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ON THE PLACE OF FISH IN A HARD-WORKING DIET WITH NOTES ON THE USE OF FISH IN FORMER TIMES

BY

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"Explanation follows impulse."

"If their money spent in food were laid out to the best account, and if they were able to cook the food in the most useful manner without waste, their incomes would go a long way further in preserving them in health."

From Dr. G. BUCHANAN'S "Report on Health of Operatives."
Parliamentary Papers, 1863, xxv. p. 309.

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PREFACE.

THERE is an old anecdote told of a clergyman who used, after writing his Sunday sermon, to read it through to his cook, feeling sure that if she could understand it his congregation would.

Having considerable doubts as to whether the parts of this book which refer to the amounts of Carbon, Hydrogen and Nitrogen in foods would be understood, I have read them to many whom I have taken to be fair types of the intelligence of the kind of readers I have had mostly, though not solely in view—the well-informed artizans who use public libraries, and their wives to whom they retail what they have read. The result of these various interviews has been that I have received many suggestions to put in fuller explanations in one place, to leave them out in another, because "everybody knows it," to mention where Carbon and Hydrogen and Nitrogen can be seen as it is, "no use talking to people about things they cannot see," or not to trouble about chemistry at all, but to tell people how to get cheap fish and explain how to get over little domestic difficulties about fire-places and hobs and frying-pans I had never dreamt of.

I have realized the beauty of the old Greek fable of the man and his sons and his donkey, far more vividly than I ever did as a schoolboy. Though I find there are still parts which to some are not clear, I fear I must let the book go as it is.

It is no new experience that you can explain things better by showing them than by writing about them, and where I have been allowed to burn candle ends, collect Carbon on clean plates, mess tumblers by blowing into lime water, dirt shovels with sulphur, make candles of fat and do such other things as are described in pp. 11 to 16, everything has seemed intelligible.

To those who are young enough not to resent a word of advice, I would say, do the simple experiments mentioned before attempting to read the book through.

It will save the time of those who already have acquaintance with the chemistry of foods to commence at page 25.

I respectfully commend p. 36 to the consideration of those who have the management of public dietaries.

ON THE PLACE OF FISH

IN A

HARD-WORKING DIET.

THE astonishment of Molière's much-quoted M. Jourdain in 'Le Bourgeois Gentilhomme,' on learning that "prose," of which he so wanted to know the meaning, was what he had been talking all his life, might probably find a parallel in the minds of many people, if, on asking what Carbon, Hydrogen and Nitrogen mean, they for the first time learnt they had been living on them all their lives—that though we find them doing many other things in the world besides being our food, our bodies are to a large extent made up of them—and—that it is the union of them in our bodies with the Oxygen we breathe that gives us the power to do any work at all, that keeps up our warmth, maintains our circulation, and performs other functions essential to our animal life.

We live on Carbon, Hydrogen, Oxygen and Nitrogen.

If they further learned how close seems to be the connection between the power to do hard work of different degrees and the proportions of Carbon, Hydrogen, and Nitrogen taken in food, and that many of our public dietaries have been for some years past calculated on the knowledge obtained about this

And the amounts of them we require vary with the amount of work we do.

connection, astonishment might be followed by a desire for information on the subject.

How can these facts be simply explained?

The intention of this part of the book is to set out information for those in whom such a desire arises, and to do so in a simple way. But at the outset there is felt this difficulty:—What may be considered a simple way?

Difficulties of explanations often arise from a want of mutual understanding about the sense in which words are used.

The saying has been often repeated, that if there is anything you have to explain, and fail in trying to explain it to the first man you come across in the street, you must regard yourself as not a clear or good exponent. This does not, however, point out that, unless you know beforehand something about the stock of knowledge possessed by the man you meet, there may be some time taken up in finding out whether he understands what you mean by the words you are using. Many difficulties in explanations arise from a want of mutual understanding about words used.

For example, a man may be able to explain in a way that would be quite intelligible to most of his companions the series of events that led to his book on the Derby coming out so differently from what he had confidently expected. But if he endeavoured to relate his disappointments to the first man he met in the street he might find it requisite to give him an explanation of terms he was using, though they are often to be seen in columns of sporting news in the daily press. He might by degrees even find that he would have to go so far as to point out that the meaning of horses starting at 5 to 2, 3 to 2, or 7 to 2, has nothing to do with the meaning railway porters would expect passengers to understand by the same words in reference to the starting of trains, or that a horse's "price at starting" would have no reference to the cost at which it could be purchased even in a "selling stakes" race.

If you want to explain to the first man you meet, so that it may be of any practical use to him in the arrangement of his daily diet, what is the *present way* of regarding the relative use of fish as compared with other foods, you must make sure that there is a mutual understanding between your hearer and yourself about the sense in which you use such words as "work," "force," "burn," "element," "oxidise," and that he knows what you mean when you use such words as Carbon, Hydrogen, Oxygen, and Nitrogen. Your listener would very probably tell you he could not follow you, as he was not familiar with your words and terms, and had no idea what they meant. You might by degrees find out you had to give him very rudimentary information before he could follow you at all.

The sense in which the words "element" and "compound" are used.

At the outset, a misunderstanding would very probably occur about the use of the words "element" and "compound." The old alchemists meant by "the elements" Earth, Air, Fire and Water, and the term still lingers in our language. It is not uncommon to meet with the expression—"the raging of the elements" in a description of a thunder-storm, and, in an account of a large fire, "the all-devouring element" is pretty sure to be mentioned. The modern chemist, however, uses the word "element" only in contrast to "compound." A compound can be split up into two, and, in many cases, three or more essentially different materials, as, for example, brass can be split up into copper and zinc, and table-salt into chlorine and sodium. An "element" cannot be split up into anything different from itself. When an element is not combined with another element to form a compound it is called "free." That is how the words are used. As to knowing what are elements and what are compounds that is a matter of examination and trying. Oxygen was found to be an element in 1774, Hydrogen in 1781, and other bodies have been at different dates discovered to be elements, to which names have been given to distinguish them. Most of the names have Latin or Greek terminations, and the significance of the distinction between these and the familiar English names, where there are any, is this: the chemical name is definite and exact, the familiar name is loose and inexact. As an example, Aurum is used only for gold absolutely pure, but we speak loosely of "gold" coinage or "gold" rings which are not pure.

Names used by chemists have more exact meanings than familiar names.

One reason, then, why the words Carbon, Hydrogen, Oxygen and Nitrogen are not more often met with, is that, unlike many words in common use, they have very definite and exact meanings and can only properly be used when referring to the elements to which these names are given, though the words "oxygenated" and "carbonised" are often loosely and inaccurately used. As these elements can be obtained separate and pure only by special precautions the names are seldom used except in relation to laboratory work.

The most satisfactory way of conveying correct ideas about them is of course to show by a few simple experiments some of their characteristic ways of behaving, but where it is not convenient to do this, perhaps it is still possible to convey some ideas about them, if not very complete and exact.

To those who feel,

> "A fire's a good companionable friend,
> Who meets your face with welcome glad,"

and love to loiter in the gloaming and gaze into it, OXYGEN is a perfectly familiar though unseen friend. Oxygen.

The old adage "seeing is believing" is taken by some as equivalent to "do not believe what you cannot see." But we believe in many things we cannot see, when we can see what they do. We cannot see the wind, but we are constrained to believe in it if it brings a chimney pot down through the roof. When, sheltered by a window, we watch the boughs swaying and the clouds scudding along in fantastic forms, or perhaps smile at undignified chases after runaway hats, we do not hesitate to say "*see* what a wind there is!"

Oxygen is a perfectly familiar gas, because any one watching a fire is seeing one of the things the unseen Oxygen is always somewhere doing. One-fifth of the air is free Oxygen. Every one knows that a fire or a lamp will not burn without air, though they may not know that it is only the Oxygen of the air that is concerned in the burning. The rest of the air has nothing to do with it so far as we know. In pure Oxygen, which can be obtained in several ways, burning is much more brilliant. The burning of a watchspring in Oxygen is a sight young and old enjoy, for as a professor at the Royal Institution used to say to his audience, one is never tired of seeing it.

Without Oxygen animal life as it now exists on this planet would be impossible, and every one, whether they know the fact or not, has had life maintained by Oxygen from the earliest moments of their existence.

Oxidation.

The word that is used to express union with Oxygen is OXIDATION. It is the oxidation of the elements of which coal is composed that gives rise to the heat and light of a fire. Oxidation appears to always give rise to heat. In some cases the heat is so slight it requires delicate instruments to detect it, in some it can be readily observed, while in many cases it is so great it gives rise to light. Very familiar cases of oxidation are those which give rise to much light—the oxidation for example which occurs in lamps and candles. Here the substances oxidized are purposely selected in consequence of their rapid oxidation producing light.

It may give rise to light or not.

This depends upon the *rate* of oxidation. Slow oxidation frequently accumulates so much heat that after a while light and flame are produced, and this not unfrequently occurs in places, as for example in hay-ricks and cotton factories, where such rapid oxidation is not desired.

Because the word "burning" is so commonly used for those cases of oxidation which give rise to light, some writers, for the sake of avoiding the unfamiliar word, speak of all oxidation as "burning." So long as a definite meaning is kept to, it is entirely a question of words, but if "burning" is used instead of "oxidation," then it must be applied to such a case as the oxidation of iron, which is commonly called "rusting," and to similar cases where oxidation does not produce light. But it is hardly in accordance with the popular use of the word to speak of an iron nail which is rusting in the damp as "burning." There is this more serious objection to employing the more familiar word "burning" instead of "oxidation." People have lately dropped into the habit of speaking of an electric incandescent arc lamp as "burning" steadily or badly, though this light does not depend on oxidation at all. "Burning" is then not always an equivalent for "oxidation." "Oxidation" not always equivalent to "burning."

It is desirable to have a clear mutual understanding about the use of this word "oxidation," as it will have to be frequently used in the following pages. Oxidation is the act of combining with Oxygen. All the elements except Fluorine combine with Oxygen. The Oxygen may come from the air of which, as mentioned, it forms one-fifth by weight; it may come from water of which it forms eight-ninths by weight; it may come from nitre of which it forms nearly one-half by weight (for which reason it is used in making gunpowder); it may come from chlorate of potash of which it forms two-fifths by weight, or permanganate of potash (Condy's fluid) or from many other compounds. The combination may be rapid as in the case of gas-burning, or slow as in the case of the "tarnishing" of kitchen coppers; it may give rise to but little heat or to dazzling light. In any case the combination with oxygen is called oxidation, and OXIDATION, it seems, ALWAYS GIVES RISE TO HEAT. The way in which our life depends on this is spoken of on p. 17, &c.

Oxygen is "free" in the air and in combination in many compounds.

Oxidation, it seems, always gives rise to heat.

CARBON is perhaps generally felt to be more familiar than Oxygen as it can be seen. Fine particles of it are a solace to the eyes of a weary man as

Carbon.

he watches them in a beam of sunlight curling slowly upwards from his pipe, and, rolling gently into lazy folds, linger over him with an air of tranquillity and rest.

Larger particles of it are the terror of the laundry-maid as she sees them settling on the linen she has carefully washed to such dainty whiteness.

Carbon, too, makes the fortune of the chimney-sweep (whose occupation the Smoke Abatement Committee are trying to abolish), and his sack is valued by many.

Under the name "black lead," which contains no lead at all, it is used for drawing-pencils, and it is met with in its purest form in the diamond.

Mixed with small quantities of other things Carbon forms the bulk of coal, charcoal and wood. Fine heated particles of it are the source of light of ordinary flames.

Complete oxidation of Carbon always gives rise to Carbonic acid.

The union of Carbon with Oxygen forms invisible gases, and THE COMPLETE OXIDATION OF CARBON ALWAYS PRODUCES CARBONIC ACID, an invisible gas of which more will be presently said.

Hydrogen.

HYDROGEN is a gas which occurs naturally in combination with some other element, and when it is wanted for use (as for the oxy-hydrogen light) or for the purpose of examining it, some compound containing it is "split up" so that the hydrogen is set free. The compound usually chosen for this purpose is Hydrogen-Oxide, commonly called water (see p. 9).

Nitrogen.

NITROGEN, like Oxygen, occurs free (that is, not as a compound) in the air. It also forms many compounds, of which two familiar ones are nitrous oxide (laughing gas) and nitre (saltpetre.)

Most people know something about other compounds of Nitrogen. Nitric acid, which is a compound of Nitrogen and Oxygen, is an example, and so is ammonia, commonly called hartshorn, which is a compound of Nitrogen and Hydrogen.

We do not live on elements as such, but only in the form of compounds.

In considering Carbon, Hydrogen, Oxygen and Nitrogen as foods, it is only in the form of compounds they come under our notice. We do not, and perhaps cannot, live on them as elements. We eat plants (roots, fruits and leaves) and we eat "beasts, birds and fishes" that have fed on plants. Simple compounds of two elements pass into plant structures first and form more complicated compounds, and we make use of these compounds direct from plants, or after they have formed fresh compounds as parts of fish, flesh or fowl. These compounds are very various in their composition, and are various in their uses to us. These uses will be spoken of later on, after more has been said of the compounds themselves.

The compounds are parts of plants first before we can use them.

Compounds are more familiar than elements are.

Compounds of these elements—some of two together, some of three and some of all four—are perhaps more familiar to everybody than are the elements themselves, though they are familiar under other names.

Water is a compound called Hydrogen-Oxide. It results from the oxidation of Hydrogen.

Water is an instance. It is a compound of Hydrogen and Oxygen, and the chemist calls it Hydrogen-Oxide—that is, if it is absolutely pure and contains nothing but Hydrogen and Oxygen. But the water of our rivers, wells, and springs contains small quantities of other things besides the Hydrogen and Oxygen of which it is essentially composed, small quantities of matter *dissolved* in it, very often lime, which makes the water hard. We also loosely, under the term "water," often include small quantities of matter suspended or floating about in it. They of course really do not form part of the water any more than a boat floating on water does—for when left at rest, they settle down in the vessel containing the water. By careful distillation an ordinary water can be freed from almost all traces of matter it has dissolved, and the Hydrogen-Oxide is left almost pure. Even if the temperature is so reduced it becomes solid it is still Hydrogen-Oxide, though in ordinary language it is then called ice; if the temperature is so raised that it passes to the gaseous state it is still Hydrogen-Oxide, though in ordinary language it is called vapour. There are several ways in which Oxygen and Hydrogen can be caused to unite to form water, and ways in which water can be split up into Oxygen and Hydrogen. Just as carbonic acid results from the oxidation of Carbon, water results from the oxidation of Hydrogen.

Water a loose and inexact name.

The name Hydrogen-Oxide is an exact name—water is a loose and inexact name. Every one then is quite familiar with Hydrogen-Oxide though they know it in its impure state and under the name of water, or other native name for it, aqua, l'eau, wasser, &c.

Carbon, Hydrogen, Oxygen, Nitrogen, are really familiar.

When some few facts like these are mentioned your "first man at the corner of the street" would no longer regard Carbon, Hydrogen, Oxygen and Nitrogen as unknown strangers, even though their names may come as new.

Written for short, C, H, O, N.

To those not accustomed to considering foods as consisting of so many ounces of Carbon, Hydrogen, Oxygen, and Nitrogen, generally written for short C, H, O, and N,* the subject may at first sight seem

* See note in Appendix.

somewhat complicated. But it is really not difficult, it requires only a little careful attention, principally in guarding against a confusion of ideas from attaching to terms meanings not intended; and it is far easier to follow when practical acquaintance has been made with C, H, O, and N by even simple experiments with them.

CHON cannot be recognised as elements in the compounds that form our food.

It may help to clear away a preliminary difficulty to mention that although, as just stated, every one has been living on C, H, O, and N, all their lives, they could not see the individual elements, not even the solid carbon, in the compounds as they occur in foods. These can only be got at by separating them out by chemical analysis at different temperatures.

Just as copper and zinc cannot be individually recognised in brass.

It is just the same as with many familiar things we do not use as food. In brass, for example, which is an alloy of the elements copper and zinc, the copper and zinc cannot be recognised as such, though they can be separated out; or in bronze the tin and copper cannot be recognised, though they can be separated out. Elements cannot be recognised in a chemical compound, though they may be in a mechanical mixture. A simple experiment that can be made on a shovel over a fire will serve to illustrate what is the difference that is meant by the terms "mechanical mixture" and "chemical compound." Get some fine copper filings and some powdered sulphur well mixed together on a sheet of paper. The copper and the sulphur can still be separately distinguished—if not with the unaided eye, they can be with a magnifying glass and the sulphur can be washed away. This is called a "mechanical mixture." But put such a mixture on a shovel over the fire till it glows, and on cooling there will be found a black

The meaning of the term chemical compound.

substance, differing in properties from both copper and sulphur. This is an example of what is called a "chemical compound." Neither the copper nor the sulphur can now be distinguished, but they are there and can be again separated out by proper chemical means.

They can only be recognised by separating them out.

Chemical compounds may pass through many changes, in none of which can the elements be recognised, and yet it can be proved they are there by their being separated out afterwards. To take one example only, the well-known "blue vitriol," or "copperas" of the oil shops. It is a compound of copper and sulphur, but neither of them can be distinguished whether the compound is in the state of the yellow solution, or of the greenish blue crystals, or of the white powder to which these crystals turn on heating. Yet the copper and the sulphur can be obtained in their original state and original quantity by chemical separation. Many illustrations of this kind might be given, but any one of them rightly understood will make it easier to comprehend the nature of the more obscure changes our food compounds pass through both in being prepared as foods by plants and animals, and also within our bodies after we have taken them as foods. The C, H, O and N can always be "separated out" at any stage, though they pass through many complicated combinations. We "live" only so long as C, H, O and N are undergoing combinations within us.

An example of separating out.

The gas we burn in our houses will furnish a simple illustration of "separating out" or "splitting up." It is, leaving out impurities, Carbon and Hydrogen in a gaseous state. When a gas tap is turned on there is nothing to be seen, but if we raise the temperature by applying a highly heated wire or a light the Carbon and Hydrogen both begin to unite with the Oxygen of the air and "burn." Hydrogen and Oxygen when combined form Hydrogen-Oxide or "water," as mentioned before, and, if a plate or anything cool be held over the flame, drops of water can be collected. The Carbon which thus loses its companion Hydrogen, and has *not* united with the Oxygen of the air, can be collected in a solid form, and, indeed, smuts and smoke are small particles of it. It has travelled through the pipes, however, as a gas. The Carbon which *does* unite with Oxygen forms carbonic acid, with which everybody may be familiar (though it is a gas which cannot be seen), and a test for its presence is given below. Thus from the gas there is obtained by "splitting up" by heat, a solid (carbon), a liquid (water), and a gas of totally different composition (carbonic acid). This is a rough chemical analysis.

Oxidation of Carbon and Hydrogen results in carbonic acid and water.

A rough chemical analysis.

The same results can be obtained from an oil lamp where the Carbon and Hydrogen are present as fluid, or from a candle where the Hydrogen and Carbon are present as solid.

The water and carbonic acid can be collected most conveniently, perhaps from a candle, as the experiment can be made on a table. For observing the formation of the water it will be an advantage to support the plate slightly tipped on one side as the drops will run together, and also to keep the plate cool by putting cold water in it. The fact of being able to collect solid Carbon is mentioned for the sake of the illustration of an element being present in a compound without its being recognised till it is separated out. It can only be obtained, however, by interfering with the flame, for in a flame properly burning it will all be oxidized and pass away as carbonic acid. Indeed, if the Carbon collected on the plate be scraped off and put on to a shovel over the fire, the oxidation will be resumed, and it will all pass away as carbonic acid.

Carbonic acid.

Carbonic acid is an invisible gas, but there is a very simple way by which its presence can be detected. It readily unites with lime to form the compound carbonate of lime, and is therefore frequently used as a test for the presence of lime in water. The carbonate of lime forms as a fine white powder which gives at first a milky appearance to the water, clearing as the powder settles to the bottom. As the result of the combination of the two is always the same, lime water is a ready test for the presence of carbonic acid. It can be obtained cheaply at a druggist's. The carbonic acid given off by a flame can easily be collected in any jar, which will not crack with heat, by holding it so that the flame is well within its mouth. It will be known when no more will be formed, as the light will then "go out," that is oxidation will cease, because there is no more free Oxygen within the jar. If the jar is then turned over, and a little clear lime water is poured in and well shaken about, so as to absorb the carbonic acid, the milkiness, due to the white powder being formed, will be seen.

Test for its presence.

It will probably help to bring home more forcibly some facts that will presently be referred to, if the experiment be repeated with some fat such as would be used for food. It is not much trouble to make a sort of candle of it with some darning worsted as a wick, so that the fat can be oxidized (i.e. burnt, see p. 6). The Hydrogen and Carbon of the fat will be found to form water and carbonic acid, just as those from the other sources. When fully oxidized they always do, whatever the source from which they come, and whether that source be in a state of gas or liquid or solid.

Fats and oils.

This is a rough and ready way of showing that C and H are present in fats. Compounds of Carbon and Hydrogen are called hydro-carbons. Fats and oils are all in the main hydro-carbons, though not always pure. Every one is familiar then with compounds of Carbon and Hydrogen, though the names may be new to them. When the amounts of C and H have to be known by weight, the simple apparatus here used does not suffice. The principle of proceeding is however the same—that of converting into Carbonic acid and water, but this has to be done in a way that admits of their being weighed.

Compounds of C and H are separated out by oxidation into Carbonic acid and water.

As the composition of Carbonic acid is always everywhere the same (three-elevenths Carbon and eight-elevenths Oxygen) it is easy to calculate how much Carbon there is in a known weight of Carbonic acid, and as the composition of water is always everywhere the same (one-ninth Hydrogen and eight-ninths Oxygen) it is easy to calculate the amount of Hydrogen in a known weight of water. If therefore we want to know the weight of Carbon and Hydrogen in any Hydro-Carbon, we get at them by separating out the Carbon as Carbonic acid, and the Hydrogen as water. This is the simple method that has been followed in investigations of the AMOUNTS OF CARBON AND HYDROGEN IN A HYDRO-CARBON COMPOUND.

By weighing the amount of Carbonic acid and of water we know the weight of C and of H present in a certain weight of a Hydro-Carbon.

The weight of N present in a compound is known by separating it out as ammonia.

The weight of N in a compound is ascertained by separating it out in the form of ammonia which is a compound of N with H, the only one they form together. This is accomplished by heating some of it with caustic soda, which causes all the N to pass off in ammonia.

The simple fact that ammonia is given off in such a process can easily be known from smell by heating any substance which contains much N, a piece of cheese for example, with caustic soda, which can be obtained at any druggist's.

To secure that all the ammonia given off is collected without waste, special apparatus is of course required.

This is not intended as a book of instruction for doing chemical operations, but it is hoped that the few homely experiments described on pp. 11 to 16 will suffice to enable those who take the trouble to do them, to realise that C, H, O, and N are actual weighable forms of matter, and to understand the nature of the work, sketched in the next few pages, only in outline, by which facts have been learned about foods and the uses of different kinds of them.

Of all the immense numbers of elements and compounds, our knowledge of which is frequently increasing through the industry of experimental chemists, all that it is essential to pay attention to for our immediate purpose is that the union of

H with O	produces	the compound	water.
C „ O	„	„	carbonic acid.
N and H	„	„	ammonia.

It is one of the important discoveries of recent years that THESE COMBINATIONS, WHICH TAKE PLACE IN THE WORLD AROUND US, ALSO TAKE PLACE IN OUR OWN BODIES.

Combinations that take place in the world around us, also take place in our own bodies.

We take in compounds of C, H, and N in our foods, we take in O from the air we breathe.

The H combining with the O forms water, which leaves us as perspiration (more as invisible perspiration than in visible "sweat"), as moisture in our breath (visible on a frosty day), and through the bladder.

The C combining with O forms carbonic acid, which leaves the body mostly through the lungs.

The N combining with H forms ammonia, which leaves the body through the kidneys.

The solid excreta which leave the body consist for the most part of actual waste—that is, material which has not been made use of at all.

It is the knowledge of these forms of outgoings of oxidized C and H—that is, C and H, which have within our bodies combined with the O we have taken in in our breath—and of ammonia that forms THE FOUNDATION OF OUR PRESENT WAYS OF STUDYING FOOD VALUES. The quantity of C, H, and N taken in as food is weighed, and the outgoings in perspiration, breath, urine, and excreta are weighed. They have been ascertained for different conditions of exercise and different conditions of health, and to some extent for different conditions of surrounding weather, so that the intakings and the various outgoings of the body can be balanced up, like the introduction of raw material and the turning out manufactured stuff in a mill can be.

The foundation of our present ways of studying food values.

That was a great advance when the genius and clear intellect of Liebig, grasping the meaning of various isolated experiments of workers in all countries and devising methods for observation not known before, elaborated the 'Thier Chemie,' which he gave to the world in 1840. England received it simultaneously with Germany in the translation 'Animal Chemistry,' the preparation of which was entrusted to Dr. Gregory, one of his pupils.

Though others had been previously feeling their way here and there, and had made slight inroads on the borders of a then unknown realm of research, he was the first to push boldly on, exploring with instruments of his own invention, and to point to further conquests waiting to be made in the domain of the Chemistry of Organised Beings.

The source of animal heat is oxidation.

That with all his energy he was but a partial explorer he knew full well, but that he had mapped out the right lines in laying down "oxidation" as the source of animal heat he felt confident. Oxidation, it seems, always gives rise to heat (p. 6 and Appendix.)

It is strange—or, remembering *humanum est errare*, perhaps it was not strange—that he should fall into the very error he so strongly deprecates in others—that of drawing conclusions from an insufficient number of observations. While, as repeated subsequent experiments have shown, he was right in pointing to the oxidation of carbon as a source of animal heat, he missed the track in the explanation of the source of muscular power. His theory, that muscular work was accompanied by the destruction of muscular substance itself, could not be verified. On the contrary, whether little or much muscular work is done seems to have hardly any effect. As the destruction of muscular substance results in the formation of ammonia, then if the theory be correct, the heavier the work done the more should be the amount of ammonia given off. But several trials showed this does not take place.

The difficulties led to many experiments in many lands.

The correlation of the physical forces, now so familiar to everybody, was then but dimly seen—or guessed at rather than seen—in the far distance. But while many of Liebig's pupils and followers were experimenting on themselves and other people as to the connection between food, work and the amounts of carbonic acid and ammonia given off, Joule was working out questions connected with the conversion of heat into motion and motion into heat.

At last, in 1866, Frankland, taking the results of many experiments, and his own laboratory work, as his data, worked out the figures showing the CONNECTION BETWEEN MUSCULAR FORCE AND THE OXIDATION OF CARBON AND HYDROGEN, and at a lecture at the Royal Institution, made the triumphant announcement HERE IS THE SOURCE OF MUSCULAR POWER. (For "hard" work, see p. 28.)

The source of muscular power.

Liebig, loving truth more than self-glorification, eventually recognised his former mistake, and the controversy that existed has passed into oblivion.

How to experimentally recognise the principles of the study.

The same rough and ready way of showing that carbonic acid is formed by the oxidation of candle fat (p. 13), will suffice to show that carbonic acid is given off in the breath. It is only requisite to blow through a tube into clear lime water to see by the formation of carbonate of lime that there is much carbonic acid in the air we breathe out. Again, it requires no apparatus to see on a frosty day that there is more water in the air we breathe out than that we breathe in. As we breathe out, then, more carbonic acid and water than is in the air we inhale, we know that carbon and hydrogen are being oxidized somewhere within the body. This oxidation gives rise to heat (p. 7)—and heat and motion go together.

This may suffice as a rough and ready way of knowing by observation what are the principles on which calculations as to C, H, O, and N, in foods are based.

The principle is the same in scientific work though the arrangements are more elaborate.

Experiments have, however, been carried further than this—not simply to find that carbonic acid and water are formed by oxidation in the body, but how much of each is formed. To do this of course requires special arrangements. For example, Dr. Edward Smith, in ascertaining how much carbonic acid was given off during exertion of different degrees, wore a sort of mask covering his nose and mouth, and a flexible tube carried his breath to his apparatus for ascertaining the weight of water and carbonic acid given off in certain time. Pettenkoffer carried out observations on a watchmaker who consented to work inside a case, one day doing no harder work than reading, another, doing his usual light work of watch-fitting, and another day working a treadle. The amount of food and of oxygen admitted to him, and of carbonic acid and water, &c., given off, were accurately weighed.

The experiments of Fick and Wislecanus are mentioned in Appendix. The two mentioned here may serve as examples that the statements and figures given by scientific chemists about the C, H, and N taken in as one set of compounds in food, and given out as different compounds, are based upon careful observations and calculations.

By such methods as these mentioned above we know the sum total of the C, H, O and N that is given off under different amounts of exercise or exertion.

The materials are sometimes "stored."

If the amounts given off in 24 hours are greater than those taken in; if for example the amount of carbonic acid given off is greater than can be accounted for by the oxidation of carbon taken in, then it is evident there has been a demand made on what has been previously stored up in the body. It is well known that people store up fat who habitually take more carbon and hydrogen than the body actually demands for the work they do, and often store it up to an extent inconvenient to themselves. And the reverse of this is also known, that additional exertion without increase of carbon and hydrogen leads to a reduction of fat, and that a total amount of food inadequate to meet the daily demands, so uses up the stores, that emaciation follows.

Carbon used up in proportion to work.

It has been found that the harder the work a man does the more carbonic acid he gives off in his breath, which means that more Carbon has been oxidized. The Oxygen comes freely in the air, the Carbon has to be taken in as food. When a man is doing a spell of hard work he should therefore have a care he is taking in more Carbon than when he is doing light work. Those who are continually doing hard work need more than those doing light work. These are facts that do not rest simply on the experiments and calculations of men of science, but have been found true by navvies. Two well-known instances are those of making a railway in Sicily and the laying of the narrow gauge on the Great Western Railway. In both cases the amount of nitrogen compounds was increased also. (See Appendix.)

It is the oxidation of Carbon in the body which is the chief source or origin of muscular power as apart from muscle structure. The oxidation of Hydrogen is known to have much the same duty, though the extent is hardly so well established by experiment.

As the result of the comparison of many sets of observations we get the following table of

Daily outgoings.

DAILY OUTGOINGS.

		lb.	oz.	gr.*
CARBON given off in				
Carbonic acid	by lungs . . .			320
" "	by skin . . .			40
Organic matter	by kidneys . .			170
" "	by intestines .			308
			9	400
HYDROGEN given off in				
Water *formed* in body	by lungs and skin		1	70
Organic matter	by kidneys and intestines . .			100
			1	170
OXYGEN given off in				
Carbonic acid	by lungs . . .	1	7	325
" "	by skin . . .			111
Organic matter	by kidneys and intestines . .			357
Water *formed* in body	by lungs and skin		9	130
		2	2	47
NITROGEN given off in				
Urea, etc.	by kidneys . .			245
Waste	by intestines . .			46
				291

* Reckon 438 [strictly 437·5] grains to oz. and 16 oz. to lb.

In this and the following table the amounts of common salt and other minerals, and of water taken in are not mentioned, for these undergo apparently no changes in passing through the body.

By water *formed* in the body is meant water which results from the oxidation of Hydrogen as distinguished from water taken in as such.

The above table represents a fair average of daily outgoings of an adult in health and of ordinary activity. Heavy exertion, whether of work or sport, will cause, we know, an increase in these outgoings. It will be readily seen, the DAILY OUTGOINGS BEING KNOWN FROM EXPERIMENTS, it is easy to state what the daily intakes must be to keep up the balance so that there may be no over-storage or no undue demand on the natural storage.

For a person whose outgoings are as in the above table there must, of course, be as follows:—

THE AVERAGE DAILY INTAKES.

Average daily intakes.

	lb.	oz.	gr.
CARBON taken in			
In starches, fats, and Nitrogen compounds		9	400
HYDROGEN taken in			
In starches, fats, and Nitrogen compounds		1	170
OXYGEN taken in			
In the air breathed	1	10	115
In starches, fats, and Nitrogen compounds		7	370
	2	2	47
NITROGEN taken in			
In Nitrogen compounds			291

As Carbon and Hydrogen are associated together in compounds, and the heat produced by oxidation of

Hydrogen is nearly as well known as that of Carbon, it is usual to sum up the whole intakes as Carbon and Nitrogen, and the nearest convenient round numbers that can be selected are—

C 4,900.
N 300.

CARBON . . .	4,900	grains.
NITROGEN . .	300	„

The mere suggestion of speaking to hard-working men about grains of Carbon and Nitrogen in food with any hope of being understood may perhaps raise a smile of half-pity, half-mockery, for it has been known to provoke downright derisive laughter. This, however, need not prevent some mutual understanding about the meaning of these figures, with the possibility that some may find them of use. It perhaps should be explained that—

What the figures mean.

In the first place they are not given as the result of any one particular experiment on any one particular person, doing a particular kind of work. They give an approximate average of the results of many experiments. They are intended to represent the daily requirements of a man about thirty, weighing 11 stone, and doing moderately hard muscular work. They mean the amount of Carbon and of Nitrogen he must get *out of his food* and *into his blood.* The quantity of food he will have to take to obtain this carbon and nitrogen depends on the perfection of his digestion and the kind of food he takes. The question of the *kind* of food is shown in the tables further on. A variation in the amount of work will lead to a variation in the amount of Carbon and Nitrogen needed. A variation in the power of digestion may necessitate a change in the food taken so as to ensure getting the Carbon and Nitrogen out of it.

In the second place it is not for a moment to be expected that any one succeeds in calculating out his daily diet with the exactness of a scientific chemist making an analysis of a food, or conducting experiments on the amount of carbonic acid given off during work of a particular kind. Even with the most rigidly routine life any attempt to meet the daily needs with exactness would be upset by changes in the weather. The nearest approach to exactness is perhaps in training for boat-racing, but every one with any experience knows how a muggy day or roughish water will "take it out of you," and make a slight increase of food necessary.

The practical utility of the experiments—such as those referred to at p. 20, which these figures summarise—is that they show this—the more the muscular work done, the more carbonic acid and water are given off, and the more C and H must be taken into the blood for oxidation. These figures C 4,900, and N 300 give an average. (For N, see p. 28.)

From what sources can our intakes be obtained?

Knowing then the amounts of C, H, and N that are needed, the next inquiry is the sources from which these can be obtained. Side by side with the investigations mentioned above, many chemists were engaged in examining the chemical composition of many substances we use as food.

Leaving out of consideration the various methods of giving the results, as this does not affect our present inquiry, the important point to look to is the total amount of C, H and N.

It has been found that there is so important a dif-

Two important groups of food compounds.

ference, as to what they do in the body, between the compounds which contain N, and those which do not, that this forms the ground of division into two great groups.

It is customary to speak of the C H O compounds as Carbon compounds, and C H O N compounds as Nitrogen compounds. It has often been found that in some minds a confusion exists between the element Carbon itself and carbon compounds, and the element Nitrogen and nitrogen compounds. It would avoid this confusion to adopt the names "C H O compounds," and "C H O N compounds," but it would be an untried innovation, and the usual custom of using the names is followed.

The important point to notice is that both groups contain C and H, and the distinction of names is not meant to imply that one group contains only Nitrogen and the other Carbon. Both have C and H, which produce heat and force, but the nitrogenous group only can, so far as we know, in addition to producing heat and force, form muscle.

It will, of course, not be forgotten that though muscle cannot be formed without nitrogenous compounds, the mere fact of having a plentiful supply of them in the blood will not form muscle. A muscle increases only by use—use, with a plentiful supply of nitrogenous compounds in the blood. The importance of fish diet in relation to this plentiful supply will be seen from the table on p. 32.

Nitrogenous compounds.

It is found that all the NITROGENOUS COMPOUNDS used as food have very nearly the same proportions of C, H and N. The elements in them are differently grouped, and to the scientific chemist they present differences which are important. Viewed, however, simply as sources of C, H and N, they are nearly of equal value. Three for comparison may suffice—

	C	H	O	N
Albumen . . .	**53½**	**7**	not given.	**15½**
Fibrine of muscle	**54**	**7**		**16**
Casein	**53½**	**7**		**15½**

These are given in parts per hundred, omitting very small fractions.

In this and the next table the amount of oxygen is purposely left out, as the object here is to fix attention on the amounts of C, H and N. It is, however, about 22 per cent. in the nitrogen compounds, 50 in starch and sugar, and 11 in the fats.

Carbon compounds.

As fair types of CARBON COMPOUNDS (which have no N) there may be quoted to be compared with the nitrogenous compounds—

	C	H	O	N
Oils and Fats . .	**76**	**12**	not given.	none.
Starches	**44**	**6**		none.
Sugar . .	**40** to **42**	**6½**		none.

Starch is one of those words about which perhaps there is need for a "mutual understanding." It is not used by the chemist exactly in the household or laundry sense, as the "starches" used as food in this country are in wheat, rice, potato, corn flour, sago, arrowroot, &c.

The range of sugars here given includes cane-sugar, beet-sugar, grape-sugar, &c.

Looking at the above tables it will be seen that oils and fats contain the largest percentage of carbon. As illustrating how the practical experience of many generations preceded the explanation which chemistry now offers of why certain things are habitually done, there is the well-known fact that in cold countries and during cold weather more fat is eaten than in hot, and the explanation is that fat contains so much Carbon, the oxidation of which produces heat. As heat is the basis of force in the body this is also the explanation of why labourers eat "hunks" of cold bacon and fat pork. The oxidation of the Carbon furnishes force for their work.

Explanation follows impulse.

Because the nitrogenous compounds as shown above contain 53½ or 54 per cent. of carbon it would at first appear that they can furnish more heat and force than starch or sugar, which contain only 44 or 40 per cent. But it has been found that when nitrogenous matters are oxidized in the body a portion (about one-seventh) of the Carbon and Hydrogen passes away *unused*. Deducting 8 as the nearest whole number to represent one-seventh of 54, we see that not more than 46 per cent. of the C is oxidised, which brings it down nearly to the value of the starches.

Chemistry cannot explain all.

This is as far as chemistry is able to offer any help at present, but so far, repeated experiments confirm what has been arrived at. Still there are some facts for which chemistry at present can offer no explanation. One of these affects those doing severe work. It is this—that severe muscular work requires an increase in the quantity of the nitrogenous compounds in food. This does not appear to be the case with the mere increase in the number of hours of work, it is the severity or as it is commonly called the "hardness" of the work that makes the difference. Though the scientific chemist cannot explain it, it is accepted

Nitrogen compounds and hard work.

as a fact and practically acted upon in public dietaries and by artizans and navvies, who, without knowing anything of carbon and nitrogen, eat what experience tells them they require. (See Appendix.)

It is only within the last fifty years, roughly speaking, that any attention has been paid to the proportion of carbon, hydrogen and nitrogen in foods, and only quite recently—since 1866—that the work they do in the body, and the amounts of them needed for different kinds of work, has been understood.

It may perhaps seem leaving the immediate subject of "Fish in Diet" to pause to allude to this at all, but it will be seen that unless the values of different foods in general use is understood, the relative value of any particular food, whether beef, mutton, bacon, or fish, cannot be understood. Further than this, there is a wide difference in the values of different kinds of fish. Though it would add much to the interest of understanding this modern study to go through the history of how it came about, it would take time, and it is not essential to understanding the present views.

Influence of thought on digestion.

Chemistry cannot explain everything with regard to the connection between food and work. There is that mysterious connection between thought and digestion and digestion and thought. We cannot say give a man so much C and N and he will be able to do so much muscular work. The receipt of depressing news may quite upset his power to eat the food or to digest it, and the C and N must be *in the blood* before it can be of practical use, so that the mere fact of eating so many ounces of carbon and nitrogen compounds does not necessarily imply the power to do work. All that chemistry can do is to show what are the proportions of C and N on which it is found the work is done, and to ascertain the proportions in which they are met with in certain sources of food.

Differences in the amounts of C and N compounds in foods.

As a slight illustration of the great variation there is in these proportions, the following figures are arranged for ready comparison. The object of giving the table is to fix attention on the relative proportions of nitrogenous and carbon compounds, therefore the proportions of water and of small amounts of mineral matter are not given. The figures are taken from the labels of the Food Collection at Bethnal Green Museum, and those who wish for complete details can find them there.

One hundred parts of	Nitrogen compounds.	Carbon compounds.		
		Starch.	Sugar.	Fat.
	Parts.	Parts.	Parts.	Parts.
Wheat contains . . .	11	69	..	1
Fine flour ,, . .	10	74	..	1
Oatmeal ,, . .	16	63	..	10
Pearl barley ,, . .	6	76	..	1
Rice ,, . .	7	76	..	½
Indian corn ,, . .	9	64	..	5
Peas contain . .	22	51	..	2
Haricot beans ,, . .	23	32	..	2
Lentils ,, . .	24	49	..	2
Potatoes ,, . .	2	17	..	..
Skim milk contains . .	4	..	5	..
Milk ,, . .	1	..	6	2
Cream ,, . .	6	..	2	36
Butter ,, . .	1	..	..	87
Cheese ,, . .	29	..	2	29
Eggs, white ,, . .	12	..	1	1
,, yolk ,, . .	15	..	..	30
Streaky bacon ,, . .	8	..	..	65

Such vegetables as cabbages and carrots contain so large a proportion of water—about 90 per cent.—they cannot be looked upon as sources of either nitrogen or carbon compounds, as the quantities that would have to be eaten are enormous. A pound of cabbage gives no more muscle-forming material than rather less than a quarter of an ounce of meat. Sixteen pounds of cabbage would furnish only as much as a quarter of a pound of meat. Vegetables have, however, other valuable uses.

It may perhaps seem that a difficulty arises in regard to this table in working out the connection between these nitrogen *compounds* (which contain C H O N) and the carbon *compounds* (which contain C H O)—see p. 26—with the figures given on p. 24. C 4,900, N 300. A table is given at the end of this handbook for helping calculations as to the amount of N present in N *compounds*. As explained in the pages previous to p. 18, it is only by getting at the quantities of the *elements* taken in and given off in different forms we can know what chemically takes place within our bodies. Recollecting what was mentioned on p. 28 about nitrogenous compounds, it seems highly important to look at the amount of N present in foods used in a hard-working diet. In this next table they are therefore given in single column. Meat and fish are compared, for if, as seems not improbable, "The roast beef of old England" is to become merely a tradition, and the cheery song preserved as a curiosity among the ancient music in libraries, then it may be useful to know what fish most nearly correspond in the amounts of nitrogen

Can we obtain our nitrogen compounds from fish?

compounds they contain, unless such foods as cheese, lentils, haricot beans or peas (see table on p. 30) are to be a substitute.

The following analyses of fresh meat and fish are taken from the tables of the Food Collection at the Bethnal Green Museum.

One pound of		Water.	Nitrogen compounds.	Carbon compounds.
		oz.	oz.	(Fat.) oz.
Beef	contains . . .	8	2½	4¾
Mutton	,, . . .	7	2	6¼
Pork	,, . . .	6	1½	8
Veal	,, . . .	10	2½	2½
Lamb	,, . . .	8	1½	5½
Salmon	,, . . .	12¼	2	¾
Mackerel	,, . . .	10¾	3¾	1
Sole	,, . . .	13¾	1¾	little
Herring	,, . . .	12¾	1½	1
Conger eel	,, . . .	11¼	3½	¾
Pike	,, . . .	12½	3	little

On pages 34 and 35 is given a series of analyses of fish from Koenig's Nahrungsmittel.

A more recent analysis of mackerel by Professor Church gives the nitrogenous matter as no higher than 2¼ oz., but the fat as high as 2. Every one knows that fish change according to season, the most observable changes being in the amount of fat, but there is also a variation in the amount of nitrogen compounds. There is also a considerable difference between lean meat and fat meat in the proportion of nitrogen and carbon compounds.

We need more analyses.

A single series of analyses alone taken at any one time of the year does not give us all the information we want. We are only on the outskirts of the subject as yet.

Mackerel seems to have the same N. value as meat.

It would appear from chemical analysis, as shown in the table, that such a fish as mackerel is well suited for taking the place of meat as a source of nitrogenous compounds. It is a fish, too, which has this advantage—it is tasty when grilled, and a man not working at home who can grill or fry his own piece of steak, could equally well prepare his mackerel. Herring, too, which can be similarly cooked, has about the same nitrogen value as pork, though its carbon value is much less. Boiled fish loses its value, a fact which any one can infer from noticing the water, when cold, in a dish on which, say, a plaice has been taken to table.

Herring.

Effect of cooking.

This is not a book on cooking, but it must be mentioned that the chemical value of a fish as bought and as put on the table are often very different. This is a matter for the wives to think out. It is also a matter for them to consider, that while the husband is using his muscle, the children are growing theirs, and unless all our physiology and chemistry is wrong, muscle cannot be formed without nitrogenous food. It does not matter whether we can explain the "why," the fact seems to be clear.

Possibly muscle value is dying out; steam cranes, steam printing machines, steam ploughs, are doing away with the need for any consideration of a "hard-working diet," except perhaps that the *need* for muscle

FISH (FLESH).[1]

Details respecting	Water.	Nitrogenous matter.	Fat.	Extract.	Ash.	Analysts.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
Salmon	75·70	13·09	4·85	5·08	1·28	A. Payen.[a]
,,	77·06	13·11	4·30	..	5·53	F. Buckland.[b]
,, (smoked)	51·89	26·00	11·72	1·00	9·39[2]	J. König and B. Farwick.[b]
Whiting	82·95	15·09	0·38	0·50	1·08	A. Payen.[a]
Shell fish	80·97	17·09	0·35	..	1·64	J. König and B. Farwick.[c]
Stockfish[7] (dried)	18·60	77·90	0·36	1·62	1·52	Ditto.[c]
,, (salted)	47·03	31·39	0·38	..	21·32[3]	A. Payen.[a]
Pike	77·53	20·36	0·60	0·22	1·29	A. Payen.[a]
,,	77·37	19·86	0·79	1·60	0·38	C. Krauch.[d]
Herring (preserved)	48·99	19·45	12·72	2·51	16·33[4]	A. Payen.[a]
,, ,,	47·12	18·97	16·67	..	17·24[5]	J. König and B. Farwick.[c]
,, (fresh)	80·71	10·11	7·11	..	2·07	F. Buckland.[b]
Red herring (smoked)	69·49	21·12	8·51	..	1·24	J. König and B. Farwick.[c]
Sprat	59·89	22·73	15·94	0·98	0·46	Ditto.[c]
Sardine	51·77	22·30	2·21	..	23·72[6]	Ditto.[c]
Lamprey, sea	51·21	20·18	25·59	1·61	1·41	J. König and C. Krauch.[e]

Roach	75·49	24·03	0·47	..	1·71	A. Payen and Wood.[a]
Conger	79·91	13·57	5·02	0·39	1·11	
Mackerel	68·27	23·42	6·76	..	1·85	
Sole	86·14	11·94	0·25	0·45	1·22	
Carp	76·97	21·86	1·09	..	1·33	
Gudgeon	76·89	17·37	2·68	..	3·44	
Bleak	72·89	16·81	8·13	..	3·25	
Oyster	89·69	4·95	0·37	2·62	2·37	J. König and C. Krauch.[f]
Kaviar	45·05	31·90	14·14	..	8·91[2]	J. König and C. Brimmer.[e]
Fish roe casein	19·38	34·81	28·87	6·33	10·61	V. Kletzinksy.[g]
Crab (preserved)	72·74	13·63	0·36	0·21	13·06[3]	J. König and C. Krauch.[h]
Liver of Pike	79·34	6·66	4·75	7·61	1·64	V. Bibra.[i]
„ Trout	78·64	16·05	3·00	0·42	1·89	
„ Carp	68·06	14·37	2·03	13·49	1·15	

1 Chemische Zusammensetzung der menschlichen Nahrungs- und Genussmittel. Von Dr. J. König. Berlin, 1879, p. 16.
2 With 7·94 p. ct. Chloride of Sodium.
3 Including 19·55 p. ct. Chloride of Sodium.
4 Including 42·62 p. ct. Chloride of Sodium.
5 Including 15·14 p. ct. Chloride of Sodium.
6 Including 20·59 p. ct. Chloride of Sodium.
7 For one meaning of stockfish, see p. 64.

a Compt. rend. Bd. xxxix. S. 318.
b Archiv f. Pharm. 1874. Bd. 203, S. 178.
c Zeitschr. f. Biologie, 1874, S. 497.
d Original.
e Chem. u. techn. Untersuchungen der Versuchsst. Münster, 1878, S. 106.
f Original.
g Mittheilungen aus den Gebiet der reinen und angewandten Chemie. Wien, 1865, S. 33.
h Dictionnaire des altérations et falsifications des substancesalimentaires, par Chevallier et Baudrimont. Paris, 1878, S. 564 u. 565.
i Moleschott, Physiologie der Nahrungsmittel, 1859, S. 80.

work, or the alternative decay as a nation, is recognised and acted on in open-air sports. Perhaps one or two generations of a particular family may go on without much muscle, but the consideration is a national one.

No direct evidence as to value of fish in diet for hard work,

Unfortunately we are without any direct evidence as to the value of fish in a hard-working diet. That fish-eating people are strong and healthy is remarked by travellers. But the question is on *what* fish do they live? When the nitrogen value of different fish is considered, this is seen to be an important question.

nor for workhouse diet.

We have no records of railway making, pile driving, or even training being effected on fish. Even in the attempts to introduce fish into workhouse dietaries, nothing is said of what fish is used.

Should be practically tried.

The best practical answer that could be given to "What is the place of fish in a hard-working diet?" would be for a certain amount of work to be undertaken on fish instead of meat.

At present all we can say is, that as far as what is commonly called chemistry goes, as apart from spectrum analysis investigations, of dissociation, and apart from that yet unexplained polarization, there seems no reason why cheap fish should not take the place of dear meat in a hard-working diet. Fish cost nothing to rear. But it must be tried, as it has not yet been tried; for though there *seems* no reason for doubt, test tubes and reagents may not cover the whole question. If the British workman, after considering the facts which chemistry seems to teach, such as here sketched out, decides for the future to work on fish not twelve hours stale, instead of oatmeal or tinned meats, he can do it, always, however, providing fish-shoal movements remain as experienced fishermen believe them to be. For what the British workman determines to do, by CO-OPERATION he can do. Truck loads might be had direct.

Only one-fifth of energy obtained from food is available for external work.

As regards hard work, it must be remembered before a man is able to do this he must keep himself alive, and only one-fifth of the energy he obtains from his food can be used for what is called "external work." The work of mere living is hard work—the work involved in the beat of the heart and the action of the lungs alone, which goes on during sleep as well as by day, and the maintenance of heat.

Here is a table by Professor Frankland, showing alternative foods of a person even lying quite idle.

Requirements for "internal work."

WEIGHT OF VARIOUS ARTICLES OF FOOD REQUIRED TO SUSTAIN RESPIRATION AND CIRCULATION IN THE BODY OF AN AVERAGE MAN DURING TWENTY-FOUR HOURS.

Name of Food.	Weight in ozs.	Name of Food.	Weight in ozs.
Cheshire Cheese	3·0	Whiting	16·8
Potatoes	13·4	White of Egg	23·1
Apples	20·7	Hard-boiled Egg	5·8
Oatmeal	3·4	Gelatin	3·6
Flour	3·5	Milk	21·2
Peameal	3·5	Carrots	25·6
Ground Rice	3·6	Cabbage	31·8
Arrowroot	3·4	Cocoa Nibs	1·9
Bread	6·4	Butter	1·8
Lean Beef	9·3	Cod Liver Oil	1·5
Lean Veal	11·4	Lump Sugar	3·9
Lean Ham (boiled)	7·9	Commercial Grape Sugar	4·0
Mackerel	8·3		

Consideration of relative cost.

Then, besides the chemical aspects of the question, there is that very practical one of relative cost—a subject to which Dr. Edward Smith paid much attention, and on which he drew up suggestive Tables, which he included in the Reports to the Privy Council, made under such circumstances as mentioned in the next few pages which seemed to fully justify a Government Enquiry as to how people live at home. It would take too much space to reproduce them. (See Appendix.) Here, however, is a concise table of Professor Frankland's, of relative values, which may suggest thoughtful consideration for the wives who keep the weekly accounts.

EXTERNAL WORK = $\frac{1}{5}$TH OF ACTUAL ENERGY.

Name of Food.	Weight in lbs. required.	Price per lb.	Cost.
		s. *d.*	*s.* *d.*
Cheshire Cheese	1·156	0 10	0 11½
Potatoes	5·068	0 1	0 5¼
Apples	7·815	0 1½	0 11¾
Oatmeal	1·281	0 2¾	0 3½
Flour	1·311	0 2¾	0 3¾
Peameal	1·335	0 3¼	0 4½
Ground Rice	1·341	0 4	0 5½
Arrowroot	1·287	1 0	1 3½
Bread	2·345	0 2	0 4¾
Lean Beef	3·532	1 0	3 6½
Lean Veal	4·300	1 0	4 3½
Lean Ham (boiled)	3· 1	1 6	4 6
MACKEREL	3·124	0 8	2 1
WHITING	3·69	1 4	9 4
White of Eggs	·745	0 6	4 4½
Hard-boiled Eggs	2·209	0 6½	1 2½
ISINGLASS	1·377	16 0	22 0½
Milk	8·021	5*d.* per qt.	1 3½
Carrots	9·685	0 1½	1 2½
Cabbage	2·020	0 1	1 0¼
Cocoa Nibs	0·735	1 6	1 1¼
Butter	0·693	1 6	1 0½
Beef Fat	0·555	0 10	0 5½
COD LIVER OIL	0·553	3 6	1 11¼
Lump Sugar	1·505	0 6	1 3
Commercial Grape Sugar	1·537	0 3½	0 5½
Bass's Pale Ale (bottled)	9 bottles.	0 10	7 6
Guinness's Stout	6¾ "	10 10	5 7½

It is desirable to have a knowledge of food values to lay out money for most useful foods.

As market prices vary from time to time, and wages vary and work varies, it would be a great help to an artizan or labourer to have just that acquaintance with the results of chemical research to avoid laying out his money for one food when another would be more to his advantage. Health is proverbially the greatest of all blessings, and health depends on the judicious selection of food suited to the individual constitution, or idiosyncracy, as the old Greeks called it. THE SUBJECT OF THE CHEMICAL COMPOSITION OF FOODS IS NOW RECOGNISED AS OF NATIONAL IMPORTANCE.

The first Government enquiry into the diet of artizans.

In 1862 a piteous time befell South Lancashire and the bordering counties. The people of the cotton trade had a long rest from labour.

The greater part of the district wore an air of quiet. The habitual din of the mills was hushed, the engine fires did not send their accustomed rolls of smoke up chimney stacks to blacken the sky, the bleach works ceased to taint the air, the busy clatter and thud of the cotton-and-silk hand-looms was stilled in the little dwellings. Looking down from neighbouring hills on groups of towns, the aspect day by day appeared that of a Sabbath. But the women were not in their Sunday dress, and the men were not afield with their dogs or flying their pigeons. Their rest was no holiday of choice; anxiety marred attempts at enjoyment. The quiet meant only no work was to be had. No work meant no money, and no money meant no food. The sufferings of the people were described by the deliberately thoughtful pen of a contemporary historian, well known to students of blue books, though perhaps but little known to readers furnished only with volumes through subscription or free libraries.

"The staple industry of these densely-peopled districts, the industry which previously gave livelihood, direct or indirect, to two millions of population, had for some months been declining, and was now probably at not more than a sixth part of its usual activity. Widespread bitter poverty was of course the result; and this poverty was in strong contrast with former circumstances. The affected class was not a common low type proletariat, familiar with parish doles, and preferring pauperism to labour. On the contrary, it was a people . . . . legitimately proud of its old self-supporting power and independence. Borne down of late by the increasing stress of a poverty which was quickly tending to become absolute privation, the sufferers had not clamoured as to their growing need for help. Even to the last they had rather shrunk from disclosing it . . . . As wages had begun to fail, first in many cases, there were previous well-earned savings to be exhausted; then in nearly all cases there was household furniture and bedding, or at least clothing, which might be pawned or sold. Gradually during the summer these resources had been drawn upon . . . . And now in October a crisis in this long contest was at hand. Besides the pauperism which was known, there was an unascertainable but enormous amount of impending destitution. The ill-nourished were in myriads; . . . . there was imminent danger that death on a large scale might result directly or indirectly from starvation."*

Such is the description as addressed by Mr. John Simon to the Privy Council.

The long-continued suffering was a severe trial. Worse off than people in a besieged town, to whom a successful raid might bring food that would be common store, the starving ones had to regard the rights of property, and to exist amid supplies they could not buy as their own. How the people through all the land sent their money to relieve those who had fallen into such grievous straits through no fault of theirs is commemorated in the window of the Guildhall.

This calamity, which in many of its lessons was so important an event in the commercial history of the country, and which so aroused kindly feeling for those in temporary need, was the cause of the first official inquiry into the diet of any portion of the artizans of England. Workhouse dietaries had before been an object of investigation ; but workhouses contain people who have drifted there from different causes and from different occupations, and after varying periods of struggles for existence in health and weakness. The returns sent in are in a form that suggest that economy in management was the principal point. There may possibly have been some philanthropic motive in the background, but it is not apparent. Those inquiries went but little to show what was the necessary diet for any particular class of artizan in work as could be learnt from their usual habits.

The theory that an Englishman's home is his castle was so far disregarded that Dr. Edward Smith, who had already distinguished himself by inquiries into the kind of foods that furnish muscular power, was sent down in accordance with instructions of the Privy Council to make inquiries into the lives of people in their little castles. Dr. G. Buchanan had been already sent down to be in the suffering districts, at the request of the Lords of the Privy Council, that they might "satisfy themselves that due local precautions were being taken to prevent the destitution which breeds diseases" (p. 18, Report). The object in sending down Dr. E. Smith is recorded thus—

"Their Lordships found it expedient also to provide themselves with more exact scientific information than was at the moment available with regard to the

This was the first time the N and C in foods was calculated in an official enquiry

minute economies of diet." The details of the inquiry are lengthy, but the important point for us to remember is that for the first time the carbon and the nitrogen of diet was recognised in an official inquiry as a basis for its working value.

This enquiry, together with others subsequently made in other parts of the country, furnished facts as to how artizans lived, and at the same time Professor Frankland's work furnished the explanation of the origin of muscular power (p. 19).

The subject not yet one of national education.

The knowledge gained has hardly yet become a subject of national education, even though the "Food Collection" now at Bethnal Green Museum has been successively under the care of Dr. E. Lankester, Sir Lyon Playfair, Professor Huxley, Professor Frankland, and Professor Church, who has laboured that its teachings shall contain the latest results with exactitude. The Parkes Museum contains a collection arranged by Mr. Thomas Twining, and Professor Corfield has done much to spread information, yet we can hardly say the subject forms part of national education. Each must think out for himself.

RECAPITULATION.

Heat and force from Carbon and from Hydrogen.

It has been shown that :—

1. The complete oxidation of C always results in the formation of CO_2 carbonic acid. The complete oxidation of H always results in the formation of H_2O water.

2. The supply of O may come—

(*a.*) Direct from the air as in such simple experiments as those described on pp. 13 and 14.

(*b.*) Or from a compound that readily gives up its O, (p. 7), which admits of oxidation being made to take place in a closed vessel.

(*c.*) Or, as in the body from the blood where the O is mainly conveyed in the corpuscles.

3. The results of the oxidation of C and H within the body are carbonic acid and water, just the same as if they were oxidized in a candle or lamp.

4. That C and H when oxidized, as all the elements (except fluorine) do give rise to heat, often accompanied by light.

5. That the oxidation of C and H in the body give rise to heat and force, but not such heat as to give light.

6. That the results of the oxidation of C and H within the body (the carbonic acid and the water) are, with small exceptions, (p. 22) carried away from the place of oxidation by the blood to the lungs, which, while at each inspiration supplying fresh O to the blood, at each respiration relieves it of some of its CO_2 and H_2O.

7. That the amount of CO given off by the lungs is therefore a nearly exact measure of the amount of C oxidized.

8. That the result of many careful experiments in collecting and weighing the amount of CO_2 given off at different times shows that more is given off during hard work than during light work.

9. Whether the carbon is being oxidized at a rapid or slow rate, the supply whether immediately used up or stored has to be furnished by the blood to the parts where it is wanted, and the blood receives it from the stomach and associated parts, which, in their turn, obtain it from the foods.

Briefly, carbon enters through the mouth as some form of compound, becomes oxidized in the body, giving rise to heat and force, and leaves the body as carbonic acid.

Hydrogen enters also as some compound, becomes oxidized in the body, giving rise to heat and force, and leaves the body as water, mostly in the breath.

The amounts given off have to be supplied by foods (see p. 23).

Nitrogen.

1. The union of N with H forms ammonia.

2. The N taken into the body in foods leaves it as ammonia.

3. A calculation of the amount of ammonia given off tells therefore the amount of N given off.

4. The amount given off has to be supplied by foods (p. 23).

5. Muscle cannot be formed without N.

6. It appears from experience that a HARD-WORKING DIET must be largely made up of nitrogenous compounds—compounds which contain all the four elements, C, H, O, N (p. 28).

These must be accompanied by carbon compounds.

7. There are some fish, herring, mackerel, sprats, &c. (see pp. 32 to 34), which have nearly the same N value as beef, mutton, or pork, and, so far as chemistry can tell, hard work can be done on them as well as on meat

8. We are without the direct evidence of experience.

The average daily requirements of those doing only moderate work is (see p. 24) C, 4,900 grains; N, 300 grains.

Section II. Historical.

The history of the people of that marvellous land of Egypt, the cradle of so many of the arts, is generally, for the convenience of chronological reference, divided off into periods corresponding with the dynasties of its rulers, even though the dates are uncertain. Sir Gardner Wilkinson supposes the date of the reign of Thothmes III. to be B.C. 1463, and assigns the fourth year of his reign as the time of the departure of the Israelites from their bondage. The wars of annexation of this powerful monarch, and of Rameses II. [B.C. 1355] commonly called the Great, who victoriously carried his arms right into the heart of Asia, mark an important era in the history of the nation. Military successes were followed by social changes among the wealthy, who prided themselves on having many luxuries for their use brought at great expense from distant lands. Foreign fish were among the rarities prized. Egypt.

Before this period, however, the use of fish was entirely confined to the toilers of the land. To the higher and priestly class it was forbidden.

The home supply in Egypt, as we know from Herodotus, was chiefly derived from the Nile and the numerous canals and lakes, and large quantities of fish were taken after the subsidence of the annual inundation, being stranded on the fields. From the monumental paintings at Thebes and Beni Hassan we have representations of fish capture and curing.

Fishing with ground bait, using a landing-net, drawing nets weighted with leads, carrying in and opening fish preparatory to salting, carrying the dried fish on a pole, and groups of people eating fish are all depicted. Angling for sport was practised by the wealthy, as is indicated by the dress of the angler comfortably seated, and by the presence of attendants. The net was used by the poor, and the spearing trident by the sportsman.

Fishing was under Imperial control, and Herodotus mentions that the profits from the fisheries of Lake Mœris and its canals paid daily into the treasury amounted to a talent of silver, about £193 15*s*., during the six months the waters were retiring.

After the time of the XIXth dynasty, B.C. 1269 to 1180, when fish became a recognised luxury of the banquet, and was imported from the distant waters of the Orontes, Euphrates, Halys, and the lakes of Palestine and North Syria, the Egyptians, like most nations in periods of luxury, turned their attention to fish culture: and the *vivaria*, or ponds, formed an important part of the domestic establishment of an Egyptian retem or noble.

Salted and dried fish, as well as fresh, formed a portion of the diet of the Egyptian; and the former was especially prescribed as the food to be eaten on fast days.

In consequence of the attention given to fish as an article of diet during the golden age of Egypt, three kinds were strictly prohibited. These were the Oxyrhynchus—the *mezdeh* of the Arabs; the Phagrus, or eel, which to this day is avoided by Orientals, chiefly on account of its unwholesome qualities; and the Lepidotus, which Dr. Birch suggests as the Kelt-el-Bahr, or Nile dogfish, which was not eaten, probably on account of its unpleasant appearance.

The Hebrews.

The Hebrews, who had formed part of the poorer population of Egypt, during the time of bondage had been fish eaters. There are many references in their history made to this, e.g. in the book of Numbers (xi. 5). "We remember the fish which we did eat in Egypt freely." They adopted a somewhat similar division between the clean and unclean to that in vogue in Egypt. The Mosaic distinction, which classed fish which had not fins and scales as unclean, was proved by experience to be ambiguous, and led to many ingenious comments and evasions by Talmudic writers. It was, however, similar to that of the Arabic lawgiver, El Hakim, who would allow none of the finless and scaleless fish to be sold in the markets of Egypt.

Long prior to the conquest of Canaan that land had been one of the chief sources of the fish supply of Egypt, and the names Sidon (Saidu), "the fish town," and the two villages of Bethsaida ("house of fish") on the Sea of Galilee, still remain to tell of the fisher life of the people. In the time of the historian Nehemiah, Tyrian merchants traded in Jerusalem in sea fish, in the market near the fishgate. The Sea of Galilee furnished the markets of Jerusalem with fresh fish, and during Roman rule a high rent was paid for the right of fishery over the lake, a distinct body of tax collectors being appointed to gather the dues.

In the richly watered valleys of the Tigris and Assyria. Euphrates fish was also largely adopted as an article of food, and the monuments of Nineveh furnish illustrations of the various modes of capture employed. As in Egypt, fishing both by net and by line was practised, while attached to the palaces of the kings were tanks in which fish were bred and fattened. Among the zoological inscriptions from the palace of Assurbanipal (B.C. 664), the Sardanapalus of Greek writers, are several lists, some of them fragmentary, of the various kinds of fish known to the Assyrians. In the religious calendars found at Babylon, dating about B.C. 550, we find that fish was ordered to be eaten on certain days by the people.

The Greeks.

Among the ancient Greeks diet received much attention, even at an early period of their history, for Homer is careful to give details of the feasts of his heroes, whom he describes as living not on dainty dishes, but on such foods as were calculated to make them vigorous in body and mind. The characteristic feature of the diet of the Homeric age is, with temperance, that the banquet is composed of "viands of simple kind" and "wholesome sort." The chief seem to have been mutton, beef, or pork, roast and in some cases boiled, though the former mode of dressing was more frequent. These imply the possession of herds which represent wealth. To the meats were added bread in abundance, and wine, but no fruit or game or fish are mentioned. We may fairly conclude that the diet thus set forth by Homer as that of the heroes was such as was most regarded at the time of the writer as productive of mental and bodily vigour. Familiar with the rich fisheries of the Mediterranean, he seems to have regarded fish as the wealth of the sea for the masses of the poor only, but he never once represents fish any more than he does game as being on the table of his great men.

Fish was apparently not regarded by ancient Greeks as so muscle-forming as beef or mutton.

For the banquet of the later luxurious age of Greece, so vividly described by Athenæus in "The

Deipnosophists," we find a much wider scope in diet was adopted, and fish assumes an important place, whether from a falling off from heroic taste or from enlarged knowledge is not clear. It is evident however from his statements that fish was by some not only eaten as a matter of taste, but also from an empirical knowledge of the principles of dietetics. He quotes in his work (bk. iii.) the opinions of several Greek writers and epicures as to the relative suitability of certain fish and preparations of them for the table. On the authority of Diphilus the Siphnian, salt pickled fish was to be avoided on account of its irritant character. Diocles, the Carystian, is his authority on the various kinds of tunny (bk. iii., sec. 85), while Archestratus, the epicure, who sailed round the then known world in search of delicacies, is his authority as to the most wholesome modes of cooking. In the banquets fish appears in both the first and second course, oysters and salt or pickled fish being taken as *hors d'œuvres*. Quoting the parodist Matron (bk. ii.) he thus describes the course. After the bread which formed the first part of the Greek banquet both in the Heroic and later ages—

Its place during the age of luxury.

> "Then all to pot herbs stretch their hands in haste,
> But various viands lur'd my nicer taste,
> Choice bulbs, asparagus, and, daintier yet,
> Fat oysters help my appetite to whet."

It is probable that the Egyptian birth of Athenæus, he being a native of the city of Naucratis, may have made him so ardent an admirer of fish, and led him to devote the greater part of his seventh book to their study, and to laud in flowing hexameters the various edible kinds. This lavish praise by

The later recognition of its dietetic value.

Athenæus and the numerous authorities he quotes shows that fish was a recognised article of diet, and that the greatest care was taken in the selection of the best and most digestive species for the table.

More than forty kinds are enumerated as eaten by the Greeks. Among the shellfish were oysters from Abydus, mussels from Ænus, and cockles from Messene, which were eaten raw, but on account of the amount of salt water they absorb, which rendered them indigestible, Mnesitheus, the Athenian, recommends their being boiled; the reason he states being that when boiled they get rid of all, or at all events of most, of their saltness. Of the sea-fish eaten we find mention of tunny, turbot, mullet, char, and conger eels as most in favour, while pike, eels, and grayling represent the freshwater fish. The great fondness of the epicure for fish is illustrated by an anecdote preserved to us by Athenæus. Philoxeus of Cytheras, learning from his doctor that he was going to die of indigestion, from having eaten too much of a most exquisite fish—"Be it so," he exclaimed; "but before I go allow me to finish the remainder."

General inferences.

So far as we can gather the history of fish-eating among the Greeks seems to have been this: the poor always used them as the many streams and countless bays and inlets of the irregular coast furnished them in abundance. The wealthy who relied on their herds and flocks for food, despised fish till in the later period of fastidious luxury the daintier kinds, or those which could only be obtained at trouble and cost, became fashionable delicacies. Those who studied their use from a dietetic point of view are sure to have been a minority. It is so in every land.

The Romans. We have scanty information as to use of fish by the mass of the population.

We know very little of fish eating among the Romans. It is probable that whether under kings—triumvirs—emperors, or after the dismemberment of the nation, it was much used by the people of the land as it was plentiful, but what everybody did no one thought of recording. From the satires written on the follies of the luxurious age, we know more of occasional freaks of extravagance than we do from history of the regular habits of the people.

No Roman banquet was complete without its fish course, and most lavish prices were paid for turbot and mullet. As with the Greeks, the Romans used oysters from Britain or from Lucrini Lake with pickled tunny, similar to the *scabeccio* of modern Italy as *hors d'œuvres*, while turbot, mullet, sturgeon, char, eels, lamprey, and pike, dressed with a skill probably little, if at all, behind that of the *chef* of the present day, were part of the first course. The taste of the Romans for fish was so fine that not only were various species of fish selected, but those from certain waters or fed in certain pools were held to be especially good. This attention to condition led to the construction of stews or fish-ponds in which fish were preserved and fed for the table. In the reign of Domitian, Vedius Pollio is reported to have fed the eels in his pools with the flesh of slaves put to death for that purpose, but though strongly rebuked by the emperor this act met with no serious punishment.

In the main the use of fish among the Romans was similar to that of the Greeks, but the gourmets of the empire had invented many varied modes of dressing them, and had sent far and wide over all the empire in search of delicacies for the banquet. Not content with the rich supply of the Mediterranean and the lakes and rivers of Italy, fish was imported from Britain, from Greece, Egypt, and the Danubian provinces, and even the rivers of Syria and Asia Minor furnished their delicacies to the Imperial banquets.

Of both the Greeks and Romans, however, we know next to nothing of the way in which fish was used by the masses of the people.

The use of fish in other countries at the present time.

At the present day fish forms a very large element in the diet of many nations and tribes. So largely is fish eaten in China that the home supply is not sufficient, and vast numbers of the population find employment in obtaining it from other countries. One of the chief imports is the bêche-de-mer or trepany, a species of sea-slug, much prized as a delicacy by the Chinese gourmets. Fiji and the islands of Polynesia furnish the largest quantities, and from them also there is a steady supply of dried sharks' fins, which are regarded as especially nourishing on account of the great amount of gelatinous matter they contain. The great salmon fisheries of Yezo, so well described by Miss Bird, find a ready market in China, but for some reason not wholly for home consumption, as several million pounds of dried or preserved salmon are exported every year. Throughout China the millions who form the population dwelling entirely on boats or rafts on the rivers and canals, find their chief sustenance in fish or water-fowl. The tribes of Beloochistan feed almost entirely upon fish, and fish boiled or dried is even given to the cattle during times of scarcity. The Tartar tribes of Siberia and Central Asia, the Esquimaux, Coreans, Greenlanders, the coast tribes of North America, and the Indian races of both North and South America, as well as some of the Aboriginal tribes of Australia and New Zealand, live almost entirely upon fish diet. In some cases it is consumed in a raw state, as in Hawaii, where a meal is thus described by M. Ruschenberger:—"The earth floor was covered with mats, and groups of men squatted in a circle, with gourd plates before them. They ate of the raw fish, occasionally sopping the torn animal in salt water, as a sauce, then sucking it." The diet of the inhabitants of New Guinea is described by Admiral Moresby as consisting of "Roots, fruits of trees, vegetables, &c., but chiefly fish caught in holes in the bed of the river." Again, "fish of all sorts is everywhere so plentiful along the shore that they may be caught with the greatest ease in uncommon abundance."

Fish diet conducive to health.

That fish diet is conducive to the health and stamina of the people is shown by the opinion of the people expressed by a traveller who says, "They (the Papuans) have a large stature beyond European, and larger than that of a people of more miscellaneous diet." This latter statement is quite in agreement with the opinion of fish diet expressed by Dr. Davey, who directed much attention to the subject, and thus sums up his results: "In no class than that of fishers do we see larger families, handsomer women, and more robust and active men, or greater exemption from illness."

SELECTIONS FROM HISTORIC NOTICES OF THE FORMER USE OF FISH IN ENGLAND.

The following extracts are made for the convenience of those who do not find them in their own public libraries.

They may suggest ideas as to the extent fish may be again used in diet as well as objects for sport, or for being kept in ponds only for ornament. Some of them are curiously quaint, but they all seem to show that, whatever the period from which the quotation is made, more attention was paid to the use of fish than has been in this 19th century up to the time of the Fisheries Exhibition.

Time of Edward IV.

1. Time of Edward IV.

From *Joannis Lelandi*, in 'Collectanea de Rebus,' vol. VI., "Out of an old Paper Roll."

The great feast at the intronization of the Reverende Father in God, George Nevell, Archbishop of Yorke and Chancellor of Englande in the 6th year of the reigne of King Edward the Fourth. And first the goodly provision made for the same.

Amongst other things there were the following fishes :—

Pikes and Breames, Porpoises and Seales.

Here followeth the serving of fish in order.

First Course.

First potage, Almonde butter, Red Herringe, Salt fish, Luce salt, salt Eel, boiled Keyling, boiled Codling, boiled Haddock, Thirlepoole (roast), Pike in Rarbite, Eels (baked), Salmon chynes (broiled), Turbot (baked), and Fritters (fried).

Second Course.

Fresh Salmon jowles, salt Sturgeon, Whitings, Pilchards, Eels, Mackerel, Plaice (fried), Barbelles, Conger (roast), Trout, Lamprey (roast), Bret, Turbot, Roches, Salmon (baked), Lynge in jelly, Breame (baked), Tench in jelly, Crabbes.

Third Course.

Jowles of fresh Sturgeon, great Eels, broiled Conger, Chenens, Breame, Rudes, Lamprones, small Perches (fried), Smelts (roast), Shrimps, small Menewes, Thirlepoole (baked), and Lobster.

2. Henry VII.

Time of Henry VII.

In the following record of a celebrated series of fish "meals" it is difficult to know whether to call them feasts or not. The "Sabbati" means Saturday.

"Intronizatio Wilhelmi Warham, Archiepiscopi Cantaur, in passione Anno Henrici 7, vicesimo et Anno Dom. 1504, nono die Martii."

"The hye stewarde of this feast was Lord Edward, Duke of Buckingham, and was also chief butler, making his deputy Sir Thomas Burghey, Knight."

Die Sabbati ad prandium Ducis. Summa serculorum in die Sabbati seq. Cum servit Archiepiscopi et Ducis.

Primus Cursus.

Lyng in oil, Conger in oil, Pike in satin sauce, Conger (roast), Salmon in oil (roast), Carp in sharp sauce, Eels (roast), Custarde (planted).

Secundus Cursus.

Frumentie royall Mamonie to potage, Sturgeon in oil with Welkes, Soles, Breame (sharp sauce), Tenches (floryshed), Lampornes (roast), Roches (fried), Quynce (baked), Tart Melior Leche Florentine, Fritter ammel.

Die Sabbati ad cœnam.

First Cursus.

Lyng, Pike, Salmon in sorry, Breames (baked), Conger (roast) in oil, Eels and Lamperones (roast), Leche comfort 7, Creame of Almondes, Sturgeon and Welkes, Salmon (broiled), Tench in jelly, Perch in sorry, Dulcet amber, Tart of Proynes,* Leche Tramor.

On the following day, Passion Sunday, the 9th of March, the year of our Lord 1505, in the 2nd yeare of the reigne of King Henry the 7th. The first course at my Lord's table in the great hall was as follows :—

Primus Cursus.

Frumentie royal and mainmonie to potage, Lyng in oil, Conger p. in oil, Lampreys with galantine, Pike in latmer sauce, Conger (roast), Halibut (roast), Salmon in oil (roast), Carp (sharp sauce), Eels (roast), Salmon (baked), Custarde (planted), Leche Florentine, Frittered Dolphin.

Secundus Cursus.

Jolie Ipoccas and prune dreudge to potage, Sturgeon in oil with Welkes, Turbot, Soles, Breame in sharp sauce, Carp in armine, Tenches florished, Crevesses, Lamprons (roast), Roches (fried), Lampreys (baked), Tart Melior, Leche Florentine, Fritter ammell, Fritter pome.†

Afterwards the Duke is served in his chamber with a separate meal :—

Frumentie and Hamonie for potage, Lyng in oil, Conger in oil, Lampreys with galantine, Pike in latmer sauce, Turbot, Salmon in oil, Carp in sharp sauce, Eels (roast), Breame in paste, Custard (planted), Leche Comfort, Fritter Dolphin.

At the Archbishop's board end. First course like to the Duke's, except two dishes less in the whole course, that is to say, Salmon in oil and Eels roasted. At which board the Archbishop did sit.

* ? Prawns. † ? Apples.

At the Lord Stewarde's board :—

Second Course.

Jolie Ipocras tart to potage, Sturgeon in oil with Welkes, Conger, Breame in sharp sauce, Carp in grenine, Tench (floryshed), Crevesses, Lampreys (roast), Salmon in Alowes, Soles (fried), Lamprey paste, Tart Melior, Leche Florentine, Fritter ammell, Quinces and orange paste.

At the Archbishop's board end same as the Lord Steward except two dishes, Crevesses d.d. Lampreys.

For the hall at the Bretherns Board.

First Cursus.

Rice molens potage, Ling in oil, Conger in oil, Lamprey with galantine, Salmon, Pike in latmer, Custarde royal, Leche Damaske, Fritter Dolphin.

Second Cursus.

Joly Amber, Sturgeon in oil, Torbut in oil, Soles, Breame de river, Carp (sharp sauce), Tench (floryshed), Eels and Lampreys (roast), Tart Lombarde, Quince paste, Leche Cyprus, Fritter.

Messes to be served for another suite for the Great Hall and Chambers :—

First Course.

Rice moiens potage, Lyng, Lamprey or Eel, Pike in herbiage, Cod or Haddock, Breame paste, Leche Damaske, Frittered Dolphin.

Second Course.

Joly Amber potage, Sturgeon in oil, Carp or Breame in sharp sauce, Salmon in oil, Eels (roast), Orange paste, Tart Lombardi, Leche Cyprus, Frittered Columbine.

For the little Hall :—

Eels in sorry pot, Lyng, Salmon or Eel, Sturgeon, Turbot or Bret, Whiting, Bream or Eel paste, Leche Cyprus, Quince paste, Frittered pome.

For the Vailes :—

Eels in sorry pot, Lyng, Haddock, Whiting, Plaice, Eel paste, Leche Cyprus.

For the Hall at second dinner of servitors :—

Lyng in oil, Conger in oil, Pike (latmer sauce), Lampreys with galantine, Conger, Halibut, Salmon in oil, Custarde (planted), Leche comfort,* Frittered Dolphin.

For my Lord Archbishop, Lord Steward and other Lords sitting at a board at night :—

Joly Ipoccas, Leches (floryshed), Lamprey paste, Quince and orange paste, Tart Melior, Leche Florentine, Marmalade, Succade, Comfettes, Wafers, with Ipoccas.

On the following Monday.

For my Lord :—

First Course.

Rice molens potage, Lyng in oil, Conger in oil, Eels, Pike in oil, Haddock or Plaice, Salmon, Breame paste, Leche Damaske, Fritter pome.

Second Course.

Homonie potage, Sturgeon and Welkes, Breame in oil, Tenches in grisell, Roaches (fried), Carp (broiled), Chynes of Salmon (broiled), Eels and Lamprey (roast), Quince paste, March pear, Leche Florentine, Fritter orange.

For the Knights' and Dukes' Council :—

First Course.

Rice potage, Lyng, Conger, Eels, Pike in sharp sauce, Haddock, Plaice, Salmon, Breame paste.

Second Course.

Homine potage, Sturgeon, Breame in oil, Tench in grisell, Carp (broiled), Chynes of Salmon (broiled), Eels and Lampreys (roast) Quince paste, Leche Florentine, Frittered orange.

* ? Comfit.

For the principal mess in the Hall :—

First Course.

Eels in sorry pot, Lyng, Salmon, Eel, Pike in sharp sauce, Haddock.

Second Course.

Plaice, Salmon, Breame paste, Leche Florentine, Fritter orange.

The common fare of both the Halls :—

Eels in sorry pot, Lyng, Salmon, Eels, Pike (sharp sauce), Haddock or Plaice, Plaice, Quinces and tart paste, Leche Florentine.

3. Date—1512 to 1525.

A.D. 1512 to 1525.

From the 'Antiquarian Repertory.'—Vol. IV.

In treating of accounts of the great Earl Percy's household, we find the following items of fish in the yearly providings.

Item to be paid to the said Richard Gowge and Thomas Percy for to make provision for cxl. stokfish for the expensys of my house for an hole yere after, ij*d.* obol (2½*d.*) the pece by estimacion. All the said fisch to be brought at Candlemas next cummynge to serve my house from Shroftide to Ester next, after and to be occupied from the said Shroftich to Ester, viz. all the Lent season, some xxxiij*s.* iij*d.*, which is to be paid all to geder (altogether) to the said Richard Gowge and Thomas Percy at the said Candlemas, because of the occupying of theym in the said Lent following. And so the hole somme for full contentacion of the said stokfish for one hole yere is xxxiij*s.* iiij*d.* (33*s.* 3*d.*)

To the same parties for white herrings follows, on the same account for the "hole yeare," iiii*li.* x*s.* (£4 10*s.*)

For Salt Fishe do. do. (£18 14*s.*)

For Rede Herringe, do. do. (63*s.* 4*d.*)

For Sprootis (sprats ?), do. do. (10*s.*)

For Salmon Salt somme c. s. do. do. (£5.)

For Salt Sturgeon 10*s.* the ferekyne, ditto ditto. (30*s.*)

What is allowed for breakfast.

This is the ordre of suche braikfast as shal be allowed in my Lord's house, every Lent begynnyng at Shrovetide, and ending at Easter. What they shall have at breakfast Sunday, Tuesday, Thursday and Saturday--except my Lord's children, which shall have breakfast every day in the week in Lent.

For my Lord and Lady. First a loaf of bread in trenchors, ii manchets, a quart of beire, a quart of wine, ii pieces of salt fish, vi baconned herrings, iv white herring or a dish of sproits, i.

Breakfast for my Lord Peircy and Master Thomas. First a loaf of bread in trenchors (same as preceding, only half the quantity).

For the nursery for Lady Margaret and Master Tugeram Peircy—

A manchet, a quart of beer, a dish of butter, a piece of salt fish, a dish of sproits or four white herrings.

For my Lady's gentlewoman—a loaf of bread, a pottell (bottle ?) of beer, a piece of salt fish, or three white herrings.

For my Lord's Breder and head officers of household—two loafs of breed, a manchet, a gallon of beer, two pieces of salt fish and four white herrings, i.

Then follow directions in similar style, for gentleman ushers and marshalls of hall.

For gentlemen of household, viz. korvers, cupbearers, &c.

For ii meas (mess ?) of gentlemen o' th' chapel and a meas of children.

For my Lord's clerks—viz. clerks of the kitchen, &c.

For goemen—officers of household, &c.

Here follows *flesh* days. Then comes breakfast of fish to be allowed within my Lord's house on Saturdays throughout the year "OUTE OF LENT."

My Lord and my Lady,—a loaf of bread in trenchors, two manchets, a quart of beer, a quart of wine, a dish of butter, a piece of salt fish or a dish of buttered eggs.

And so on all the household salt fish or buttered eggs.

[Another extract, date 1610, is given at the end of the book.]

4. DATE—1259 to 1400.

ROGERS' 'HISTORY OF AGRICULTURE AND PRICES IN ENGLAND.'—VOL. I.

THE following is a curious old memorandum of the 14th century:—

"Be it rememberȳd that ȳ Elȳs holcote wardeȳne of Merton College in Oxforde owe to Will Thommȳs Cȳtesȳn and Stokke fȳschmonger of londone for dȳverse ffȳsche bowght of the same Will xiii li. vis. iiiid. (payabȳle) to be paȳd at Wȳtsontȳde next comȳnge aftȳr the date of the bȳlle. In wȳtneise whereof ȳ have sett mȳ seal to the present bȳlle ȳevȳn at londone on the feest of Seȳnt valentȳn

Prices A.D. 1259 to 1400.

the yere of the Reȳne of Kȳnge Herrȳ the vj^th aftȳr the Conquest xxv^th."

This acknowledgment also contains endorsement of receipts on account written by the creditor or his agent. The original is in Holcot's writing.

Stock-fish.

Stock-fishmonger was a regular branch of trade in medieval times. Salt herrings, red and white, salmon, eels, sturgeon, lampreys, haddock, lyng, morucæ (which are said to be cod), mulvells, melyng, hake, haburden, cropling, dogdrave, and hard, stock and salt fish, were all cured. Fish was then expensive.

In those days whale and porpoise were favourite dishes, as well as conger eels. Piscaries were very valuable property, farmed by owners or let at high rents. The eel fishery of Wythornesemere is made the object of an annual account and audit on the part of the Countess Isabella de Fortibus, as was also the salmon fishery of Westshene, the property of the King (Edward II.). The piscary of Dibden was rented by fishermen under the Provost and Corporation of God's House in Southampton; and the fishing in Cherwell at Oxford was let by the warden and fellows of Merton, whenever this Corporation did not consume its produce in their own commons.

Herrings.

Herrings were usually bought by the thousand (1,200), occasionally by the last (containing ten such thousand). They were purchased sometimes in very large quantities, as, for instance, in Winchester in 1259 on behalf of the Bishops; at Rochester, for the purpose of victualling the castle against the siege, 1263; at Sandwich, and especially at Acle, where Roger Bigod appears to have had a castle. Large quantities were bought at Wolrichston against harvest time; the proprietors of that manor dealing out a certain number of herrings to their servants at that time. In Norfolk and Suffolk, the centre of the herring trade, prices were comparatively moderate; going inland, carriage added considerably to the price of the fish.

Ospring, in Kent. There are sixteen entries, prices uniform, between the years of 1277 and 1295. Herrings then were 8*s.* 4*d.* the thousand in that place, and lowest in price at Waleton on the Eastern coast. Prices were high in 1311–1320, and during the last fifty years of this enquiry seven herrings were sold for one penny, and at about fourteen a penny, on the average of the previous ninety years.

Before and after the plague herrings were sold by the cade (500 or 600 of fish) at the rate of 3*s.* 8½*d.* All these entries are at the close of the 14th century.

Prices * varied. In 1318 it was as low as 4*d.* a pound at Oxford; as high at Gloucester in 1327 as 6*s.* 5*d.* Salmon.

At Westshene (Richmond)

				£	*s.*	*d.*
Salmon sold in		1313	were worth	5	13	0
Do.	„	1315	„	3	10	0
Do.	„	1316	„	2	1	0
Do.	„	1317	„	9	9	0
Do.	„	1319	„	8	1	0
Do.	„	1320	„	6	14	0
Do.	„	1321	„	0	13	6

This was Crown property, and besides the profit derived from the sale of the fish caught, the manor

* In 1846, and later, salmon was purchased at 6*d.* a lb. in the south-west of Ireland.

received certain payments from fishermen licensed to angle or net parts of the piscary. On an average these licences amount to 10*s.* 1¼*d.* annually. Thames salmon sold at very high prices; their value, when expressed in present money, being on an average £2 15*s.* 10*d.* No salmon are now taken in the Thames, sewage having destroyed them.

Christchurch fish was about the same value.

But none equal the value of Severn fresh fish, sold at Gloucester at 6*s.* 5*d.* each. This is enormous despite the traditional price of Severn fish.

Eltham—they were sold for 1*s.* 6*d.*

In this record salt fish is expressly named; thus fourteen are named as being purchased at Gloucester at 2*s.* 9½*d.*; six at Conway in 1392 at 2*s.* 6*d.*; three at Hardlaugh—that is Harlech—at 11*d.* each. In 1316 a sturgeon was caught at Mortlake which the bailiff of Westshene purchased for £1 for the King's use. By a statute of the same reign (16 Ed. II. cap. 1) all sturgeon, wherever caught, are declared vested in the Crown by virtue of its dignity or prerogative, and are to be delivered *without* purchase.

Lampreys.

Lampreys were considered the choicest of fish. They were expensive luxuries in the year 1284, selling in Clare at 7*s.* a dozen, and in Bridgnorth, in 1392, 6*s.* 8*d.* was the price for a single dish.

Eels.

The dearest eels were those caught at Wythornesemere in Yorkshire, which sold at 3*s.* 8*d.* the stick of twenty-one. All these entries are before the plague. After those are two entries of *salt* eels, in 1392 at 6*d.*, in 1398 at 2*s.*, the stick. Conger eels were bought at Winchester in 1259, at Branndon in 1327. The latter gives an entry of porpoise purchased at 8*d.* If these were bought, as would appear to be the case in Warwickshire, both porpoise and conger must have been salted.

The earliest date at which pike (*Lupi aquatici*) are quoted is 1277, Lambwaith (probably the present Lambeth). Two years after they are found three successive years at the same place, and called "pikerell." They were also taken at Cherwell, Gosford, and at Oxford. With one exception (Cambridge, 1342) all other pike were taken from the lower portion of the Cherwell, and probably in medieval times these pike had as great a reputation as they bear now. Pike.

There are few entries of oysters. But the rate of those taken at Thorney in Sussex is uniform halfpenny the hundred. And at Sharpness in Kent 7*d.* the bushel. Mussels are also quoted from this place at 5*d.* the bushel. Oysters.

5. DATE—1401 to 1582.

A HISTORY OF AGRICULTURE AND PRICES IN ENGLAND.'—*Rogers.*

Gives average prices of fish for the last fifty years of the fourteenth century:— Prices A.D. 1401 to 1582.

	£	*s.*	*d.*	£	*s.*	*d.*	
Herring (*red*), cade .	0	6	4¾	0	10	1½	1·58
Do. (*white*), barrel .	0	11	6	0	12	9	1·98
Sprats, cade	0	1	6¼	0	2	8	1·75
Salmon, barrel . .	1	7	3¼	2	15	8	2·04
Ling, c	5	4	3	9	3	9	1·76
Cod, c.	2	4	9	2	15	4	1·23
Stock fish, c.	1	7	4¼	1	7	9¼	1·38
Salt fish, warp . . .	0	1	8½	0	2	1½	1·24

The first column is the average between the years

1401–1540, the second that of 1541 and 1582, the third is the ratio of the rise in the later period approximately calculating to two places of decimals, the first column being taken as a unity.

There is also another entry.

Before the Reformation religious houses consumed a vast amount of fish, and a fish diet, partly ecclesiastical rule, partly from necessity, occupied a large portion of the year. After the Reformation the Anglican Church continued to prescribe a fish diet on fast days and in Lent, partly to sustain a national industry, partly as a relic of ancient rule. Most of the prices here collected are of salt fish for keeping, for winter and Lenten diet. Monks are said to have imported the grayling of the Shropshire and Herefordshire streams.

All fish was dear at the beginning of the fifteenth century, lowest during the forty years 1481–1520 inclusive.

White herring were purchased at Cambridge only, the red at Oxford also.

Fresh salmon, Canterbury, 1404, sold at the enormous price of 7*s.* each ; at Bicester and Cambridge in 1439 from 10*d.* to 1*s.* 10*d.* At Oxford in 1450 price from 1*s.* 4*d.* to 1*s.* 10*d.*

			s.	*d.*
At Netley Abbey	1455	at	1	4
„ Cambridge .	1461	„	1	3
„ „ .	1463	„	1	2
„ Oxford . .	1471	„	0	5
„ Wymondham	1492	„	1	2
„ Cambridge .	1495	„	0	8½
„ Thornbury .	1507	„	3	0

At Durham in 1530 there were purchases of fresh salmon at low prices, while in 1529 the King bought five fresh salmon at 1*s.* each.

Salmon was far more commonly sold salt and by the barrel, also by the pipe. The Severn salmon is best quality, and always takes the highest price.

No salt salmon sold between 1421–1440, but nine fresh were bought at 1*s.* each in 1437.

Eels. Eels were purchased salt by the barrel, and its subdivision, the stick; price generally high. Eels were frequently bought during the fifteenth century, but ceased to be purchased in the sixteenth century.

Salt Conger. Bought in 1404 at 3*s.*, in 1406 at 1*s.* 1½*d.*, in 1451 at 6*d.* each, in 1456 at 1*s.*, in 1527 at 1*s.* 7*d.*, in 1534 at 4*s.* 8*d.*, and in 1537 at 5*s.*

It is asserted pike was brought to England in 1537 (*vide* Albin), and carp imported in 1514 by Leonard Maschal. However, the entries quoted show pike and pickerell to have been in this country in the fourteenth century.

Pike.

		£	*s.*	*d.*	
In 1404	cost	5	0	0	the hundred.
„ 1472	„	0	2	0	each.
„ 1530	„	0	3	6	„
„ 1531	„	0	4	0	„

Dentrice. Dentrice vary from 4*d.* to 3*s.* 4*d.* each, though in 1435 half a hundred were bought at 10*s.* the hundred.

Dentriculi. Dentriculi were cheaper; sixty cost 4*s.* 6*d.* in 1452.

Trout.

			s.	*d.*		
Trout in	1429	cost	2	2½	each.	
„	1530	„	0	1	„	Durham.
„	1533	„	0	7½	„	Lewes.

		£.	s.	d.	
Tench.	In 1451 cost	0	0	1½	each.
	„ 1530 „	0	2	8½	„
	„ 1533 „	1	19	6	were given in Durham for 237.

Roach were 1*s.* 4*d.* to 5½*d.* each.

Dace. In 1535 2*s.* the hundred.

Flounders. Do. do.

Porpoise was much bought; the Duke of Bucks gave 7*s.* 10*d.* for a quarter of one in 1444; while Sion Abbey paid 10*s.* for the same delicacy in 1502. In 1530–3 at Durham their price varied from 15*s.* to 6*s.* 8*d.*, in 1531 from 4*s.* to 13*s.*, in 1532 9*s.*, in 1533 one whole porpoise cost 1*s.* 8*d.*

There follows a regular table of prices of all kinds of fish from the year 1401–1582.

Denison, 1492, on best season for fish.

6. Denison (Alfred). 1492.

The earliest Treaties on Angling.

(Privately printed 1872—translated from Flemish.)

Best Season for Fish.

Salmon.—April and May, and a little while after it is at its very best, and remains so till the day of St. James. Then it must be left until St. Andrew's day, and is best between St. Michael's Mass and St. Martin's.

Pike—Carp.—Pike is best in July. Only the pike is good at all times, only except when he sees the rye he spawns. Item: the fore part is best, as it is with other fishes.

Tench—Flie.—Always best in June.

PERCH.—Good except in April and May.

BREAME—MACKEREL.—Good in February and March.

MULLET.—Is good in March and April.

KULLINCK.—Is best at Candlemas day, and continues good in April.

RUDD.—Good in February and March, falls off in May.

GUDGEONS.—Good February, March, April, until May—only the young gudgeon is always good with parsley.

BLEAK.—Best in autumn.

STICKLEBATS.—Are good in March and the beginning of May; when they are full they shall be stirred with eggs.

EEL.—Eel is good in May, till the day of the Assumption of our Lady.

LAMPHREY.—Is never better than in May. And LAMPHERN, its brother, is good from the 13 Mass to the day of our Lady's Annunciation.

CRAYFISH.—Best March and April, particularly when the moon increases they are best.

Here ends this little book, that is very profitable.

And this book was caused to be printed by Matthias Van der Gose.

7. 'HOLINSHED CHRONICLES.' 1586. HOOKER. Hooker, 1586.

Vols. I., II. Third book, chap. 3.

"Of Fish value taken on our Coasts."

There is no house, even of the meanest houses, which hath not one or more ponds, reservations of water, stored with some of them (fish), tench, carp, breame, roch, dace, eels, or such like, as will live and breed together. It is not possible to tell the names of all the fishes to be found in our rivers. Yet, lest I seem incurious to the reader, in not delivering so many of them as have been brought to my knowledge, I will not let to set them down as they do come to mind.

Salmon.

First, salmon, which is not to be taken from the middst of September to the middst of November, are very plentifull in our greatest rivers, as their young store are not to be touched from mid-April to Midsummer. We have

Trout, *barbell*, *graile*, *powt*, *chenin*, *pike*, *gudgeon*, *smelt*, *perch*, *menan*, *shrimps*, *crenises*, *lampreies*, and such like, whose preservation is provided for by divers laws; not only in rivers but in lakes and ponds which otherwise would be small value to their owners.

Friendship of pike to tench.

The pike is friend unto the tench. The fishmonger openeth the side of the pike and layeth bare the fat unto the buyer, for the better utterance of his ware, and cannot make him away at the present; he laieth the same again in the proper place, and sewing up the wound, he restoreth him to the pond where tenches are; who never cease to lick and suck his greeved places till they have restored him to health and made him ready to come again to the stall when his turn come about.

I might here make report how pike, carp, and some other of our river fishes are sold by inches of clean fish, from the gills to the crotch of the tail, but it is needless; also how the pike as he ageth receiveth divers names; as from a *frie* to a *gilthed*, *pod*, *tacke*, *pickerell*, *pike*, and last of all *luce*. Also that salmon is first a *gravellin*, then *salmon peale*, then *pug*, finally *salmon.*

I might finally tell you how in fennie rivers sides, if you cut a turf and place it grass downward on the earth, so that the water may touch it as it goes past, you shall have a brood of eels. It would seem a wonder, and yet it is believed by some, that if you lay a horsehair in a pail of the like water, it will shortly stir and become a living creature. Eels.

Sea Fish.

All have particular season, few fish being in season all the year round. Soles.

December and *January* is the season for *herring* and *red fish*, *rochet* and *gurnard*. *February* and *March* for *plaice*, *trout*, *turbot*, *mussels*, etc. In *April* and *May*, *mackerel* and *cockles*. In *June* and *July*, *conger*. In *August* and *September*, *haddock* and *herring* doth most abound. Seasons of Fishes.

Of fishes, therefore, I find *five* sorts, the flat, the round, the long, the legged and shelled; so the flat are divided into the smooth, scaled and tailed. Of the *first* are the plaice, the but, the turbot, vict floke or sea flounder, dory, dab, etc. Of the *second*, the soles. Of the *third* our chaits, maidens, kingsons, flath and thornbark; whereof the greater be for the most part either dried and carried into other countries, or sodden, sold and eaten at home; while the lesser be fried or buttered soon after they be taken as a provision, not to be kept long for fear of putrifaction. Five sorts of Fish. First. Second Third.

Under the round kinds are comprehended *lumps;* an ugly fish to sight but very delicate eating. The *whiting*, the *rochet*, *sea breame*, *pirle* (?), *hake*, *sea-trout*, Fourth. Lumps.

gurnard, haddock, cod, herring, pilchard, sprat, and such like. Under this kind also are the great fish contained, the *seal, dolphin, porpoise,* the *thirlepole, whale,* and whatsoever be round of body, be it great or small.

Thirlepole.

Fifth.

Of the long sort are *congors, eels, garefish,* and such other of that form.

Sixth.

Finally of *the legged kind* we have not many; neither have I more of the sort than the *Polypus, called the English lobster, crayfish* or *crenis,* and the *crab.*

As for the little crayfish, they are not taken in the sea, but in our fresh rivers.

Lobster.

Carolans Stephanus doubted whether lobster be fish or not, and in the end concluded them to grow of the purgation of the water as doth the frog; and those also not to be eaten, for that they be strong and very hard of digestion.

Oysters.

We have plenty of oysters, whose value in old time for their sweetness was not unknown in Rome (although Mutianus, as Pliny noteth, lib. 32, chap. 6, prefer the czicena before them); we have mussels and cockles. We have likewise no small store of great winkles, scalops and periwinkles, and each of them far into the land from the sea coast in their several seasons.

And albeit all our oysters are generally forborne for the foure hot months, May, June, July, August, which are void of the letter R, yet in some places they be continually eaten, where they be kept in pits.

8. 'BUTTES' (HENRY).—1599.

Henry Buttes, 1599.

"Dyets, Dry." *Fish.*

Choice, whenever you can get it, great or little. Nourisheth best, tasteth most excellently and exquisitely; in all men's judgment a fish of chief note. Only it soon tainteth, therefore dress it presently. Carp.

Lay it scaled and gutted five hours in salt, then fry it in oil and besprinkle it with vinegar in which spice and saffron have boiled. Temperately hot and moist, in the beginning of the first. For any season or constitution.

Thick; caught in May, in a swift running river, full of deep downfalls and rocks, and not out of standing pools. Nourisheth well; soon digested; yields a cool juice for an over-hot liver and blood; therefore good in hot agues. It soon putrifieth. Scarce fit for old men and weak stomach. Seeth it in just so much vinegar as water; eat it with sour sauce as soon as you can. Seasonable in hot weather for all but decrepid; every temperature but phlegmatic. Our vulgar proverb hath it, "As sound as a trout." Trout.

River sturgeon is fatter and therefore more grateful to the palate than sea sturgeon. Seasonable in summer, the belly the best. A friendly dish on the table, very dainty and of chief account. Nourisheth well; inciteth Venus; cooleth the blood moderately. Naught for the sick or in recovery, for it is somewhat fat; makes thick and clammy juice, slowly digested. Seeth it in water and vinegar with a little cinnamon or fennel in it. Seasonable in hot weather for all but those plagued with distillations and diseased joints. Sturgeon.

Lamprey. River. In March or April for then it is notably good and the backbone marrow tenderest. It hath a most excellent fine relish, nourisheth passing well; increaseth seed. A lordly dish. Somewhat slow of digestion, specially not boiled enough; naught for the gout, or feeble sinews. Choake it with white wine, stop the mouth with a nutmeg, and the other holes with cloves; then fry it with nuts, bread, oil, spices and white wine. For any season, age, constitution, but decripit, goutie, and diseased sinews.

Mullett or Barbell. Of the lesser size are best, not taken in muddy water but on clear gravel. Pleasing to the palate; the flesh applied cures the biting of venemous things.

The wine wherein mullet is cooked is injurious—should not be used, destructive to fecundity, the meat is hard and slow of digestion. Roast upon a gridiron sprinkled with oil and the juice of oranges; or boiled with vinegar, sweet herbes and saffron. Suitable for youth and cholericke young stomackes. The Romans prized this fish at a wonderful high rate, and it is incredible what Asinius gave for a mullet.

Tench. Small river, in autumn or winter most seasonable. It little benefiteth the body, only some think cut lengthway and applied to the feet stancheth the heat of ague. Is slow of digestion, heavy on the stomach, bad nourishment, specially in the dog days. Bake it with garlic, sweet herbs and spices, oil, onions, and raisins, garlic, parsley and vinegar. Fit for youth, collerick and very labouring men.

Pike. River rather than pond. Great, fresh, new and fat; nourisheth much. The jawbones burnt to powder and given, the weight of a french crown, in wine will break the stone.

Hard of concoction. Bad nutriment, burdens the stomacke—not for the sick. Seeth with sweet herbs and oil ; eat with vinegar, or boiled with wild marjoram and vinegar. Fit for winter, youth and chollerick.

The following is a curious rhyming account of opinions of the value of certain fish.

Drayton, in his Polyolbion, has (in 25 song), Holland's oration—

"What fish can any shore, or British sea town show,
That's eatable to us, that it doeth not bestow
Abundantly thereupon ; the Herring king of sea,
The faster-feeding Cod, the Mackerell brought by May,
The dainty Sole and Plaice, the Dab, as of their blood ;
The Conger finely sous'd, hote summer's coolest food ;
The Whiting knowne to all, a general wholesome dish ;
The Garnet, Rochet, Mayd, and Mullet, dainty fish ;
The Haddock, Turbet, Bert, fish nourishing and strong ;
The Thornback and the Scate, provocative among ;
The Weaver, which although his prickles venom bee,
By fishers cut away, which buyers seldome see ;
Yet for the fish he bears, 'tis not accounted bad :
The Sea-flounder is here, as common as the Shad ;
The Sturgeon cut to keggs (too big to handle whole)
Gives many a dainty bit out of his lusty tole,
Yet of rich Neptune's store, whilst thus I idely chat,
Think not that all betwixt the Wherpoole and the Sprat,
I goe about to name, that were to take in hand
The Atomy to tell, or to cast up the sand."

1598. Epigram *De Piscatione.*

" Fishing, if I a fisher may protest,
Of pleasures is the sweetest, of sports the best ;
Of exercises the most excellent ;
Of recreations the most innocent.
But now the sport is marde, and wott ye why ?
Fishes decrease, and fishers multiply."

COLLIER'S *Poetical Decameron,* vol. ii., p. 108.

Dennis de Coetlogon, 1745.

De Coetlogon (Dennis).

Vol. I. 'Universal History of Arts and Sciences.'

Fishing.

First salting herring.

Salting herring was not discovered until 1416, though some date it from 1397. Willoughby, in his 'History of Fishes,' observes that Will Buckelty or Baccbalen, a native of Bier-ulict, rendered his name immortal by the discovery of the secret of curing and pickling herring. He adds that the Emperor Charles V. coming into the low countries made a journey to the Isle of Bier-ulict with the Queen of Hungary, on purpose to see the tomb of this first Barreleer of herrings.

The Dutch are of first quality.

Comparison of quality herring.

The Irish next in value after the Holland, principally those of Dublin, which are scarce inferior to those of the best Rotterdam or Enkuysen. The Scotch are not so well prepared, salted, etc., as the Dutch. It is not doubted that if the Scotch were as careful as their neighbours, their herring would be the best in the world.

First fishing herrings.

The Hollanders were the first to begin herring fishing (they are the most industrious people in the world to acquire wealth). Their first regular fishing is fixed to the year 1163. They begin 24 June, and employ 10,000 vessels therein, called Busses; they carry from forty-five to sixty tuns, and two or three small cannon. They are not allowed out of port without convoy, unless there be enough of them together to make eighteen or twenty pieces of cannon.

A Brief Note of the Benefits that growe to this Realme by the Observation of Fish-daies. With a Reason and Cause wherefore the Law in that behalf is made.—J. ERSWICKE, 1642. J. Erswicke, 1642.

The first cause mentioned is for the maintenance of the navy.

Second cause, that many towns and villages upon the sea coast are of late years wonderfully decayed, and some depopulated, which in times past were replenished not only with fishermen and great store of shipping, but sundry other artificers, as shipwrightes, smiths, rope-makers, net, sail makers, &c., and others mainly supported by fishing. That hereby they may be renewed, the want wereof is, and has been, a cause of numbers of idle persons with whom the realm is greatly damaged; and this happeneth by the uncertainty of the sale of fish, and the contempt which in eating of fish is conceived.

Many other things for confirmation hereof might be spoken, the weath and commodity that fishing doth bring to this realm; the cause that certain days and times for expence of fish must of necessity be observed, growne by reason the provision of fish for the people's diet must be certainly provided. . . will be sufficient to persuade such persons as esteem more the benefit of their country than their own lust or appetite, setting before their eyes the fear of God in obedience to the Prince's commandment, especially in such things as concern the benefit of a commonwealth.

An estimate of what beefs may be spared in a year in the City of London by one day's abstinence in the week. First in the year are 52 weeks—to every week 7 days—365—the Lenten Friday and Saturday in every week, and the other collected fish days being collected together extend 153. So in the year is 153 fish days and 211 flesh days. That is 58 flesh days more than fish days.

So the year having 52 weeks, abate 7 for the time of Lent wherein no beef ought to be killed, and there remaineth but 42 weeks. Then let us say there be three-score butchers freemen, . . and every butcher kill weekly the one with another, five beefs apiece. The same amounts to 13,500 beefs.

The foreigners in the suburbs and such as come out of the country to supply the town are four times as many—54,000. The beefs entered by freemen and foreigners together extend to 67,500. . . .

The beefs spared by the days mentioned to be observed as fifty days' abstinence, would be 13,500 . . . .

And this does not increase any of the fast days already in vogue, only orders a better observance of them.

1547 to 1585. 'STATUTES OF THE REALM' (1547 to 1585), Vol. IV., part I.

Anno 5, *o. Elizabeth, cap. v., sec.* 11.—And for the encrease of provision of fishe by the more usual eating thereof, bee it further enacted, that from the feast of St. M. the Arch Angels, anno Dui, fiftene hundreth three score four every Wednesday in every week through the whole year shall hereafter be observed and kept as the Saturdays in every week ought to be, and that no person shall eat flesh no more than on common Saturdays. [N.B.—Not Fridays.]

Sec. 12 orders for the benefit of the realme and to save flesh meat, it shall not be lawful for any person to eat meat on fast days; penalty forfeit £3 for every time.

5 *Elizabeth, c.* 5, A.D. 1562–3, *sect.* 12.—Penalty on not keeping fish days. Every person to pay £3 or suffer three months' close imprisonment every time they offend. The owner of every house where fish is eaten, and who shall not inform thereof, fine £2. All forfeitures for same to be divided as follows: One part to use of her Majesty, her heirs or successors, one part to the informer, one part to the common use of the parish where offence is committed. To be levied by churchwardens after any conviction in that behalf.

Sec. 13 gives licences to eat meat on payment of money. The lord or his wife shall put in parish poor-box on certain days twenty-six shillings and eight-pence. Knight or knight's wife, yearly, six shillings and eightpence. This permission excludes the eating of beef at any time of year; veal from Feast of St. M. Arch Angel unto 1st day of May. Licence also for sickness, proceeds thereof go to curate of parish.

Sec. 14 confirms old fish licences of previous kings, archbishops, and all ecclesiastical laws, &c.

Sec. 20 goes minutely into further penalties how to be levied and applied.

Sec. 22 allows only *one* competent dish of meat on Fish Wednesdays at the same meal, and *three* competent usual dishes of sea fish of sundry kinds, &c.

Further, says no man is to mistake the intent of this statute limiting orders to eat fish and to forbeare from flesh. It is intended and meant politically for the increase of fishermen and mariners, &c., and not for any suspicion to be maintained in the choice of meats. That whosoever shall by preaching, teaching, writing, or open speech notify that any eating of fish and forbearing of flesh, mentioned in this statute, is of any necessity for the saving of the soul of man, or to the service of God, or otherwise than as other politic laws are, shall be punished as spreader of false news.

'STATUTES OF THE REALM' (1586 to 1624),
Vol. IV., part 2, chap. xxviii., p. 1058.

James I. in 1603 issued a proclamation reminding his English subjects to keep Lent. This his Majesty did to help Scotch herring trade.

Charles I., 1627, sent a royal decree from Whitehall to same effect.

Froissart mentions (1429) when the English were besieging Orleans, the Duke of Bedford sent from headquarters (Paris) five hundred cartloads of herrings for the use of the camp during Lent. The French Xaintraille, Lahire, de la Tour de Chavigny, and the Chevalier de Lafayette made a desperate effort to stop the convoy, but were routed with much slaughter.

1825 to 1835.

Lent.

'APOLOGY FOR LENT.'

"Father Prout" (Rev. F. Mahony, P.P., Watergrass Hill, co. Cork) says: Lent is an institution which should long since have been rescued from the cobwebs of theology, and restored to the domain of common sense and political economy, for there is no prospect of arguing the matter in a fair spirit among conflicting divines: and of all things polemics are the most stale and unprofitable. Loaves and fishes have, in all ages of the Church, had charms for us of the cloth; yet how few would confine their bill of fare to mere loaves and fishes? So far Lent may be a stumbling block. In Edward III., A.D. 1338, Rymer's 'Fœdera,' page 1021, says that before the battle of Cressy fifty ton of Yarmouth bloaters were shipped for the troops. The enemy sorely grudged them their supplies, for it appears by the chronicles of Enguerrand de Monstrellet, the continuator of Froissart, that in 1429 they had a battle which Rapin calls "La journée des harengs."

The cultivated Athenians appreciated the value of fast days. Accordingly on the eve of certain festivals they fed exclusively on figs and the honey of Mount Hymettus. Plutarch tells us a solemn fast preceded the celebration of Thermophoria.

It appears that Numa fitted himself by fasting for an interview with the mysterious inmate of Egeria's grotto.

Gibbon, in the 'Causes of the Decline and Fall,' notices the vile propensity to overfeeding, and shows that nothing but a *bonâ fide* return to simpler fare could restore the mighty system of dominion. The hint was acted upon. The Popes, frugal and abstemious, ascended the vacant throne of the Cæsars, and ordered Lent to be observed throughout the Eastern and Western worlds.

The theory of fasting saved the Empire, taught self-control, and gave a masterdom over barbarous propensities; did more—originated civilisation and commerce.

Prout's Reliques—in his 'Apology for Lent'—says fasting is of very remote antiquity. It was in vogue at the first general council that legislated for Christendom at Nice, in Bithynia, A.D. 325; the custom was ratified by Assembly of Bishops, Laodicea, A.D. 364.

1525 to 1553. 'Liber Domicilii,' 1525—1553, published by the Ballantyne Club, enumerates the material daily ordered for the king's table. Amongst other fishes—

Seal was purchased for the larder, either whole or in quarters, and entered as Phoca or Selch. The Porpoise too was in demand under epithet of Pellok. It may be added the monks of Dunfermline had a grant from Malcolm IV. of the heads of Porpoises caught in the Forth, except the tongues.

Herrings were much used, both fresh and salt; while, contrary to the general supposition, "Aleca rubea" was not unknown in those days.

Many kinds of white fish appear to be referred to, *Mulones recentes* and *Mulones aridi,* terms by which the Cod seems to have been known. Other allied kinds are called *albi pisces,* Ware Codling, Podlokis, Codlinges, Merlingis, *Merlingis æstivales,* Lithis, and Leing, in addition to Stockfish, Speldings, and *pisces aridi.*

The flat fish, under the terms *Turbones,* Holibut, *Roues,* Turbot, Bronoscopi (hranoscopi), Flounders, seem to have been liberally supplied; also occasionally Sole. No reference is made to the Skate, unless we are to consider the fish termed Rigadia as of that sort.

Many other sea fish are referred to, as Sand Eels, *Fundolis;* Blennies, *Greenbans;* Gurnards, *Crunans;* Lump fish, *Padils;* Angler, *Murlycon;* Sea Cat, *Cattus marinus.* The Spirling, Conger Eel, and Lamprey, also have a place, while *M'fische*, a term of frequent occurrence, is of doubtful import.

At the head of freshwater fish is the Salmon, used fresh, salted, kippered.* Trout, Eels, Perch, and Pike, are also constantly used. Pike being purchased in 1525 (see Yarrell) is in opposition to the received idea that this fish was imported in the reign of Henry VIII. in 1537. It is more probable it had become so scarce it was re-introduced.

Among the molluscous, *Polupi*, or Cuttle-fish, frequently occupies a place; also Oysters, Mussels, Cockles, *Concis;* Razor-fish, *Spouttis;* Scallops, *Pectines;* and the Horse-mussel, *Pectines aquæ dulcis.* The Bucky and Limpet conclude the list. Of the crustaceous animals the supply appears to have been only of common Crab and Shrimps.

Dr. Parnell, as referred to by Mr. Yarrell, informs us of an example of Lampris opale washed ashore near North Queensferry, July, 1835. It was found by those who eat it to have flesh red and good as that of a Salmon.

The Doree is generally considered a great luxury for the table, and the derivation of its name, from adorée, with the fact that the appellation applied to it by Ovid is Rarus, are often referred to in illustration of the unanimity of this opinion.

Mr. Couch says of the Surmullet that it is now, as

* This is one of the earliest notices of kippered salmon.

it ever has been, an object of inquiry to those who indulge in the luxuries of the table, so that it became a proverb that those who caught it never knew the taste of it ; but to obtain it in its perfection it ought to be in the hands of the cook within a few hours after it has been taken out of the water. The ancients were aware of this, and it was something more than curiosity which led the Romans to produce living fish on the table for the inspection of the guests, before they delivered them to the cook. Seneca tells us they were scarcely valued unless they died in presence of the guests.

In no article of luxury does it appear that the Romans of the Empire went to such extravagant and even ridiculous extent as in regard to this fish.

Stone Bass. They form an excellent dish at table.

Red Mullet. Lucullus is sufficiently known for the great expense he was at in forming his ponds, . . . and yet he was blamed by Hortensius for want of care in allowing his fish to remain in what he considered an unhealthy situation.

Martial has an epigram on one who sold a valuable slave, that with the price he might for once thus indulge himself and be talked of, although, in fact, he gave his guest little else to eat. Under these circumstances the price might be expected to be high. A Mullet of 2 lb., each pound 12 ozs., was expected to bring its weight in silver. This value, however, was often exceeded, and specially when the fish had grown scarce in their own waters, and in consequence were sought for on the distant coasts of Corsica and the south of Sicily. . . . Juvenal speaks of a single Surmullet as having obtained the price of almost fifty pounds. . . . The more sober Suetonius tells us that on one occasion three of these Mullets were sold for thirty thousand sesterces—at least seventy pounds for each fish.

Bass, though thought excellent for the table with us, was regarded much more highly by the Romans in the time of the Empire. They set the highest value on those caught in a recognised district of the Tiber, and which those who prided themselves on their exquisite taste professed to be easily able to recognise; . . . yet it was the fish preferred by the epicure that ought to have excited disgust! for the favourite station was indebted for its excellency to the great cloaca or principal drain of the city. Bass.

Mr. Couch in his book on fishes does not often mention which are used for food; but he says, speaking of the Dolphin and Porpoise, they were esteemed fashionable dishes for the royal table as late as the time of King Charles I., although Willoughby and others are so candid as to admit that they were not thoroughly relished by all tastes. Rondeletius goes further, and says the smell itself was so nauseous as to destroy the appetite for all besides that was on the table. Dolphin. Porpoise.

The value of Skate as an article of food is very differently thought of in different parts of this kingdom and of Europe. Risso says it is not a common fish at Nice, but that it is highly held in esteem; and Lacépède also speaks of it as a delicacy. But the most favourable account is by Willoughby, who records a remarkable instance, in which, owing probably to excellent cookery and exquisite sauce, a single fish of this sort weighing 200 lbs. was found to satisfy 120 Skate.

learned gentlemen at St. John's College, Cambridge. Lacépède says it is salted and dried for exportation, particularly in Holstein and Sleswick, and in that state it is sent to Germany for sale. It is also so prepared in our own country, and sold in market at Penzance.

YARRELL, 'HIST. BRITISH FISH.'—Vol. I.

Atherine. Like smelt, they are common at Brighton, Worthing, Eastbourne, Down in Ireland, Youghall, Dublin. The liver and roe are delicious; superior in spring when full of milt and roe.

Pike. Pike were rare formerly in the latter part of the 13th century. Edward I., who condescended to regulate the prices of different fishes, that his subjects might not be at the mercy of the venders, fixed the value of pike higher than fresh salmon, and more than ten times greater than that of the best turbot or cod. In the reign of Edward III. I refer to the lines of Chaucer (see p. 6). Pike are also mentioned in the Acts of Richard II., 1382, regarding the forestalling of fish. Pike were dressed in the year 1466, at the great feast given by George Nevil, Archbishop of York. Pike are also mentioned in the famous 'Boke of St. Alban's,' printed 1481. They were so rare in Henry VIII.'s time, that a large one sold for double the price of a house lamb in February, and a pickerel or small pike for more than a fat capon.

Pennant says they live to ninety years of age. Gesner relates that in 1497 a pike was taken at Halibrun in Suabia, with a brazen ring attached to it, on which were these words in Greek character: "I am the fish which was first put into this lake by the hands of the Governor of the Universe, Frederick II., the 5th of October, 1230!" This fish was therefore 260 years of age, and weighed 350 lbs. The skeleton, nineteen feet in length, was preserved in Manheim as a great curiosity.

In Ireland they have been caught of 70 lb. weight; but Isaac Walton says: "Such old or great fish have in them no great goodness."

Those of the Medway, when feeding on smelt, acquire excellent condition and fine flavour.

Found on coast of Cornwall; its flesh is good food. Red Wrasse. The *Comber Wrasse* is mentioned by Couch, Jago, and Pennant as found on our coast, and good food.

Though taking colour from its food is not injured Tench. thereby. One taken at Munden Hall, Fleet, Essex, was dyed black as ink from fetid lake, yet, when eaten, none could taste sweeter, or be better grown. Some caught at Leigh Priory of about 3 lb. weight looked beautiful, but when dressed smelt and tasted so rank, and of a particular weed, no one could touch them.

Yarrell (Vol. II.) says of Holibut:—

Occasionally seen in London market, common on coast of Ireland; flesh firm and white, though dry, muscular, fibre coarse, little flavour, head and fries best part; sold at low price by the lb.

Higden, Polychronicon (Babington).—Vol. II.

'*Chronicles and Memorials of Great Britain and Ireland.*'

(15*th Century*).

Chapter XLI.

Note.—*Beda, libro primo.*

Fysches whiche be callede dolphynes be taken there (Britain) oftetymes, and porpas and other great fish, excepte diverse kyndes of schelle fisches, as muscles, in whom margarites be founde of every coloure, as redde of a purpulle coloure, and of the coloure of a jacinte, but most specially white margarites.

Also there be schelle fisches habundantly with whom a nowble redde coloure is made and diede. The beautuous reddenesse of whom may not appaire in eny tyme thro the heete of the sonne, neither thro the injury of reyne (rain) ; but ever the more hit (it) is werede, and in age, hit is the moore feire in coloure.

What Londoners used to have.

The Thames in 1593.

From '*Harrison on the Noble River Thames*' *in* 1593, as published by the 'New Shakspere's Society.' (London : 1877.)

Speaking of the Thames, he says: It is the longest of the three famous rivers of this isle, so it is nothing inferior unto them in abundance of all kinds of fish, whereof it is hard to say which of the three have either most plenty or greatest variety, if the circumstances be duly weighed. I will invent no strange things of this noble river, therewith to nobilitate and make it more honourable, but this I will plainly affirm, that it neither swalloweth up bastards of the Celtish brood, or casteth up the right begotten that are thrown in without hurt into their mother's lap, as *Politian* fableth of the Rhene (Epistolarum lib. 8, epi. 6), nor yieldeth clots of gold as the Tagus doth; but an infinite plenty of good fish, wherewith such as inhabit near unto its banks are fed and fully nourished. What shall I speak of the fat sweet salmon, daily Salmon. taken in this stream, and that in such plenty (after the time of the smelt be passed) as no river in Europe is able to exceed!

What store also of barbels, trouts, chenins, pearches, smelts, breames, roches, daces, gudgins, flounders, shrimps, &c., are commonly to be had therein. I refer me to them that know, by reason of experience of their daily trade in fish, better than I.

Albeit it seemeth from time to time to be as it were defrauded in sundry wise of these her large commodities, by the insatiable avarice of the fishermen, yet this river complaineth (commonly) of no want, but the more it looseth at one time, the more it yieldeth at another. Only in carps it seemeth to be scant, Carp. since it is not long since that kind of fish was brought over into England, and but of late into this stream, by the violent rage of sundry land-floods, that brake open the heads and dams of divers gentlemen's ponds, by which means it became (somewhat) partaker also of this said commodity, whereof earst it had no portion that I could ever hear. (Oh! that this river might be spared but even one year from nets, &c.! But, alas! then should many a poor man be undone.)

The tide rises and falls twice a day as high as seventy miles above London. There are floods when the Thames overfloweth her banks in the falls and changes of January and February wherein the lower ground are soonest drowned; this order of flowing is perpetual. These land floods also do greatly strain the fineness of the stream, insomuch that after a great land flood you shall take haddock with your hands beneath the bridge, as they float upon the water, whose eyes are so blinded with the thickness of that element, that they cannot see where to become and make shift to save themselves before death take hold of them. Otherwise the water of itself is very clear, and in comparison next unto that of the sea, which is subtle and pure of all other.

Haddock.

Extracts from 'THE PAMPHLETEER.'—Vol. I. 1813.

It is a singular but ascertained fact, that when the largest quantity of mackerel is in the British Channel, which supplies the London market, the fishermen who frequent Billingsgate almost wholly discontinue the mackerel fishing. It is thus accounted for—the fishermen depend on the fishwomen who daily attend Billingsgate with baskets on their heads to purchase their fish. But as soon as the common fruit comes into season these women find the sale of gooseberries and such like produce them a larger and more secure profit, with less risk and trouble.

Being disappointed of a sale for the mackerel at the time when they are most abundant, the men give up in a degree their employment for the season, and an immense amount of palatable and nutritious food is thereby annually withheld from the inhabitants of the metropolis.

On the 15th June, 1812, upward of 17,000 mackerel were purchased by Mr. Hall at £5 the thousand, and sold to the working weavers at the original cost, one penny each. They were purchased with great avidity —not merely for immediate consumption, but also put into small pots with vinegar to keep; they continued good for some time and eat like pickled salmon.

Five hundred thousand mackerel arrived and were sold in one day. They were purchased at six and even nine for one shilling. They brought down the price of meat, as butchers sold at twopence a pound under the usual price.

Improvements in agriculture and economy in the use of food are remedies usually prescribed for excess of population. There are acres of water around our coasts inexhaustible in nutritive and palatable food. These fields are perpetually white with harvest, and we have only to reap the harvest which Providence benignly supplies.

An objection is made to fish diet for the labouring class as being passed lightly by digestion, it is therefore unfit to support labour. But, *first,* the labouring poor in fishing ports who make it their principal diet *are* stout, hardy and strong.

Secondly, fish is not proposed as a sole article of food, only an addition to, or improvement on, what they now have.

Thirdly, the objection may be removed by the mode of cooking it. In America cod and other kinds of fish are dressed with pork, bacon, fat beef, potatoes, thickened with rice or oatmeal, and small suet dumplings, and seasoned with savory herbs, and pepper and salt, the whole producing a palatable and nutritious stew which they call choudep.

The benefits to accrue from a more general use of fish are—food, occupation, nursery for seamen, and increase of trade.

Norway derives five-sixths of its food from fisheries, without which its population could not exist. It is not desired, nor may it be expedient or necessary, to carry the use of fish to even a third of that comparative amount. But if *one-fourth* only of the subsistence of this country were derived from fish (the other three parts being chiefly composed of corn, meat, and potatoes and an equal quantity were exported in exchange for the wheat, rice and other foreign produce), it would not only provide for an additional population of above four million, but would supply the whole of the inhabitants of Great Britain with more nutritive and palatable diet than they now enjoy, as the saving of butchers' meat by the middle classes might allow a greater proportion of it for the poor, instead of their present scanty and too general diet of bread, water and tea.

Fisheries would afford employment to a numerous class of courageous, adventurous individuals, who are too volatile to fix any settled steady course.

The addition to our export trade would be great, the saving of money enormous, as for many years past we are drained of millions of bullion annually remitted to foreign states as the price of our daily subsistence.

March 10, 1813.

As an illustration of the way in which the use of fish was studied before the chemistry of foods was studied, there is given the following long extract from T. Venner's *Via Recta ad Vitam Longam* (1650) :— T. Venner, 1650.

OF FISH. *Section* 5.

It is because fish increaseth much gross, slimey, and superfluous flegm, which, residing and corrupting in the body, causeth difficulty of breathing, gout, the stone, the leaprie, the scurvy, and other foul and troublesome affects of the skin. Wherefore I advise men that are much delighted with the use of fish, that they be careful in the choice of it; as that it be not clammy, slimy, neither of a very gross and hard substance, not oppleted with much fat (for all fat is of itself ill and noisome to the stomach; but of fish it is worst), neither of ill smell and unpleasant savour. Wherefore of sea-fish the best swimmeth in a pure sea, and is tossed and hoist with wind and surges; for by reason of continual agitation it becometh of purer and less slimey substance. And for the same cause, the fish that is taken near a shore that is neither earthy or slimey, is of a harder digestion, and of a more slimey and excremental substance. The fish also that taketh itself from the sea to the mouths of great rivers and swims in fresh water, quickly become better or worse. If in slimey rivers they lose much of their goodness, if in pure gravel improve, and the farther they go from sea the better they are. Fish in standing pools, unwholesome by reason of impurity of the place, it breedeth a very slimy excrementall nourishment, very hurtful to them who are subject to gout, and stone, and obstructions of the breast.

Sole. The sole is somewhat hard, is remarkable for whiteness and purity of substance, pleasant taste, good juice, and far exceedeth all other sea-fish; therefore may be called sea-capon. It is verily to be reckoned amongst meats of primest note; and for such as are infirm and sick, *non magis quàm salutaris cibus.* Severn soles excell all others.

Plaice. Plaice is pleasant to palate, easily digested, and, in the judgment of some good men, a good fish. But my opinion is that it is watery, and giveth excremental nourishment, special if not well grown. It is agreeable to those who are by constitution choleric; but to the phlegmatic very hurtful, because it aboundeth with phlegmatic juice.

Dab. The dab, or little plaice, is worse.

Gurnard. The gurnard is of harder digestion than any of the former. The red is the best. Both kinds give good nourishment and nothing slimey; therefore they are better for the phlegmatic than plaice or flounder.

Whiting. The whiting, notwithstanding that it is unsavoury and nourisheth little, is much liked. It is easy of digestion, and the nourishment which it maketh, if little, is good. The younger and smaller are more sweet and pleasant, and give the best nourishment.

Smelt. Smelts have fragrant odour, which doth commend them They delight the palate, and yield good nourishment.

Breame. Breame is somewhat acceptable to the palate, and is of meetly good nourishment. It is best for choleric bodies, and worse for phlegmatic. Some love to eat the eyes of the breame; but they are very excremental, as are the eyes of all fish.

Shad. Mackrell. Shad and mackrell are both sweet in taste and soft in substance; they are not very wholesome, quickly producing loathing and sickness of stomach, and breed excremental nourishment. They are convenient for labouring-men and those who have strong stomach.

Dogfish and hake are near of nature; not of hard concoction, but yet scarcely of laudable nourishment, for they increase crude and waterish humours. Dogfish. Hake.

Codfish, for whiteness of colour, and moderate hardness and friability of substance, is commended. It is easily digested, and yieldeth meetly strong nourishment, and not very excremental. Being salted, dried, and so kept, it becomes of harder concoction and worse nourishment. Codfish.

Haddock is pleasant to taste, in nature somewhat like cod, but it is of lighter concoction, and not of so firm and durable nourishment. Haddock.

Mullet is somewhat of a hard substance, yet if taken in gravelly and stony shore, is not of hard digestion. It is of pleasant taste, and meetly good nourishment; but if taken in a muddy place, is not easily digested, is hurtful to the stomach, and breedeth gross and excremental humours. The smaller mullets are the best. Mullet.

Bass is, in goodness of juice, inferior to mullet, for it is of harder concoction, and breedeth a more gross and slimey nourishment. Both mullet and bass are agreeable for them who are of hot temperature and have strong stomachs. Bass.

Salmon is ranked with the best sort of fish; it is pleasant to taste, and not hard of digestion. It maketh good nourishment; in consistence neither clammy or gross, yet it quickly oppresseth a weak stomach; wherefore let such as have weak stomach and are infirm so carefully moderate appetite, as that the jucundity of it intice them not to a perilous and nauseative fulness. And it is not good for them that have strong stomachs to eat too much of it, for it soon weakeneth the stomach, subverteth appetite, and that oftentimes with the danger of a deadly surfeit. The belly is to be chosen before any other part, because it is tenderer, and of a more sweet and pleasant taste. The eyes of a salmon are far wholesomer than the eyes of any other fish. Salmon.

Salmon-peale. The young salmon, salmon-peale, is far better than that which is fuller grown; for it is of a softer and whiter substance, of a pleasanter relish, of easier concoction, more acceptable and agreeable to the stomach, and of very good wholesome nourishment. The salted salmon loseth much of his goodness and pleasant taste, and is therefore much inferior in point of wholesomeness.

Turbut. Turbut or birt is meetly pleasant to the taste, and if it be well digested maketh good and firm nourishment. It is of somewhat hard substance, and therefore not easily digested. But it is very good meat for such as are healthy and have strong stomachs. But for the aged and those who are phlegmatic, and that have weak stomachs, it is very inconvenient and hurtful.

Sturgion. Sturgion is a very acceptable dish, and best welcome at tables. Whether this is because of rarity, goodness of meat, pleasantness to palate, and inducing withal a smoothing delectation to the gullet, is doubtful. I will plainly deliver my opinion. The flesh is white, and meetly pure substance, consequently laudable nourishment; if it were not intermixed with a gross and nauseative fat, for which reason it is not so easily digested, and is quickly offensive to the stomach, making gross and clammy nourishment. Wherefore let such as are aged or have weak or cold stomach refrain from it. It is most accommodated for the hot season. The little or young sturgion is wholesomest. The belly of the sturgion, like that of salmon, is the best. The sturgion, both old and young, is very hurtful unto them that are troubled with rheumes and articular griefs.

Hallibut. Hallibut is a big fish and of great account, white, and of hard substance, therefore not easily digested; but it is very pleasant to the taste, and for goodness of meat scarcely inferior to sturgion. The belly is best. It is a convenient meat for young men, and for hot choloric bodies; but for phlegmatic, and them that have weak stomachs, hurtful.

Dorie. Dorie for substance is of a mean consistence, and not very delectable to the palate. It giveth mostly good nourishment. But it is not good to eat too much of, specially for those of weak stomach, or who suffer from gout or stone, because it breedeth gross and phlegmatic juice.

Allowes is taken in the same place as salmon, it is meetly pleasant to the taste. Yields much, and somewhat a thick nourishment, yet not ill, so it be well concocted in the stomach; but it is of hard concoction, wherefore it is hurtful to them of weak stomach, and that are by constitution phlegmatic and melancholy. The allowes that tarry in and are taken in sweet waters is wholesomer than that of the sea; for it is fatter, of tenderer substance, of easier concoction, and of better savour. Allowes.

The guilthead or goldine is whiter, and not quite so hard as the allowes, therefore of easier concoction and better nourishment. It is only in season in the winter, when he is sweeter in taste; and is convenient for every age, temperature of body, so that the stomach be strong enough to take it. Guilthead.

The calaminary sea-cur or cuttlefish and poure-cuttle are even of one and the same nature; they are of hard concoction, and fill the body with crude and gross humours. They may, when in want of better meat, serve mariners and rusticall bodies, who through strength of stomach and hard labour are able to convert any gross meat into good nourishment. The small ones are best, being more tender and easily digested. They are all hurtful to them who have weak sinews, and are subject to the palsey. Calaminary. Cuttlefish.

The wolf-fish is of cold, moist temperature, pleasant taste, and easy of concoction. It breedeth a cold, thin, waterish juice, and therefore such as are phlegmatic and rheumatic perpetually shun the use of it. The Wolf.

The lump or lomp-fish, so named from his shape, is in taste agreeable to the name; it is hard of concoction, and of gross excremental juice. Lompfish.

The conger is a large round fish like unto an eel, and is Conger.

called conger-eel. It yieldeth gross excremental nourishment as the common eel doth. It is a meat notwithstanding pleasant to most men's palate, but is only convenient food for those of strong stomach and firm body. To the phlegmatic, those of weak stomach, subject to dropsy, gout and stone, it is very hurtful.

Lampreys. Lampreys are of some greatly esteemed, but very unworthily; they are of the nature of eels, yet somewhat wholesomer, not being so clammy or gross. They are pleasant to taste, but not easily concocted. They give much nourishment; but the same somewhat clammy and tough, therefore they are not fit for weak stomach or those suffering from obstruction. They also increase melancholy, and are hurtful to the gouty and those with weak sinews. The small lampreys are the best, they are not so tough, and give most nourishment.

Thornback. Thornback is of moist substance, of gross excrementall and putrid juice; whereby it cometh to pass that it is a meat of ill smell, unpleasant savour, unwholesome nourishment, noisome to the stomach. The use breedeth cold diseases, and epilepsy very speedily if it be eaten hot. The noisome quality doth (as I think) in cooling sometimes evaporate, and sooner arise being eaten hot, for that it is a moist fish and full of superfluity. It is a meat fit for hard labouring men.

Tunie. Porpoise. The tunie, porpuise and such like great bestial fish are of very hard digestion, noisome to stomach, of a very gross excremental and naughty juice.

Herrings. Herrings are somewhat pleasant to the taste, yet not wholesome, as is often proved. Through eating fresh herrings some quickly surfeit and fall into fevers. The salt herring giveth saltish unprofitable nourishment. They are good for them who want better meat.

Pilchard. Pilchard is of like nature of herring, but of pleasanter taste and better nourishment. Yet it is not good for those of weak stomach, or it soon cloyeth with a nauseatif fullness; but, being well salted before using, the superfluity of their excremental is much corrected, and they become less fulsome and hurtful.

Red herring and sprat give a very bad and adusted nourishment; they are only good to excite thirst, and to make drink acceptable to palate and throat. They are hurtful to them of choloric constitution and melancholy. I commend them to the Spaniards and Italians, whereby our merchants make a good commodity. Red Herring. Sprat.

Anchovas, the famous meat of drunkards and of them who desire their drink to oblectate their palats. They are used as sauce with meats, as with mutton, etc., and is in great esteem with them who affect sauce and meats of strange relish and taste. They nourish nothing at all but naughty choleric blood. They may excite the appetite of some peevish stomachs, and by reason of their saltish acrimony are thought to cleanse phlegm from the stomach and intestines; wherefore, if they be good for any, it is for the phlegmatic, so that they pour not too much drink with them. But in my opinion the special good they have, if it may be termed good, is as of pickled oysters, to commend a cup of claret to the palate and stomach. They are therefore chiefly profitable to the vintners. Anchovas.

In shellfish it is to be observed some are of soft substance, and are easily digested; some hard and more difficult of concoction, though of firmer and better nourishment. Shellfish.

Of shellfish oysters are of a most soft substance and easily digested, and least offend the stomach, except they be taken, as we commonly say, against stomach. And also, by reason of the saltness of their juice, they make the belly soluble; they give a light, salt, phlegmatic nourishment; and therefore they are not only very hurtful unto them that be phlegmatic, but also unto all such as have cold weak stomachs, because in them they abundantly increase flegm. Unto choloric bodies and such as have strong stomachs they are agreeable. They must be eaten with pepper and vinegar, a cup of good claret or sack drunk presently after them, for then they will be the better digested. Onions also Oyster.

sliced in the vinegar and eaten with them is an excellent correctory to the flegm if they be not offensive to the eater. But why are oysters eaten a little before meals, and that with one-way bread? For two reasons I conjecture. The first is, because of their subductory quality concerning the belly, which also is holpen with one-way bread; the second is, because through their saltness they excite appetite. Oysters roasted on the coals or stewed in white wine, with butter, pepper, and a few drops of white or claret wine vinegar, and so eaten, do oblectate the palat and stomach, and nourish better than if eaten raw.

Pickled Oysters.

Pickled oysters, by reason of their heat and saltness, please the palate of drunkards as anchovies do; the fewer that are eaten the less the hurt. They are least hurtful, and if at all beneficial, to the phlegmatic that have cold, moist stomachs; but they are most pernicious to choloric and arrabilaric.

Muscles.

Amongst shellfish muscles are of grossest juice and worst nourishment, and most noisome to the stomach. They abundantly breed flegm and gross humours, and dispose the body unto fevers. I advise all such as are respectful of their health utterly to abandon use of them.

Cockles.

Cockles are not so noisome as muscles; they are of lighter concoction, and better nourishment, yet not laudable meat for such as lead studious or easy kind of life or have weak stomach.

Crab.

Crab is not very hard of digestion, somewhat pleasant to taste, and yieldeth to the body much gross nourishment. It is meat best fitted to labouring men, who have strong stomachs; but to old men, students, and all such as have weak stomachs, and are subject to oppilations of the breast, distillations from the head, or are otherwise wont to be affected in the head, it is very hurtful. The freshwater crab is wholesomer than the sea crab, and the sea is wholesomer if it is taken out of fresh water.

Lobster.

Also is not easily digested, and therefore it quickly offendeth a weak stomach; but, if well digested, giveth much good and firm nourishment. But the same is of a hot and ebullient nature, and therefore I advise young men and such as are of choloric natures and hot temperament to refrain from the use thereof, for unto hot natures they are hurtful, and greatly offend the head.

Prawns and shrimps are of one and the same nature; for goodness of meat they excell all other shellfish. They are of good temperament and substance, of a most sweet and not of hard concoction, and of excellent nourishment. By reason of their moist and calorisical nature they proritate Venus: they are convenient for every age and constitution of body, if the stomach be not too weak. The prawns and shrimps of Severne excell all others of this kingdom. Prawns. Shrimps.

Of Freshwater Fish.

The trout is best, of a somewhat cold and moist temperament, of an indifferent soft and friable substance, of pleasant taste, easy concoction, and good juice. It yieldeth somewhat of a cold nutriment, very profitable for them that have their liver and blood hotter than is convenient, therefore it is with good reason given to them who are in fevers. Trout.

Trout is good food for every age and constitution of body, except for the phlegmatic who have cold and moist stomachs. The smaller trout are best.

The pike is somewhat of firm hard substance, and therefore a little harder of concoction than the trout. It is pleasant meat, and giveth good nourishment. It is agreeable to all, specially the young and such as are by constitution choloric. Pickrell is the young of pike. It is easier of concoction, pleasant of taste and goodness of juice, (in my judgement) ranks with trout, and to be given to invalids (only river pickrell). That taken in meers, or muddy water, is somewhat excremental and hard of concoction. Pike.

Perch taken in pure water is of white and pure substance, for taste and nourishment equal to trout or pickrell. Perch is usually sauced with butter and vinegar; but add thereto the powder of nutmeg, which to this fish is very proper, it Perch.

becometh delectable to the taste, and grateful to the stomach. The spawn of perch is of delicate and wholesome nourishment, very good for the weak, or of cold temper of body. The lesser perch are best. But if the great ones are kept a day or two, specially if transported from the place where they are taken, their substance becomes more tender —very good for every condition of body, age, and constitution.

Carp. Carp is of sweet exquisite taste, but the nourishment doth not answer to the taste; if it were, it would be numbered amongst fishes of primest note. It giveth slimy, phlegmatic, excremental nourishment, and quickly satiateth the stomach. Let all who are of weak stomach eschew it. The head and spawn of the carp are the pleasantest and wholesomest; to be preferred before the rest of the fish.

Barbell. The barbell is soft and moist, of easy concoction, and very pleasant taste; of good nourishment, but somewhat muddy and excremental. The greater excel the lesser for meat, because their superfluous moisture is amended by age. The spawn of them is to be objected to as most offensive to the belly and stomach.

Tench. The tench is unwholesome. Hard of concoction, unpleasant of taste, noisome to the stomach, and filleth the body with gross slimey humour. Notwithstanding, it is meat fit for labouring men.

Roach. The roach is of easy concoction, of light and meetly nourishment; not hurtful to any age or constitution of body, so long as the stomach desire it.

Gudgeon. The gudgeon, though but a small fish, yet for goodness may challenge the prime place of freshwater fish. It is delightsome to taste, easy of concoction, and good nourishment for all ages and constitutions. Dace. The dace is much the same, but of lesser nourishment.

Eeles. Eeles are pleasant to taste, but they are hard of digestion, slimey, gross, phlegmatic, and soon noisome to the stomach. They breed obstructions, because they make a gross and glutinous nourishment, and are most hurtful to those subject to gout and stone and obstruction of the breast. Those in pure water and gravel soil are best. In meeres and pools not so good. I recommend only those to eat of them who are more addicted to their palate than to their health. Moreover, in impure places they oftentimes couple with snakes, and so receive venomous quality, wherefore they are not commendable for any age or temperament. They are most hurtful to the aged, phlegmatic, or subject to obstructions. Roasted or broiled they are least injurious, the fire exhausteth their worst qualities. For like reason the powdered eel is wholesome, though not so taken by the dainty-mouthed. To conclude, they are only convenient food for hard labourers, or those who indulge their appetite.

Crawfish are of meetly good nourishment, and not hard of concoction, yet I do not approve of them for those who have weak stomach, or are subject to obstruction of the mesaraick veines. They are best agreeable to such as are of choloric temperature of body. Crawfish.

The puffin is neither fish nor flesh, but a mixture of both; for it liveth altogether in the water, yet hath feathers, and flieth as fowls do. Whether they be eaten fresh or powdered, they be of an odious smell and naughty taste; are unwholesome. Yet great drinkers esteem well the puffin, because it provoketh them to drink, which is the best faculty it hath. But mark the end of such, and you shall commonly see them, even in firm and constant age, to have turgid and strouting-out bellies and a dropsie, the upshot of all their outrageous drinkings. Puffin.

Fresh fish is the best for food. Salt fish, if it be much eaten, hurteth the sight.

Of all sorts of salt fish, ling and milwell be the best. Of all other salt fish, those who are careful of their health refrain from using.

1625.

"Treatise of Fasting."—*Henry Mason.*

Chapter II.

Voluntary fasts are of two sorts. They are either worldly and profane, or religious and holy.

Worldly and profane I call those whose end is for some worldly use, or for some respect belonging to this life. And these are divers. For sometimes men may fast for effecting of some worldly business with better speede, as Saul and his soldiers did, when the people tasted no food, because the king had *adjured them, saying; Cursed be the man that eateth any foode untill evening, that I may be avenged on my enemies.* We see the reason of this fast was, because the King would not allow them any time of eating, for that they might bestow all the time in pursuing of the enemie. And so in like sort a man may fast for his health, that he may get rid of undigested humours; for his gain, that he may spare his purse; and for the public good, that he may preserve the breede of cattell; yea, and for very luxury and of a gluttonous disposition, that he may keep his stomach for better cheer. When men fast for these or any such like ends, their fasts are worldly and profane, and therefore have no place amongst religious exercises.

The second are holy and religious fasts. And so I call those which are intended and do serve for some special use, which concerneth God's glory and the good of men's souls.

Chapter X.

He says of Lent—

Because the fast of Lent was antiently observed in divers churches and countries after a very diverse and different maner. First, there was a difference in the number of weekes appointed for this use; some observing eight weekes, some seven, some six, and some, as we now doe, six weekes and foure daies. Secondly, there was difference in the fasting daies of Lent; some places they fasted every day save Sunday; in some other, every day except Saturday and Sunday; in some other every second day; and in some, but every week only. For on those other daies in Lent, though they abstained from some meats, yet they did eat their dinner: and then the Antients thought it to be no fasting day.

1st. Politic reason for keeping Lent—

Because at this time of the yeare is a time of breed, and of the increase of creatures; and the sparing of the increase by abstinence and slender diet, might cause plenty and store in the common wealth for all the yeare after.

2nd. A physicall reason—

Which is because at this time of the yeare there is most increase of blood in a man's body; and the heat thereof might breed fevers and hot diseases; but spare diet, *especially* consisting of fish and herbs and roots will serve to qualify the blood and bring it to a right temper.

DATE—1610. A.D. 1610.

"A COLLECTION OF ORDINANCES AND REGULATIONS FOR THE GOVERNMENT OF THE HOUSEHOLD ROYAL."

DIETS FOR THE PRINCE HIS HIGHNESS UPON A FISH DAY.—DINNER (HENRY, A.D. 1610).

Bread, beere, ale and wine as upon a flesh day; Chickens (boyled), 4 services; Mutton (boyled), 2 services; Veale (boyled), 1 service; Lambe (boyled), quarter; Shoulder of Mutton (rost), 1; Veale (rost), 2 services; Legge of Mutton, 1; Capon in greace, 1; Chickens, 5; Partridges, 2; Lapwings, 3; Larkes, 18; Conyes, 3; Peares, 1 pye; Custard, 1; Tart, 1; Lyng, 1 service; Pyke, 1 service; Carpe, 1; Whiteings, 1 service.

Diet to the Chamberlain, Treasurer, Comptroller, Steward and Groome of the Stoole upon a fish day.—Dinner—

Bread, beere and wine as upon a flesh day; Lyng and cod, 2; Pyke, I.; Whiteing, I.; Gurnard, I.; Soales, I. payer; Playce, I. service; Custerd, I.; Tart, I.; Butter, Sweet, I. lb.

Supper—breade, beere, and wine as at dinner aforesaid; Lyng and Codde, II. services; Pyke, I.; Whiteing, I.; Gurnard, I.; Soales, I. payer; Playce, I. service; Dulcets, I. service; Tart, I.; Butter, Sweet, I. lb.

Covenants concluded and made by the officers of the Greencloth with Robert Parker and George Hill, Yeoman Purveyors of fresh-water fish, both for the more honourable and also more profitable serving of the King, His most excellent Majesty, in the household of all kindes of fresh-water fish in manner following:

First, it is determined by the Lord Great Master, Mr. Comptroller, and all the officers of the Greencloth at Durham Place, Saturday, the 10th of December, 34 Henry VIII., that neither the Purveyors of fresh-water fish shall bring in any fish to the King's use, but he shall present with the same a bill of all such prices as he doth pay unto the parties of whom his fish was bought, with also the names of the said parties; and that he present not one farthing above the same his payment, upon paine of looseing of his service, and further to be punished by the discretion of the officers of the Compting house.

Item: It is further agreed that the said Purveyors of fresh-water fish shall have for every fish day, that he or they shall bring fish into the Court, 12*d.* per day for every horse and man; and for every carriage horse 6*d.* per day.

Item: To be given to the Yeoman-Purveyors of fresh-water fish for Friday and Satterday, for every of those days 9*s.* per day, that is per Septiman, 18*s.* If there be three fish dayes in the weeke they are to have 6*s.* 8*d.*, that is per week 20*s.* If the whole weeke be Fasting dayes they are to have 4*s.* per day, that is per week 28*s.*

Item: The said Robert and George doe covenante and agree to and with the aforesaid. . . . that neither of them, their factors, servants, assignes. . . . shall at any time make larger provision of fresh-water fish, by virtue of the King's commission, or by any coloured means than shall serve for the expences of the King's most honourable household, to the intent to sell the same, or convert any part thereof, to their own use, lucre or advantage; upon paine of losse of their roomes, confiscation of their goodes, and perpetuall imprisonment of their bodies, if due proofe be made against them of the same.

Item: . . . . They have also covenanted and agreed to make carriage of . . . Pikes, being by them provided, unto the Court, and there to deliver them quick into the King's Privy Larder at their own cost and charges, as long as the King sojourneth or lyeth within twenty miles of London, then they to have allowance for carriage of them by comptrollment.

Item: . . . . They shall not send any pike of less scantling than 18 inches long, and being 18, 20, or 21 inches long, both quick and well fed, they to have the same pike for 14 pence.

Item: They shall not send, nor bring into the Court *ut supra*, any fresh-water Breame of lesse scantling than 6 inches long; and being 16, 17, or 18 inches, they to have for same 2*s.* 6*d.*; if any be exceeding the same length to have therefore by the discretion of the comptrollment of 14 to 20 at 12*d.* Carps of 16 to 18, at 4*s.* and upwards at the discretion, *ut supra.* Perches of 9 and 12, 3*d.* Eeles weighing 3 lbs., 10*d.* Troutes of 14 inches to 17, 8*d.* Chevins of 16 and upwards, 16*d.* Great Flounders and Roches of 10 inches, 8*s.* the 100d.; small Flounders and Roches at 7 inches, 2*s.* 100d.; the panier of Crabs and Lobsters, 100 lbs., 8*s.* Fresh Salmon, Calver, and other, at the discretion of the comptrollment.

Item: . . . . John Hopkins, the Purveyor of See-fish, shall not henceforth have any further allowance for his expence goeing about the provision of See-fish, but onely £40 granted to him for his fees for the same.

Item: That Hopkins the Yoeman-see-fisher hath, from the last day of September, Anno 33d. forth, no manner of allowance of prices of fish, already stricken in the kitchen-roll, unlesse he declare unto the Clerkes-Comptrollers a reasonable cause why he should have further allowance; and that to be done six days after the striking of the said prices.

"On Fish days they should only have two courses of fish, each consisting of two kinds, with an intermeat of one kind of fish, if they thought fit. And those who should transgress this ordinance should be severely punished." (*See* 'Ryley's placita Parliamentaria,' p. 552, from the Clause Roll of 9 Ed. II., m. 26, dorso.) This rule was brought in because the excess of diet and provisions had become so great, that the consequences were likely to be detrimental to the nation. So the King issued a proclamation to restrain it. "Each course should consist only of two kinds of Flesh meat, except for Prelates, Earls, Barons and the great men of the land, who might have an interest (*une entremese*) of one kind of meat if they pleased."

APPENDIX.

Note to p. 10.

The letters C, H, O, N, when used by chemists, stand not only for Carbon, Hydrogen, Oxygen, and Nitrogen, but for certain definite relative weights of them—the weights in which they combine with one another and with other elements. The letters thus used are called "symbols," and the combining weight, though not expressed, is understood as included in the symbol. Each element has its symbol. For the purposes of this book it has not been requisite to enter into this; but in any elementary work on chemistry the combining weights of the elements will be found.

Note to p. 18. *Extracts from Liebig's 'Animal Chemistry' on Oxidation.* (1st Edition.)

"All vital activity arises from the mutual action of the oxygen of the atmosphere and the elements of the food." (4). "The first conditions of animal life are nutritious matters, and oxygen introduced into the system." (11).

"The consumption of oxygen in equal times may be expressed by the number of respirations. It is clear that in the same individual the quantity of nourishment required must vary with the force and number of the respirations." (14.) "The number of respirations is smaller in a state of rest than during exercise or work. The quantity of food necessary in both conditions must vary in the same ratio." (15.) "Excess of food is incompatible with deficiency in (respired) oxygen, that is, with deficient exercise." (16.) "In an equal number of respirations we consume more oxygen at the level of the sea than on a mountain. The quantity of both oxygen inspired, and of carbonic acid expired must therefore vary with the height of the barometer." (17.) "The amount of oxygen capable of being taken up in the animal body is limited by the amount of oxygen which can come into contact with the blood, and of blood which can come into contact with the oxygen." (19.) "The supply of heat lost by cooling is effected by the mutual action of the elements of the food, and the inspired oxygen which combine together. . . . It signifies nothing what intermediate forms food may assume, what changes it may undergo in the body; the last change is uniformly the conversion of its carbon into carbonic acid, of its hydrogen into water; the unassimilated nitrogen of the food together with the unburned or unoxidized carbon is expelled in the urine or in the solid excrements." (21.)

Note to p. 20.

Fick and Wislecenus experiment.

In 1866 Dr. A. Fick, Professor of Physiology, Zurich, and Dr. T. Wislecenus, Professor of Chemistry, Zurich, made their celebrated ascent of the Faulhorn, celebrated, not in connection with any sensational narrow escapes, but because it was selected as a form of exercise undertaken to test whether muscular exertion was associated with the oxidation of nitrogen.

The bearings of their investigations on the then state of the question of the origin of muscular power are set forth in a paper they communicated to the 'Philosophical Magazine' through Professor Wanklyn.

They regarded the theory that "muscular action was brought about by chemical changes alone," as having found such acceptance it might be said to be a universally acknowledged fact. That these chemical changes were processes of oxidation they thought almost equally well established, but the exact point as to what element it was whose oxidation gave origin to muscular power was still a matter of doubt, demanding further experiments. They allude to the recognition that the mechanical work of muscles represented only *a part* (see p. 37) of the actual energy resulting from the oxidation of the carbon or nitrogen or whatever it was. The limits of the problem narrowed down practically to this—was it the oxidation of nitrogen or of carbon which furnished the store of energy? Smith's experiments, referred to above (p. 20), they did not regard as a direct disproof that waste of tissue by the oxidation of nitrogenous matter was the source of power. (Reference to Voit and Bischoff.) They proposed to themselves direct experiment. Here is their own statement, with some few omissions, as rendered in English in the 'Philosophical Magazine.'

There is one way in which the question whether muscular force can be generated only by the oxidation of albuminoid compounds* might be decisively negatived, and that possibly by a single experiment. It is suggested by the following simple line of thought: granting that a person might accomplish a certain measurable amount of external labour, say *m* mètre-kilogrammes, and that in so accomplishing it he oxidized *p* grammes of albumen in his muscles;

* For composition of albumen, see p. 27.

granting also that we know the amount of heat which is liberated when a gramme of albumen is changed by oxidation into the products of decomposition in which the constituents of albumen leave the human body; then if the thermic equivalent of the manual labour m be greater than the amount of heat which could possibly be produced by the oxidation of p grammes of albumen, the question may be negatived with the most complete certainty. But if, on the contrary, the thermic equivalent of m mètre-kilogrammes is less than that of the heat arising from the oxidation of p grammes of albumen, the question has by no means received an affirmative answer. It is only in the former case that the experiment has a decisive result.

Such an experiment has been made by us conjointly. . . . As measurable external labour we chose the ascent of a mountain peak, the height of which was known. . . . Of the numerous peaks of the Swiss Alps, the one most suitable for our purpose appeared to be the Faulhorn, near the lake of Brienz, in the Bernese Oberland. It was necessary that the mountain which was to serve for our experiment should be as high as possible, and nevertheless should permit of our passing a night on its summit under tolerably normal circumstances; for had we been obliged immediately to descend again, the measurable amount of work would have been at once followed by an undeterminable but violent exertion of the muscles, in which much metamorphosis would occur, the thermic equivalent of which would be, however, entirely liberated as heat. The Faulhorn satisfies all these requirements; for although its height is very considerable, rising to about 3000 mètres above the lake of

Brienz, yet there is an hotel on its summit. Besides, it can be ascended by a very steep path, which was, of course, favourable for our experiment, because the amount of muscular action which is lost and not calculable (being reconverted into heat) is thus reduced to a minimum. We chose the steepest of the practicable paths. . . . [The details of the experiment are then given.]

In order to diminish as far as possible the unnecessary consumption (*Luxus consumtion*) of albumen during the experiment, they took no albuminoid food from midday on August 29 until 7 o'clock in the evening of August 30. . . .

The experiment proper began on the evening of the 29th of August at 6 P.M. and ended at 6 A.M. August 31st. The composition of the products of the body leaving through the kidneys during that time was subsequently strictly analysed, and the results obtained, too long to give here, furnished a new testimony to the fact, which has often before been experimentally proved, that muscular exertion does NOT notably increase the quantity of nitrogen in such products.

Note to p. 22.

In the case of the Great Western Railway referred to, p. 22, when in 1872 500 miles of rails were shifted within a fortnight, the extra nitrogen, together with extra carbon supplied, was in the form of oatmeal. The men carried their own bacon, bread, cheese, cocoa, &c., as usual; but a pound-and-a-half of oatmeal (see the value of oatmeal on p. 30), and half-a-pound of sugar was allowed daily to each man, and for each gang of twenty-one men a cook was provided. Temporary fire-places of stone were built, and the oatmeal was *well* cooked and served out in pannikins. Three thousand men were employed working double time, and no case of sickness occurred, while it is said the men much appreciated this form of extra diet.

In making the recent extension of railways in Sicily the progress was retarded by the slack work done by the Sicilian navvies compared with the English gangs. The former took scarcely any meat, preferring to save wages their comrades expended in that way. The idea occurred to the contractor of paying the men partly in money and partly in meat; and the result was a marked increase in the amount of work executed, which was brought up nearly to the British average.—(See *Encly. Brit.* 9th ed.)

Note to p. 22. Tables of Outgoings and Intakes.

In most works on foods and diet it is usual to give the chemical composition of the human frame, the average selected being for 5 ft. 8 in. high, 11 stone weight, and about 30 years of age. Such an analysis is printed below, the figures being taken from the 'Handbook of the Bethnal Green Museum Food Collection,' as revised by Professor Church.

It is here purposely kept far apart from the daily outgoings and intakes mentioned on p. 22 to prevent confusion in the minds of those who have not previously studied the subject, between the continuous needs of the body for work internal as well as external (see p. 37), and the "balance" between these outgoings and intakes.

Daily variations, even during health, in the amount of fibrin (No. 2), fat (No. 4), and albumen (No. 9), are often considerable, as the "storage" referred to on p. 21 fluctuates. The fact of such fluctuations is familiar. For example, it can be observed with some exactness by those who during the training of the University crews watch the daily accounts of weights as given in all the newspapers, or by those who at Turkish baths keep records of their own fluctuations.

The amount of phosphate of lime (No. 3), probably nearly constant, depends mainly on the dimensions (partly the density) of the bones, and heredity, feeding, habits, and atmosphere, determine this during the first eighteen or twenty years of life. The amount of fluoride of calcium (No. 12), and phosphate of magnesia (No. 13) differ from the same cause of individual structure.

Such a table cannot of course be taken as an exact account of the composition of all men of the size, weight, and age mentioned.

The chemical analysis is given first in compounds and then as elements.

COMPOUNDS.

	lbs.	ozs.	grs.
1. *Water*, which is found in every tissue and secretion, and amounts altogether to ..	109	0	0
2. *Fibrin*, and similar substances, forming the chief solid material of muscular flesh, and also occurring in blood	15	10	0
3. *Phosphate of Lime*, in all tissues and liquids, but chiefly in the bones and teeth	8	12	0
4. *Fat*, a mixture of three chemical compounds, distributed throughout the body	4	8	0
Carried forward	137	14	0

	lbs.	ozs.	grs.
Brought forward	137	14	0
5. *Ossein*, the organic framework of bones and the chief constituent of connective tissue; it yields gelatin when boiled	4	7	350
6. *Keratin*, with other similar and nitrogenous compounds, forms the chief part of the skin, epidermis, hair and nails, weighs about ..	4	2	0
7. *Cartilagin*, a nitrogenous substance, is the chief constituent of cartilages; it resembles the ossein of bone, and amounts to	1	8	0
8. *Hæmoglobin*, a very important nitrogenous substance, containing iron; it gives the red colour to the blood, and amounts to ..	1	8	0
9. *Albumen*, a soluble nitrogenous substance, is found in chyle, lymph, blood and muscles ..	1	1	0
10. *Carbonate of Lime*, is found chiefly in bone ..	1	0	350
11. *Kephalin* with myelin, cerebrin, and several other nitrogenised, sulphurised, or phosphorised compounds, is found in brain, nerve, &c.	0	13	0
12. *Fluoride of Calcium*, is found chiefly in bones and teeth	0	7	175
13. *Phosphate of Magnesia*, chiefly in bones and teeth	0	7	0
14. *Chloride of Sodium*, or common salt, occurs throughout the body	0	7	0
15. *Cholesterin*, *Inosite and Glycogen* are compounds containing carbon, hydrogen and oxygen, found in brain, muscle and liver ..	0	3	0
16 *Sulphate, Phosphate and Organic Salts of Sodium*, are found in all liquids and tissues ..	0	2	107
17. *Sulphate, Phosphate and Chloride of Potassium*, are found in all tissues and liquids	0	1	300
18. *Silica*, occurs in hair, skin and bones	0	0	30
Total	154	0	0

ELEMENTS OF THE HUMAN BODY.

1. *Oxygen*, a permanent gas, the great supporter of combustion. This gas constitutes $\frac{8}{9}$ of the water and $\frac{1}{5}$ of the air. The quantity in the human body would fill a space of about some 1290 cubic feet, and would weigh about ..	109	2	335

	lbs.	ozs.	grs.
2. *Carbon*, a solid, occurs nearly pure in charcoal. The carbon in the body is variously combined with other elements, and by its burning sets free heat, and produces carbonic acid gas ..	18	11	50
3. *Hydrogen*, a gas, and the lightest substance known. It occurs mainly in water; the quantity in the human body would fill a space of some 2690 cubic feet, and would weigh about	14	3	150
4. *Nitrogen*, a gas without energetic properties. It is an essential part of all bones and blood and muscle. The quantity in the body would occupy about 66 feet cubic, and would weigh about	4	14	0
5. *Phosphorus*, a solid. It occurs specially in various compounds of the bones and of the brain. It burns so readily in air that it is here kept in water. In the human body we find about	1	12	25
6. *Sulphur*, a yellow combustible solid, often called called brimstone. Like all the preceding elements, it is found in all the tissues and secretions of the body, but always in combination. It amounts to	0	8	0
7. *Chlorine*, a greenish-yellow gas found in the body chiefly with sodium, the compound being common salt. The chlorine in the human body would fill a space of 2 cubic feet and 510 cubic inches, and would weigh ..	0	4	150
8. *Fluorine*, hardly known in the separate state, but probably a gas. It is found united with calcium in the bones and the teeth. The quantity in the body would fill a space 2 cubic feet and 150 cubic inches. It would weigh	0	3	300
9. *Silicon*, a solid occurring in union with oxygen in hair, bones, blood, bile, saliva and skin ..	0	0	14
10. *Calcium*, a metal, the basis of lime. It occurs chiefly in bones and teeth	3	13	190
11. *Potassium*, a metal, the basis of potash. It is lighter than water, and when placed on it			

	lbs.	ozs.	grs.
burns with a lilac flame. It occurs mainly as phosphate and chloride	0	3	340
12. *Sodium*, a metal, the basis of soda, and must be kept from the air. It occurs chiefly in union with chlorine as common salt, but also in other compounds and bile	0	3	217
13. *Magnesium*—this metal is found in union with phosphoric acid, mainly in bones	0	2	250
14. *Iron*—this metal is essential to the colouring matter of the blood. It occurs everywhere in the body	0	0	63
15. *Manganese*, a metal much like iron. Faint traces occur in the brain, and decided traces in the blood.			
16. *Copper*—traces of this metal are invariably found in the human brain, and probably also in the blood.			

Note to p. 29.

It has been suggested that it is the instability—the readiness for change—of the nitrogen compounds which makes them so serviceable for hard work. All that can be said at present is, that though the facts as to their use seem clear, the explanation has not yet been satisfactorily arrived at.

Note on Dr. E. Smith's popular form of putting the results of his work, p. 38.

The following is an example of the way in which Dr. E. Smith illustrated that cost and economy in foods are different things.

Two breakfasts are here selected for comparison, both of the same cost per head (1½*d.*) while one gives 909 grains of carbon and 41 grains of nitrogen more than the other.

Breakfast of tea, bread and butter :--

Tea, $\frac{1}{8}$ oz. ; sugar, $\frac{1}{2}$ oz. ; skimmed milk, $\frac{1}{4}$ pint ; water, $\frac{1}{2}$ pint ; bread, 6 oz. ; butter, $\frac{1}{2}$ oz. [The quantities refer to the share for each person.] Amount of carbon, 1081 grains ; nitrogen, 46 grains.

Breakfast of oatmeal brose, treacle, bread and bacon :—

Oatmeal, 5 oz. ; skimmed milk, $\frac{1}{2}$ pint ; water, $\frac{1}{4}$ pint ; treacle, 1 oz. ; bread, 3 oz. ; bacon, 1 oz. Amount of carbon, 1,990 grains ; nitrogen, 88 grains.

CHRONOLOGICAL TABLE.

The table of anatomists and physiologists from 1500 is given for the purpose of showing how large a number of brains have been occupied in finding out what our bodily organization is, and in the collateral column how many brains have been occupied in finding out methods of investigation which have come as aid, in explaining ourselves. It may help the realisation of the meaning of such an expression as "There are many things we do know," being something different in significance from the answer of a schoolboy, "Don't know, Sir," to a question say such as what is the aorist of *οραω* ? or, what is the capital town of Northamptonshire ? The table is based, with modifications, on one of Professor McKendrick's. In the latter part it is meant to be suggestive rather than complete.

Period.	Anatomists and Physiologists.	Representatives of Collateral Sciences.
1540	Faliopius, 1523–1562.	
1550	Eustachius, *d.* 1574.	
1610	WILLIAM HARVEY, 1578–1657 (*Circulation*).	
1620	ASELLI, about 1622 (*Lacteals*).	
1650	PECQUET, about 1651 (*Thoracic duct*).	
1660	JOLLYFE, *b.* about 1622 (*Lymphatics*) MALPIGHI, 1628–1694 (*Circulation under the Microscope*). LOWER, 1631–1691 (*Transfusion of Blood*).	
1670	HOOKE, 1635–1703 (*Artificial respiration*). MAYOW, 1645–1679 (*Respiration*).	
1680	RUYSCH, 1638–1731 (*Art of Injecting*).	
1700	Boerhaave, 1668–1738. Keill, 1673–1719.	Stephen Gray, *d.* 1736.
1710	STEPHEN HALES, 1677–1761 (*Circulation*).	Nicholas Bernoulli (I.), 1687–1759.
1720	Réaumur, 1683–1757.	Maclaurin, 1698–1746. Bradley, 1692–1762. John Bernoulli (I.), 1667–1748.
1730		Linnæus, 1707–1778. Maskeleyne, about 1732. Hawksbee, about 1731. Dollond, 1706–1761. Euler, 1707–1789. Dan Bernoulli (I.), 1700–1752.
1740	HALLER, 1708–1777 (*Muscular Irritability*). Whytt, 1714–1766.	Boscovitch, 1711–1787. Kästner, 1719–1800. Lacaille, 1713–1762.

Period.	Anatomists and Physiologists.	Representatives of Collateral Sciences.
	Needham, 1713–1781. Trembley, 1700–1784. Lieberkühn, 1711–1756.	John Bernoulli (II.), 1740–1790.
1760	JOHN HUNTER, 1728–1794 (*Blood-vessels*). SPALLANZANI, 1729–1799 (*Digestion, respiration, generation*). GALVANI, 1737–1798 (*Animal electricity*). HEWSON, 1739–1774 (*Blood glands*).	James Watt, 1736–1819. Hutton, 1726–1797. Lavoisier, 1743–1794. Joseph Black, 1728–1799. Coulomb, 1736–1806. Bailey, 1736–1793. Franklin, 1706–1790. William Hunter, 1718–1785. Biot, about 1774.
1770	LAMARCK, 1744–1829.	Cavendish, 1731–1810. Sir J. Banks, 1743–1820. Gmelin, 1748–1840. John Bernoulli (III.), 1744–1807. Priestley, 1734–1804. Jacobi, 1743–1819. Playfair, 1748–1819. Berthollet, 1748–1822. Scheele, 1742–1786. Bramah, 1749–1814. Daniel Bernoulli (II.) 1751–1834. Jenner, 1749–1823. Fourcroy, 1755–1809.
1780	Blumenbach, 1752–1840.	Legendre, 1752–1833. Count Rumford, 1753–1814. James Bernoulli (II.), 1759–1789. Chladni, 1756–1827.
1790	BICHAT, 1771–1802 (*Life of tissues*).	Fourier, 1768–1830. Brunel, 1769–1849. Leslie, 1766–1832. W. Humboldt, 1738–1822. A. Humboldt, 1769–1859 Playfair, 1749–1819. Dalton, 1767–1844. Cuvier, 1769–1832. Ampère, 1775–1836.
1800	THOMAS YOUNG, 1773–1829 (*Measurement of time, colour*). J. F. Berard, 1780–1828. Rudolphi, 1771–1832.	Gauss, 1777–1855. Pfaff, 1773–1852. Malus, 1775–1812. Seebeck, 1770–1831. Oersted, 1777–1851.

Period.	Anatomists and Physiologists.	Representatives of Collateral Sciences.
	CHARLES BELL, 1774–1842 (*Sensory and motor nerve*). Treviranus, 1776–1837.	Arago, 1786–1853. Thomas Thomson, 1773–1852.
1810	Edwards, 1777–1842. Purkinji, *b.* about 1787. Sir B. Brodie, 1783–1862. MAJENDIE, 1783–1855 (*Absorption*). Sir E. Home, 1756–1832.	Peltier, 1785–1845. Döbereiner, 1780–1849. Hare, 1781–1858. C. Ritter, 1779–1859. Gay Lussac, 1778–1850. Fresnel, 1783–1827. Niepce, 1765–1833. Wollaston, 1766–1828. Frauenhofer, 1787–1826. Bessel, 1784–1846. Nobili, 1784–1835. Ohm, 1787–1854. Christopher Bernoulli, *b.* 1782. Braconnet, 1781–1855. Brande, *b.* 1788. Cagniard de la Tour, *b.* 1776. Chevreul, *b.* 1786. A. C. Becquerel, *b.* 1788. Berzelius, 1779–1848.
1820*	Krause, *b.* 1797. BEAUMONT, about 1824 (*Digestion*). Gmelin, 1788–1853. Serres, 1782–1862. E. H. WEBER, *d.* 1878 (*Circulation, muscles*). J. L. Prevost, 1790–1850. Von Baer, *b.* 1792. MARSHALL HALL, 1790–1857 (*Reflex action*). FLOURENS, 1794–1867. (*The brain*). Ehrenberg, *b.* 1795. POISEUILLE, *b.* 1799 (*Manometers*). Dupuy, 1774–1849.	Basevi, *b.* 1799. Despretz, *b.* 1792. Chasles, 1793–1880. Struve, 1793–1864. Daniel, 1790–1845. Cauchy, 1789–1857. Mitscherlich, *b.* 1794. Audouin, 1797–1841. Poggendorff, *b.* 1796. Payer, *b.* 1795. Bischoff, *b.* 1792. Moebius, *b.* 1790.
1830	JOHANN MULLER, 1801–1858. SCHLEIDEN, 1804–1872 (*Cell theory*).	Faraday, 1794–1867. Colladon, *b.* 1802. Sturm, 1803–1855. Lassaigne, *b.* 1800.

* The dates of the decease of comparatively recent authorities have not been in all cases ascertained.

Period.	Anatomists and Physiologists.	Representatives of Collateral Sciences.
	Volkmann, 1801–1877.	Frémy, *b.* 1814.
	Schroeder van der Kolk,	Listing, *b.* 1808.
	1797–1862.	Melloni, 1798–1854.
		Amici, *b.* 1786.
		Balard, *b.* 1802.
		Von Bibra, *b.* 1806.
		Boussingault, *b.* 1802.
		Christison, 1779–1880.
		Mulder, *b.* 1802.
		Gassiot, *b.* 1797.
		Dumas *b.* 1800.
1840	CLAUDE BERNARD, 1813–	Foucault, *b.* 1819.
	1878	Gorup Von Besanez, *b.* 1817.
	(*Vaso motor nerves*).	Thomas Graham, *b.* 1805.
	SCHWANN, *b.* 1810	Lord Justice Grove.
	(*Cell theory*).	A. W. Hofmann.
	John Reid, 1809–1849.	J. P. Joule.
	JOHN GOODSIR, 1814–1867	Lehmann, *b.* 1812.
	(*Secretion*).	W. H. Miller, *b.* 1801.
	FECHNER, *b.* 1801	J. R. Mayer, *b.* 1814.
	(*Psycho-physik*).	Regnault, *b.* 1810.
	Carpenter.	Liebig, 1803–1873.
	Bowman.	Draper, 1811–1882.
	Henle.	Andrews, *b.* 1813.
	Wasmann.	Bunsen, *b.* 1811.
	Ranke.	Cahours, *b.* 1813.
		Kopp, *b.* 1817.
		Wertheim, 1815–1861.
1850	Ludwig.	A. E. Becquerel.
	Von Helmholtz.	A. Beer.
	Donders.	Berthelot.
	Brücke.	Sylvester.
	Brown-Sequard.	Clausius.
	Du Bois Reymond.	Tyndall.
	Schiff.	Kekule.
	Lister.	Kirchoff.
	Vulpian.	Knoblauch.
	Vierordt.	Moleschott.
	Huxley.	Pasteur.
	Pettenkofer.	Frankland.
	Czermak.	Lyon Playfair.
	Lothar Meyer.	Lawes & Gilbert.

	Examination of Liebeg's Theory.	Practical Application.	Educational.
1840.			
	1845.—Boecker.		
1850.			
	1854.—Lawes and Gilbert.		
			1856.—Ruehrig's practical cookery based on Liebig.
	1858.—Humbert's 'Kritik.'		1858.—Mr. Thos. Twining's Food Collection formed.
	1859.—Smith, Experiments on exhalation of carbonic acid.		1859.—Food Collection of Science and Art Department, South Kensington Museum, arranged under direction of Dr. Lyon Playfair.

1860.	1865.—Lyon Playfair. 1866.—Fick and Wislecenus, expts. 1866.—Frankland on 'Origin of Muscular Power.' 1867.—Parkes, Experiments. 1869.—Liebig himself reverses his conclusions.	1863.—Dr. E. Smith's Report on distressed operatives. Cotton Famine. 1864.—Dr. E. Smith's Report on the food of the poorer labouring classes of England. 1866.—Dr. E. Smith's Report on workhouse dietaries. 1867.—Dr. E. Smith's Report on uniformity of workhouse dietaries.	1863.—South Kensington Museum Collection, under direction of Professors Huxley and Frankland. New Handbook.
1870.	1871.—Parkes, Second experiments.		1876.—South Kensington Museum Collection, under direction of Professor Church. New Handbook. 1878.—Parkes' Museum Collection formed. Professor Corfield's course of lectures at Birmingham.
1880.			1880.—Professor Church lectures at School of Cookery.

An easy way to calculate the number of grains of Nitrogen present in different weights of Nitrogenous Compounds.

Though fractions of a grain are important in a chemical analysis it is near enough in practical dieting to be within $\frac{1}{4}$ of an ounce. The daily range of nitrogenous compounds taken is between 4 and $5\frac{1}{2}$ ounces.

Calculate 438 gr. to oz.; 219 to $\frac{1}{2}$ oz.; 110 to $\frac{1}{4}$ oz. (near enough). For ready reference—expressed in grains—

4 oz. = 1752 gr.; $4\frac{1}{4}$ oz. = 1862 gr.; $4\frac{1}{2}$ oz. = 1971 gr.; $4\frac{3}{4}$ oz. = 2081 gr.; 5 oz. = 2190 gr.; $5\frac{1}{4}$ oz. = 2300 gr.; $5\frac{1}{2}$ oz. = 2409 gr. (more exact than 2410).

If the analyses of various nitrogen compounds is examined it will be seen that about $15\frac{1}{2}$ or 16 parts per hundred (three examples of which are given on p. 27) are nitrogen. This is so uniformly the case in all analyses that for the convenience of calculation *without analysis* 16 parts in the hundred of any nitrogenous compound are taken as nitrogen. In making calculations in grains every 100 grains of a nitrogenous compound is taken to contain 16 grains of nitrogen, every 50 contains 8, every 25 contains 4, and so on.

Beginning at the 4 oz., that is 1752 grains, there are 17 hundreds (17 times 16 = 272) and one fifty (= 8 grains N), and the odd 2 may be omitted; so 1752 grains of nitrogen compound contain 272 + 8 = 280 grains of nitrogen. Working out this way or any other more convenient, the results come :—

Nitrogenous compound. oz.				Grains of Nitrogen.
4	or expressed in grains	1752	contain	280
$4\frac{1}{4}$	,, ,,	1862	,,	298
$4\frac{1}{2}$	,, ,,	1971	,,	314
$4\frac{3}{4}$	,, ,,	2081	,,	333
5	,, ,,	2190	,,	350
$5\frac{1}{4}$	,, ,,	2300	,,	368
$5\frac{1}{2}$	,, ,,	2409	,,	385

This can, of course, be worked the reverse way. Supposing a diet is wanted to contain 350 grains of nitrogen, then 5 ounces of some nitrogen compound must be taken.

Many curious references will be found in the sixteenth and seventeenth century books mentioned in this list. Some few are quoted in the previous pages.

Date.	Author.	Title of Work.
1259	Rogers, James E. T. .	A History of Agriculture and Prices in England. (London, 8vo., 1876, &c.)
1306	Ballantyne Club . .	Scotland, The Accounts of the Great Chamberlain of State. (Edinburgh, 1817, 3 vols., 4to.)
1402	Rogers, James E. T. .	A History of Agriculture and Prices in England. (London, 8vo., 1876.)
1494	Vincentius, Bellovacensis.	Speculum Naturale. Ventiijs. Fol.
1519	Glanvilla, Bartholomeus de.	Venerandi patris . . . Opus de proprietatibus rerum. (Koberger, Nuremberg, 1519, folio.)
1532	Arlunus, Joannes Petrus	De faciliori alimento summula (Milan, 1539, fol.)
1535	Glanvilla, Bartholomeus de.	Anno MDXXXV. De Proprietatibus Rerum (Translated into English by J. Trevisa, B.L.) MS. Notes by W. H. Ireland. (London, 1835, folio.
1541	Elyot, Sir Thomas .	The Castel of Helth. (London, 1541, 4to.)
1547		Statutes of the Realm. (Vol. iv. Parts 1 and 2.)
1548	Gibson, Edmund, D.D.	Codex Juris Ecclesiastici Anglicani, vol. ii. (Oxford, 1761, fol.)
1568	Thevet, André . .	The New Found Worlde, or Antarctike (Translated from the French, by T. Hacket, B.L.) (London, 1568, 4to.)
1577–1586	Holinshed, Raphaell .	Chronicles (Hooker). (London, fol., 1587.)
1593	England	A Brief Note of the Benefits that grow to this Realme by the Observation of Fish Days. (London, Roger Ward, 1593, fol., 5 vols.)
1599	Buttes, Henry . . .	Dyets Dry Dinner. Fish (36). (London, 12mo., 1599.

Date.	Author.	Title of Work.
1601	Glanvilla, Bartholomeus de.	De genuinis rerum . . . . proprietatibus libri XVIII. (Francofurti, 1601, 8vo.)
1608	Cains, Bernardinus .	De alimentis quæ cuique naturæ conveniant, de voluptatis natura, de saporibus. (Venetiis, 1608, 4to.)
1616	Munday, Anthony .	Chrysanaleia : the Golden Fishing ; or, Honour of Fishmongers. (London, 1616, 4to.)
1617	Castellanus, Petrus .	Vitæ illustrium medicorum qui . . . ad hæc usque tempora floruerunt. (Antverpiæ, 1617, 8vo.)
1625	Mason, Henry . .	Christian Humiliation, or a Treatise of Fasting. (London, 1625, 4to.)
1626	Mason, Henry . .	The Epicure's Fast ; or, a Short Discourse, discovering the Licentiousness of the Romane Church in her religious Fasts. (London, 1626, 4to.)
1640	Somner, William . .	The Antiquities of Canterbury. (London, 1640, 4to.)
1642	Erswicke, John . .	A Brief Note of the Benefits that grew to this Realme by the Observation of Fish-days. (London, 1642, 4to.)
1650	Venner, Tobias . .	Via recta ad vitam longam. (London, 1650, 4to.)
1679	Trapham, Thomas .	A Discourse of the State of Health in the Island of Jamaica. (London, 1679, 8vo.)
1680	Mundy, Henricus .	Βιοχρηστολογια seu commentarii de cære vitali, de esculentis, de potulentis, cum corollario de parergis in victu. (Oxoniæ, 1680, 8vo.)
1682	Collins, John . . .	Salt and Fishery : a Discourse thereof, &c. (London, 1682, 4to.)
1685	Valvasor, John Weichard, R.S.S.	Philosophical Transactions, vols. xv., xxi., xxii. (London, 1685, &c., 4to.)
1705	Lemery, Louis . .	Traité des Aliments. (Paris, 1705–04, 12mo. Two Parts.)
1709	Hecquet, Philippe .	Traité des Dispenses du Carême, &c. (Paris, 1709, 12mo.)
1710	Andry de Boisregard, Nicholas.	Le regime du caresme, considéré par rapport à la nature du corps et des alimens. (Paris, 1710, 8vo.)
1713	North, Roger . . .	A Discourse of Fish and Fishponds . . . done by a Person of Honour. (London, 1713, 8vo.)
1720	Albin, Eleazar . .	A Natural History of English Insects. London, 1720, 4to.

Date.	Author.	Title of Work.
1721	Brookes, Richard . .	A History of the most remarkable Pestilential Distempers that have appeared in Europe for 300 years. (London, 1721, 8vo.)
1731	Arbuthnot, John, M.D.	An Essay concerning the Nature of Aliments, and the Choice of Them. (London, 1731–32, 8vo.)
1734	Hilscher, Simon Paul	Prolusio II. de Methodo Ciceronis tuendi Valetudinem. (Jena, 1734, 4to.)
1738	Forster, Wm., Practitioner in Physick.	A Treatise on the Various Kinds . . . of Foods, &c. (Newcastle-upon-Tyne, 1738, 8vo.)
1740	Brooke, Richard, M.D.	The Art of Angling. (London, 1740.)
1745	De Coetlogon, Dennis	An Universal History of Arts and Sciences. (London, 1745, fol., 2 vols.)
1746	Griffiths, Roger, Water Bailiff.	An Essay to prove that the Jurisdiction and Conservancy of the River Thames, &c., is committed to the Lord Mayor. (London, 1746, 8vo.)
1748–1752	Somers	Tracts, vol. ii. (London, 4to.)
1758	Borlase, William . .	The Natural History of Cornwall. (Oxford, 1758, folio.)
1759	Mackenzie, James .	The History of Health, and the Art of Preserving it, &c. (Edinburgh, 1759, 8vo.)
1760	Lelandi	Feast of Fishes, Archbishops. (London, 1760.)
1763	Brookes	A New and Accurate System of Natural History, vol. iii.; 6 vols. (London, 1763, 12mo.)
1787	Brichoz, Pierre Joseph	L'Art Alimentaire, ou Méthode pour préparer les alimens les plus sains pour l'homme. (Paris, 1783, 12mo.)
1790	Arundel Collection (MS., No. 344.)	Royal Household. A Collection of Ordinances. (London, 1790, 4to.)
1794		The Gentleman's Magazine, vol. lxiv., Part II.
1796	Thompson, Benjamin (Count Rumford).	Essays, Political, Economical, and Philosophical, vol. i. (London, 1796–1802, 8vo.)
1797	Thompson, Benjamin (Count Rumford).	Essays, Political, Economical, and Philosophical, vols. vi. and vii. (London, 1797, 8vo.)
		Additional MS. Parlyament Proposal to King, as to fishing. 28,079—15,155—15,154—15,156.

Date.	Author.	Title of Work.
1798	Thompson, Benjamin (Count Romford.)	Essays, Political, Economical, and Philosophical, vol. vii. (London, 1798, 8vo.)
1801	Brookes, Richard, M.D.	The Art of Angling. (London, 1801, 12mo.)
1802	Thompson, Benjamin	Essays, Political, Economical, and Philosophical, vol. iii. (London, 1802, 8vo.)
1809	"Accounts of the Great Seal."	Antiquarian Repertory, vol. iv. (London, 1809, 4to.)
1809	Tobias, Gentleman .	Harleian Miscellany, vol. iii. ('England's Way to Win Wealth.' London, 1809, 4to.)
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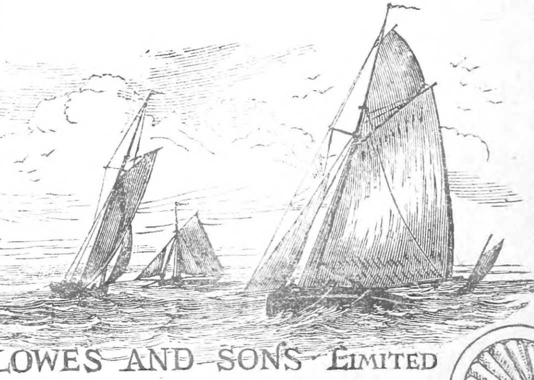

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