posture and gait. Something may be said and noted on weariness and fatigue in almost any class visited, and the extrinsic and intrinsic factors that contribute to it can be determined. Every student is then taught how to examine the throat and to recognize enlarged tonsils, and the general and local conditions suggestive of adenoids. The effect of the latter on speech is clearly demonstrated. Rickets receive careful attention in order to impress on the students the crippling effects a preventable disease may have, and the question of enlarged glands and their relation to tuberculous infection is not neglected.

In order that teachers may help in the work of medical inspection of school children, especially in the way of collecting and tabulating physical data, we spend two meetings on practical work in weighing and measuring children. Height and weight are carefully ascertained, compared with the standards, and the differences noted. We usually teach the students also how to take the length and breadth of the head, and how to work out the classification as dolichocephalic, mesocephalic, or brachycephalic. Two days are devoted to the important matter of eyesight testing, and the class has ample opportunity of practically becoming acquainted with the use of the test-cards for far and near vision. Another day is given up to the subject of hearing, and to the testing of that sense by the watch and by whispering. We do not neglect such practical points as the hair, the skin, the teeth, and the clothing, and observations are made in connexion with all of these. Our great object is to get the students to observe for themselves, and to help them to interpret correctly what they see, and to correlate these various phenomena with their practical work as teachers. If possible, we like to take the classes to visit special schools, particularly those for physically and mentally-defective children, in order that they may see the effects of bad nutrition in early life and adverse home conditions upon the mind and body, and also the special means of instruction given in these schools. Twice during the session each student fills up the details of a schedule for the physical examination of school children, first of all on a somewhat restricted scale, after, perhaps, ten meetings for practical work; the second, which is thoroughly detailed, at the end of their course. One of the most conclusive and satisfactory proofs of the progress our students are making in this subject is to be found in the excellent way in which these schedules are filled up by young men and women who, seven or eight months earlier, had practically no knowledge of the subject at all.

I have given our scheme in some detail because, taking it all round, it has been found to answer well, and because I believe it may be of assistance to others. This work, however, could not have been carried on so successfully had I not, on the one hand, received every support and an adequate supply of teaching material from our Provincial

Committee, and, on the other, been favoured with two very helpful, able, and conscientious assistant lecturers, in the shape of Dr. Agnes Cameron and Dr. David McKail.

The practical work is rendered possible by an arrangement between the Provincial Committee and the school boards of Glasgow and Govan, whereby certain schools in these areas are rendered available for instruction of this kind.

SEVENTY-SIXTH ANNUAL MEETING

OF THE

British Medical Association.

Held at Sheffield on July 24th, 25th, 27th, 28th, 29th, 30th, and 31st.

PROCEEDINGS OF SECTIONS.

SECTION OF NAVY, ARMY AND AMBULANCE.

Lieutenant-Colonel EDMOND MONKHOUSE WILSON, C.B.,
C.M.G., D.S.O., R.A.M.C.(retired), President.

PRESIDENT'S ADDRESS.

THE PRESIDENT, after extending a welcome to the members of the Section, said that he had received letters of regret from Sir Alfred Keogh, Inspector-General Porter, Director-General R.N., Colonel Trimble, and Fleet Surgeon Gaskell, Vice-Presidents. He informed the meeting that for the first time invitations had been sent to Directors-General of foreign countries, and courteous replies received from Vienna, Christiania, and The Hague, and that they had the pleasure of welcoming among them Staff-Surgeon Minter, of the Empress Victoria's Grenadier Guards, who had come at the request of the Director-General of the German army, also Lieutenant-Colonel Fotheringham, of the Canadian army, who they hoped would take part in their discussions. The President stated, in conclusion, that he had just received a letter from that veteran leader in ambulance work, Surgeon-Major G. A. Hutton, of Leamington, who was unable to attend in consequence of increasing weight of years. He suggested that they should send a letter of thanks and good wishes to Major Hutton.

THE INFLUENCE OF ALCOHOL IN THE SERVICES.

By Lieutenant-Colonel A. M. DAVIES, R.A.M.C.

BEFORE considering the subject of the influence of alcohol in the army, I think it advisable to define the position that I venture to take up as regards the consumption of alcoholic beverages in general; and this entails a reference, however brief, to the physiological aspect of the question.

Alcohol is both a food and a poison; that is to say, it can be oxidized within the body into carbon dioxide and water, so producing heat and energy, and therefore acting as a food; while, if taken in excess, after a preliminary and transient stimulating effect, it soon acts as a powerful depressant, and eventually as a paralyser of the nerve centres.

As to its use as a *food*, there are so many other articles of food of equal, and greater, value as a source of heat, and free from the peculiar characteristics of alcohol, that it cannot be considered either necessary or advisable simply from the dietetic point of view. As an *adjunct to food*, on the other hand, there can be little doubt that it may act beneficially by stimulating the flow of the saliva and gastric juice, in the way of a condiment or appetizer, taken in strict moderation, according to the apostolic injunction; but this applies to the elderly or weakly, or to the sick, not to the healthy nor to the young and vigorous, such as compose the naval and military forces, whose case we are now considering. For the healthy young adult, it must be admitted, or asserted, that alcohol is in no way, and under no circumstances, a necessity; perfect health and vigour

of body and mind can be maintained without any indulgence whatever in alcohol in any shape or form.

I.

The question as to whether alcohol is to be regarded as a food in any accurate sense has been much debated in recent years; and as there are differences of opinion, and considerable divergences of statement in the current literature on the subject, the position taken up by the present speaker may be shortly defined.

Liebig had long ago suggested that alcohol is an aliment analogous to sugar, and capable of being similarly burned up in the system, with the production of heat and energy. But many observers, finding that it is excreted in the urine, perspiration, and expired air, came to the opposite conclusion—namely, that it is not utilized in the body, and is therefore in no true sense a food. It was especially Perrin who endeavoured to show (1864) that alcohol does not become oxidized within, but only passes through, the system, "fixing itself momentarily in the nerve centres, which it excites or intoxicates, to be slowly eliminated afterwards by the skin, lungs, and kidneys," either as alcohol, or oxidized only to a very small extent in the state of aldehyde. It was also found, or thought to be found, that under the influence of alcohol the quantity of carbon dioxide expired was diminished, and this appeared to support the opinion that alcohol is not oxidized within the body. Subsequently, however, Anstie, Dupré and others, Parkes and Wollowicz (1870-72), determined that alcohol is excreted unchanged only when it is taken in relatively large quantities; and that when the amount is small, oxidation and utilization do really take place within the body, the alcohol acting as an aliment—not, of course, a tissue-former, but a producer of heat and energy. Owing to the difficulty of making exact quantitative determinations of the substances excreted, very different results have been arrived at by different observers; and it is only within quite recent years that the question can be said to have been definitely settled on physiological evidence; even now there are many authorities who hold a view contrary to that here set forth. Sir Thomas Fraser, of Edinburgh, in 1901 laid down that (1) alcohol is very easily oxidized; (2) after ingestion of alcohol, the output of carbonic acid and the intake of oxygen are increased; (3) only an insignificant amount of alcohol is to be discovered in any of the excretions. Such facts as these show that alcohol is absolutely burned up in the body, and must therefore necessarily generate force and energy; it is, indeed, more readily burned up than either carbohydrates or fat.

The chief experimental grounds on which we may base the opinion that alcohol is really a food are afforded by the researches of Atwater and Benedict, published in 1902. These observers first established a diet for themselves such as would maintain their weight, and the heat they evolved, at a constant level; the experimenters were enclosed for several days in a respiratory calorimeter, the total amount of energy produced by the food consumed being measured in the form of heat. Then a certain quantity of alcohol (namely, the value of a litre of wine in twenty-four hours) was substituted for an equivalent, or isodynamic, quantity of sugar or starchy material, and the calories (that is, work done or energy produced) again measured. Lastly, a return was made for three or four days to the original diet, without alcohol, and the same observations repeated as a check or control. It was established that the quantities of heat produced were identical (almost to a thousandth part) both when alcohol was taken, and when an isodynamic quantity of sugar or starch was consumed. Subsequently, by means of a motor cycle combined with an ergometer in the calorimeter, the mechanical work of the body was measured and found to yield the same amount of heat, both when alcohol was taken and when it was not. The potential energy of alcohol was transformed into kinetic energy in the body as completely as that of any ordinary nutrient material; except for the energy of the external muscular work, the whole of the food energy, including that of the alcohol, left the body as heat, and must necessarily therefore have been transformed into heat within the body. Only 1.9 per cent. of the alcohol ingested was eliminated by the lungs, skin, and kidneys. The radiation of heat from the body was found to be but very slightly greater