CHAPTER FOUR

THE CONQUEST OF HUNGER: HOW MANKIND IS FED

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CHAPTER FOUR

THE CONQUEST OF HUNGER: HOW MANKIND IS FED

§ 1. *The World Eats*

EVERY day upon this planet about 1,900,000,000 people eat, and eat at least enough to keep themselves alive. In no part of the civilized world now does death from starvation figure as a dominant item in the mortality list. There may be many deaths to which wrong or insufficient nutrition is a chief contributory cause, in India and China, particularly—some million or so a year. But by the scale of 1,900,000,000, the deaths from actual starvation do not bulk large. We come now to the fashion in which this primary need of the species *Homo sapiens* is met.

It is doubtful if ever before the world has carried and fed so immense a human population as it does to-day. Even in the most prosperous and fertile phases of the early civilizations it may be questioned whether the total came to much more than a few hundred million, and the boldest estimate of the numbers of our race in late Palæolithic and early Neolithic times would probably fall within the compass of a million or so; who were far more closely occupied by the food hunt and for the most part much nearer famine than any human community to-day. As for still earlier stages of our evolution, have we not already called attention to the fact that the great apes must needs be rare and unsocial creatures because each small group of them requires square miles of rich tropical forest for its food supply? Throughout all history until the present age famine has been a periodic experience. To-day, in spite of the world's immense unprecedented population, it is a restricted local accident.

The Neolithic Age was an age of more food—and of proliferation up to the limits of the food supply.

§ 2. *Fertilizers*

In Chapter I we have stated the broad facts, as they are known

to-day, of man's agricultural beginnings. If we were to expand the subsequent history of food production until we came to present conditions we should next have to compile a history of the growth of agricultural knowledge and method.

So soon as agriculture passed beyond the flood lands of the great rivers, where the soil is annually renewed and refreshed, the fact of soil exhaustion pressed for attention. The soil demanded intervals of rest and refreshment. The history of agriculture tells of the passage from natural husbandry with resting fallow lands, to the realization of the value of legumes, beans, vetches, etc., in restoring fertility to the soil, to the modern rotation of crops, and so on to the systematic restoration of soil by natural and artificial fertilizers. From that it goes on to modern intensive cultivation with every possible artificial assistance and acceleration of nature's generosity, and to the scientific breeding and feeding of animals.

The story of artificial fertilization falls broadly into three well-marked stages. By 1840 the labour of botanists like De Saussure and chemists like Liebig had shown that in addition to air and water, four materials were essential to plant life—nitrogen, phosphorus, potassium and lime. The replacement of these elements after cropping began to be studied systematically. An empirical use of fertilizers already prevailed. Manuring with natural products, with humus (mould), dung and lime, had been practised for centuries. Now it was realized that the necessary nitrogen, phosphorus and potassium could also be introduced from other sources. The developing science of chemistry set itself to discover and prepare the most suitable forms of these additional plant foods. The first factory to make a successful chemical manure was opened by Lawes in 1843. Liebig had made an earlier attempt, but his enterprise was a failure because he fused his materials together and rendered them insoluble. The fertilizer prepared by Lawes was superphosphate of lime, obtained by treating bones or mineral phosphates with sulphuric acid. Bones also began to be used directly, ground up more or less finely; mineral phosphates were employed; and the Basic Bessemer and Siemens processes for steel-making provided basic slag, supplying phosphoric acid, particularly useful for pasture on heavy soils.

Potash was obtainable only by burning wood (pot-ashes) and seaweed, until the discovery of immense deposits at Stassfurt about

the middle of the century, It is now obtainable from flue dust in certain industrial operations, and other natural deposits are being worked. An attempt is also being made to recover it from the bed of the Dead Sea.

The first phase of the nitrogen industry (1839–68) was the use of guano, the accumulated droppings of sea birds, mostly from Peru. Then—as the guano deposits approached exhaustion, nitrogen, combined in a suitable form and in large quantity, was discovered near the surface of certain arid areas in Chile. The ordinary saltpetre is nitrate of potash; Chile saltpetre is nitrate of soda. With the development of gas manufacture this source was supplemented by ammonium sulphate. The ammoniacal liquor obtained during the distillation of coal is neutralized by sulphuric acid. These were the only sources of agricultural nitrogen until 1906, when synthetic nitrogen appeared.

Artificial fertilizers, and the restoration of fertility by a rotation of crops, are at present used mainly in the intensive farming adopted in thickly populated areas. They are not employed in the vast wheat-growing regions of the world. The ultimate effect of growing the same crop year after year without making up the loss is exhaustion of the soil,* and nitrogen compounds are so soluble that if they are not used up quickly they are washed out. At the British Association Meeting in 1898 Sir William Crookes emphasized this tendency to soil exhaustion. He pointed to the growing demand of the world for wheat, and the limited supply of mineral nitrates. And it was he who first suggested the abstraction of nitrogen from the inexhaustible store in the atmosphere.

Lord Rayleigh had shown a few years previously that when an electric discharge passed through air, oxides of nitrogen were formed and could be isolated under proper conditions. By 1907 a process based on this reaction was in commercial operation. The fertilizer produced by this process is calcium nitrate. Another method was found in which nitrogen was passed over lime and charcoal, when calcium cyanamide was formed. Put into moist soil this yields

* It might be inferred that continuous cropping led to a continuously declining yield. This is not so. The field at Rothamsted, cropped with wheat year after year to which no fertilizer or manure has been given, has yielded about 12 bushels an acre since 1875 without showing any tendency to diminish further. The experiment began in 1852 and a decline occurred in the first twenty years, after which the field stabilized. *Carr-Saunders.*

ammonia. These original processes are gradually being superseded by one invented by Haber in Germany just before the war. In this a mixture of hydrogen and nitrogen (from liquid air) is passed at a high temperature and pressure over finely divided platinum. The resulting ammonia is then converted into the sulphate or other compounds. One of these, of great utility, both as a fertilizer and in the manufacture of the synthetic resins we have described in Chapter II, is urea.

In 1903 the total output of agricultural nitrogen expressed in metric tons of pure nitrogen was 352,000, and it was all in the form of naturally occurring nitrogen compounds. In 1928 the amount used was just close upon 2,000,000 metric tons, of which 1,019,200 owed their nitrogen to the air.

So much for the scientific and practical development based on a chemical theory of fertility.

But Berthelot, the great French chemist, early expressed a suspicion that fertility was not entirely due to normal chemical reactions, and by 1880 research was actively at work upon this doubt. While nitrates were found to be immediately effective, ammonium compounds were apparently inactive for twenty days.

In 1887 Warrington in England and Winogradsky in Russia detected and isolated special types of bacteria which changed ammonium compounds into nitrates. There are, in fact, two stages in the change, and each is due to a specific organism. One changes the ammonium compound into a nitrite, and the other converts a nitrite into a nitrate. Both of the types of bacteria concerned are called nitrifying bacteria. Ten years later it was discovered that the nodules on the roots of leguminous plants (peas, beans, clover, etc.) contain colonies of a third type of bacteria which enable the plant to absorb nitrogen direct from the air in the soil. The last are called nitrogen-fixing bacteria. With their discovery a biological theory of fertility was superimposed on the older chemical theory.

But even these two parallel explanations are insufficient for the complete account of soil fertility. Since 1900 it has become recognized that both the chemical and the biological changes are dependent upon physical conditions. Temperature and moisture are to some extent functions of the physical condition of the soil—the fineness as well as the character of the particles, the closeness of packing and so on. And there is in many cases an optimum state

(By courtesy of the Canadian Pacific Railway)

PLOUGHING BY GASOLINE TRACTOR: ALBERTA, CANADA

"You must multiply the horse-power by eight to get the equivalent in superseded man-power"

(By courtesy of the Topical Press Agency, Ltd.)

INDUSTRIAL CONFLICTS AFFECT MORE THAN THE INTERESTED PARTIES

Children were trampled and women injured when police charged a strikers' picket line at Gera Mills, Parsaic

of division and distribution of the fertilizer. The water-holding capacity of the soil, which is no less important than the food supply, is in large measure determined by the physical conditions of the soil particles, for the roots of plants require, on the one hand, water wherewith to supply the leaves, and air wherewith themselves to live. So that if all the soil space is occupied by water the plant dies of suffocation, and if it is all occupied by air the plant perishes by drought.

The farmer of former times discovered by experience the advantages of thorough cultivation, of liming and marling, of natural manures and of rotation of crops. But he did all this by rule of thumb and tradition. He knew nothing of the vast complexity of mineral substances and of living organisms, nor of the marvellous changes that go on in the chambers and corridors of the soil. And it will perhaps be another century before he can interpret these with the same certainty with which an experiment in a chemical laboratory can be understood.

§ 3. *The Mechanized and Electrified Farm*

Machinery is rapidly coming to the help of the farmer, and a steady "electrification" of agriculture is in progress. Cultivation for endless centuries was carried out entirely by hand labour and the use of animals. It was always a conservative industry, modifying its methods only in response to some urgent stimulus. The application of machinery to agriculture came later than in mining or manufacture. It marked the change-over from agriculture for immediate consumption to agriculture for marketing. In England the outburst of mechanical invention of the eighteenth century was coincident, in the latter half, with the enclosure of land and the associated revolution of agricultural practice. There appeared the drill (sowing machine), harrow, reaper, winnowing machine and haymaker. A primitive type of threshing machine was introduced in 1798. These machines came into wider and wider use continuously throughout the nineteenth century.

The use of machinery in America dates from about 1850, and in the wide, unbroken stretches of the newer countries there was greater scope for it than in the small enclosed fields of older civilizations. Here the sheaf-binder first saw the light. It not only cut

the corn, but tied it into bundles ready for stooking. To-day in the drier areas of California and Australia, where the wheat ripens on the stalk, a machine is used which cuts off the heads and threshes and bags the corn. The stubble is then burnt and its mineral constituents restored to the soil.

In the latter quarter of the nineteenth century the steam engine began to replace horses. The first step was obviously to secure speed and economy of human effort in the heavier and more laborious operations. Ploughing, harrowing, and threshing were accomplished by steam. Because the heavy steam engine pressed heavily upon and consolidated the soil, it was sometimes, and still is, used in a fixed position, and the plough hauled backwards and forwards by chain tackle.

The greatest service was rendered to all agricultural operations by the development of the oil engine. This rapidly came into use for barn machinery, such as hay, chaff, and root cutters, cake and seed crushers. The earlier oil tractors for ploughing and cultivation were heavy machines with the same disadvantages of weight as the steam tractor and suitable only for large farms. But small machines drawing a two-furrow plough soon became available and are now widely used. With a tractor it is possible to plough five acres or more a day as compared with one by a man and a horse. It has been calculated that ploughing absorbs from 15,000 to 20,000 horse-power hours per square mile, and other mechanical cultivators from 7,000 to 10,000 horse-power hours. You must multiply the horse-power by eight to get the equivalent in superseded man-power. So while the agricultural population decreases annually in comparison with the town population, the world production of food increases. Machinery, scientific cultivation and the improvement in the strains of agricultural plants necessitate rural depopulation.

Steam and oil power are now being supplemented, and to some extent displaced, by electricity. This form of power is less suitable for many agricultural operations because of the need of a supplying cable. On light land the oil tractor and on heavy clay the steam-tackle plough are preferable. Electrical ploughs or cultivators are, however, used on the Continent and in America under favourable conditions. Current is conveyed by a cable wound on a drum on the tractor. But it is in the farmhouse, yard, and outbuildings that electricity is of the greatest service. Much work, especially with

animals, has to be carried out before daylight and after dark. The byres and stables are lighted first. Then the housewife demands a washing machine. Then comes electric dairying. Milk is drawn from the cow by an electric milking machine which absorbs only one-sixth of a horse-power. With a herd of fifteen cows the saving in time is one and a quarter hours a day. The milk is now cooled in an electrically operated refrigerator, the cream is separated in an electrically driven separator, and churned in an electrically driven churn. The utensils are sterilized in an electrically heated chamber. If the cow's drinking water is warmed, she yields more milk.

In the barn, electricity is more convenient for driving the various choppers, cutters, crushers and mixers, machines for corn shelling, husking and shredding, grain cleaning and grading, hoisting and elevating, than an oil engine. The tendency is to use separate electric motors for each machine, so that overhead shafting with pulleys and belts is avoided. Out of doors electrical energy is used for pumping, including domestic water supply and irrigation. Add to these such household utensils as cookers, kettles, irons, vacuum cleaners, toasters, and the manifold uses of electricity on the modern farm become even more impressive.

In Sweden experiments are in progress in warming the soil by an underground cable in order to promote early growth. Seeds for garden crops are being irradiated by ultra-violet light, which is also used to supplement sunlight in greenhouses. Poultry houses are lighted morning and evening in winter. The hens thus have a longer daily period for exercise and food. They are found then to lay a larger proportion of eggs in winter when hitherto there have been a shortage and high prices. The total output per hen does not seem to increase; she simply becomes a less seasonal bird. When all the poultry houses in the world are lighted we may expect eggs to be a uniform price all the year round. But the consumer will have to pay the electric light bill.

Progress in the use of electric energy has been hampered by the scattered population of agricultural areas and the high capital cost of transmission. In the United States this is five times as great per head as for the average town consumer. In England there are electrically operated farms in Sussex, in the neighbourhood of Chester and elsewhere. An extensive experiment is proposed in the eastern counties. On the Continent there has been a more

vigorous development of electrified cultivation because of the prevalence of cheap electricity derived from water power. Between 1924 and 1927 the number of farms in the United States supplied with electricity increased by 86 per cent. In the latter year there were 227,442 farms supplied from public sources, and probably a larger number with private plants. It has been estimated that 600,000 or nearly 10 per cent of the farms in America are using electricity in these various fashions we have noted.

§ 4. *The Spectacle of Cultivation: The Vineyard and the Bee Keeper*

To make a complete picture of contemporary food-getting we should next have to review various special aspects of the business, contrasting new ways with old, in market gardening, in the working of orchards, vineyards, and plantation generally, in dairying, pig-keeping, cattle-ranching, and fisheries. A year or so ago the British Empire Marketing Board produced a wonderful film of the herring fishery, showing the journey of the herring from the shoal to the market, but I am afraid it is too Utopian an anticipation to suggest that our encyclopædia should be supplemented by films for use in the study. Whether our science museum will be able presently to provide permanent side-shows of this sort is another matter. Films and moving-picture peep-shows are used in the Kensington Science Museum and at Munich. From the cattle ranch, the sheep run and the levelled fields and the quay, from the terraced hillside and the marshalled orchard and orange grove, we should follow the beasts and fish and the grain and the fruits and the roots and so forth on their journey—often now a journey halfway round the world—to become food for the table. We should give a stirring picture of the slaughter houses of Chicago (one of the earliest instances of mass production). We should assist at fish-drying, at the preparation of haddock and kipper, and we should feel the chill of the modern refrigerator car and the storehouse for frozen meat. Jam should have its meed: the fruit-picking, the boiling, and the canning.

The bee keeper, ancient and modern, demands at least a section. We should tell of the passing of the beehive and the end of the annual slaughter of the bees. With the beehive the grindstones of the old windmill have passed away. The world was full of windmills

and beehives when we sexagenarians were children. We should have to treat of modern flour-handling and of modern bread-making and biscuit factories. And after food production would follow a review of food transport and methods of modifying and preserving food, chiefly with a view to its use during unproductive seasons or its removal to remote markets. Butter, cheese and such new milk products as condensed and powdered milk must be dealt with, and the preparation of those "cereals" which play so large a part now in the nursery and on the breakfast table. We should need a long chapter on the canning and food-packing industries. Close to that comes the manufacture of meat extracts. Nowadays, not only meat extracts but vegetable juices stand ready prepared for the cook's hand.

I find myself with an assortment of items about the history of feeding that have still to be arranged. Each by itself has its special interest, but the assembled mass of information would be overwhelming. Our complete encyclopædia would have an account of margarine—a long and interesting chapter that would be now—in the history of edible substances. Margarine is edible substance won from the comparatively inedible. It is made from various animal and vegetable oils, so treated as to resemble butter in every respect except its vitamin content. We have told already (Chapter II, § 7) how it stole the fats from the soap-boiler, and a full history of salesmanship should relate how the popular mind was won over, by changes of name and novelties in marketing, to the new comestible.

And there would have to be the story of wine. The trivialities of creed and controversy have, alas! estranged Mr. Hilaire Belloc from me, to my infinite regret, though they leave my admiration for his vigorous writing undiminished, or how gladly would I get a special chapter from him on wine, with supplements from colonial agents-general, anxious to recommend their particular brands of Cape hock and Australian Burgundy—Mr. Belloc objecting or not, as the case may be—in vivid footnotes. Nowadays the grapes are often crushed by mechanism, but still in the Province of Champagne red feet dance to music in the wine press. They may go on doing so. I am told that the twigs and seeds get crushed nowadays in the cement presses and yield unhelpful additions.

Beer and cane sugar, syrups and treacle, would give another sunlit chapter to that unwritten encyclopædia of ours. Cocoa and

chocolate would have also to be told about. The entire grocer's stock indeed would be traced to its origins and explained. Or rather it must be dealt with at its origins and traced step by step to the grocer's counter. It would be a book of bright little marvels. And the reader, the nine-out-of-ten reader, would never read all that mass of detailed information. He would dip into it and find it amusing until he began to tire. He would skip and turn it over and stop here at this picture and there at a headline. And then he would stop reading. Most of it he would take as read, which is precisely what we are doing here. We are merely taking two steps instead of one. We are taking it as written, and then we are taking it as read. The result is exactly the same.

Now, passing very briefly over the marketing of this food stuff, for marketing is to be dealt with later, we wave a hand to the modern kitchen, with its gas cooking and its electric refrigerators, make the customary contrast with past conditions, and pause at the breakfast table and the dining-room door.

§ 5. *Substitutes and Adulteration*

We freeze food, we store it, we move it over immense distances and modify it in hitherto unheard-of ways—and we have increased our gross supply enormously. But certain less agreeable aspects of modern food production must not be ignored in this survey. Science casts a shadow wherever she distributes her benefits. New substances are not always unmitigated blessings. It is impossible to deal completely with the feeding of mankind unless we bring into the picture the ingenuity and industry that are lavished in—how can I put it?—supplementing the supply of recognized foodstuffs by calling in, as unobtrusively as possible, substances less obviously nutritious and appetizing. The harsh word for this is "adulteration."

When I write "harsh word," I have in mind a gentleman charged with supplying a lubricating grease into which he had put 40 per cent of chalk, which, unhappily for the machinery and him, happened to be mixed with iron filings. "Oh," he protested to his barrister, "we don't call *that* adulteration. That is a most objectionable word. We call it 'loading.' " In matters of food and drink, the gentler, more acceptable term is "substitution." Originally adulteration was understood to be plain cheating, and the adulterator

had little to say for himself when he was found out; his adulterated stuff was destroyed, and he went into the pillory or was branded, nailed by the ear to any convenient woodwork, or otherwise roughly handled.

But the increase of knowledge and human subtlety have complicated this question. The idea of artificial and synthetic foods has a peculiar charm for the practical substitutionist, and the conception of suggestion comes in as a very real help when one is detected in misdescription. There may be substitution in series giving the most remarkable results. In one delightful instance a firm was prosecuted for selling something called lemonade crystals which was labelled "Pure Fruit Juice and Sugar Only." It was shown that neither fruit nor sugar was used in their manufacture. The "accepted substitutes"—ingenious phrase—for lemon juice and sugar in the trade are citric acid and glucose. But this particular firm had procured its citric acid from a purveyor whose idea of an "accepted substitute" for citric acid was tartaric acid. And tartaric acid also by the charitable customs of commerce can have an understudy, and so what this firm of caterers was finally handing out to thirsty little boys and girls was a "tartaric acid substitute"—of which they did not know the composition. Analysis showed it to be dirty phosphoric acid. The label had not only the lying words quoted above but a picture of a large yellow lemon in vivid contrast with a lovely green leaf. The defendants alleged that this was to help people to "realize that it tasted like lemons"—which my informant declares stoutly it did not do. All the more need for the helpful label, the defendants might argue. It is distressing to think of the virtuous teetotaller, who has avoided alcohol as a deadly poison throughout his life, betrayed into the consumption of this sinister brew of glucose and old bones.

This is but an outstanding instance of an all too prevalent disposition to put a brave face upon dishonesty. S. L. Bensusan, the well-known writer on British Agriculture, has recently come upon and made a happy use of a private and confidential memorandum upon Jam. Jam, Mr. Bensusan protests, should be made of sound fruit and sugar alone. Swedes and vegetable marrow, dyes and so forth, are inadmissible to the housewife's preserving pan. But this memorandum sets up certain standards for "First Quality" and "Second Quality" jams, and its guiding instructions to the patriotic

jam-maker leave Mr. Bensusan and ourselves astounded. "First Quality" jam for the British market need not have more than 50 per cent of fruit, and "Second Quality" more than 20 per cent. The "fruit" may be brought from abroad in tubs with preservatives; it may be eked out with any old vegetable pulp as an "acceptable substitute," the want of seeds in this pulp may be supplemented by the stale stock of the seedsman, it may be livened up with citric, tartaric and malic acids and brightened with any "permitted" colouring matter, and there it is, First Quality British Jam. What Third Quality Jam for the millions can be like is known only in the deepest recesses of the British Food Manufacturers' Association.

In a systematic treatment of this question we should find ourselves confronted by certain main types of justifications and excuses. There are "preservatives." Some, it is alleged, are quite harmless, but that is no reason why the consumer should not know clearly that they have been employed, just as he has a right to know that food has been kept in a refrigerator. Most preservatives employed seem to be injurious in various degrees, and some are a plain danger to health. Yet they may be arranged in an unbroken ascending order of virtue until you come to the time-honoured practices of salting beef and pork, smoking hams, hanging game and putting sugar or lemon in your tea. Is there any really "natural" food except unmixed fresh raw fruit?

Next to preservatives come various colouring matters employed to restore our confidence in faded and jaded substances. It is a fine line that separates decorative and encouraging from deceitful coloration. It needs a still finer discrimination to distinguish between the modern "flavouring substance" and the herbs in the soup or the mint English cooks put with peas and potatoes. Finally there is the bulk substitution of one cheaper and less reputed foodstuff for another. It is called by the more reputable name, to help the imagination and stimulate the receptive juices of the consumer. Why should they not be stimulated?

You see that this is not a simple case of wickedness and adulteration on the one hand and goodness and no adulteration on the other. We can pass by imperceptible degrees from the poisonous scoundrelism of those lemonade sellers to the makers of the most desirable foodstuffs and condiments and to every sort of innovator in dietary. What of the breakfast cereal? What of the sausage?

When Raleigh came to Europe with the potato, did he realize that he was bringing over an "acceptable substitute" for wheat flour?

A constant warfare goes on between two types of alert intelligences in this field of food supply, a conflict which indeed extends far beyond catering into almost every field of human activity. People are being shabbily active and intelligently cunning in the feeding of mankind, and they are spending their lives and finding their profits in degrading human food, but at the same time another active class is making the most strenuous efforts to increase the quantity and quality of human nutrition and to restrain and defeat the sordid interests that would poison and enfeeble us. The campaign for more and better food is a world-wide and on the whole a not unhopeful one. We have already glanced at the conflict of the same factors in the problem of journalism, where we found sordid considerations and unimaginative self-seeking cheapening and corrupting that general supply of information and discussion which is now so necessary to civilized life, and we have found the countervailing forces as yet undefinable and ineffective; but as regards the more urgent matter of food, what we may call antiseptic organization is better developed. There is a great body of legislation for the protection of the people's food in every civilized country; there is an organization of analysts and inspectors.

Our projected *Science of Work and Wealth* would tell in full of the development and organization of this new preventive service--for its beginnings date only from the middle of the nineteenth century. Before that time the only check on adulteration, except for outbursts of popular indignation and municipal action (taking the form of market control), was through the Revenue service, which naturally confined its attention only to the sophistication of dutiable articles. An interesting part of that history would be the passing and working of the Federal Food and Drugs Act of the United States of America (1906). That marks a very important phase in the history of the American stomach, and also in the history of private enterprise. From being a country where private enterprise had carried the adulteration and misbranding of food to extremes, the United States now ranks among the most wholesomely nourished lands in the world.

There is also the American Consumers' Service, Inc., to be noted, which reports to its subscribers on the real value of commodities

offered for sale—with especial reference to adulteration.

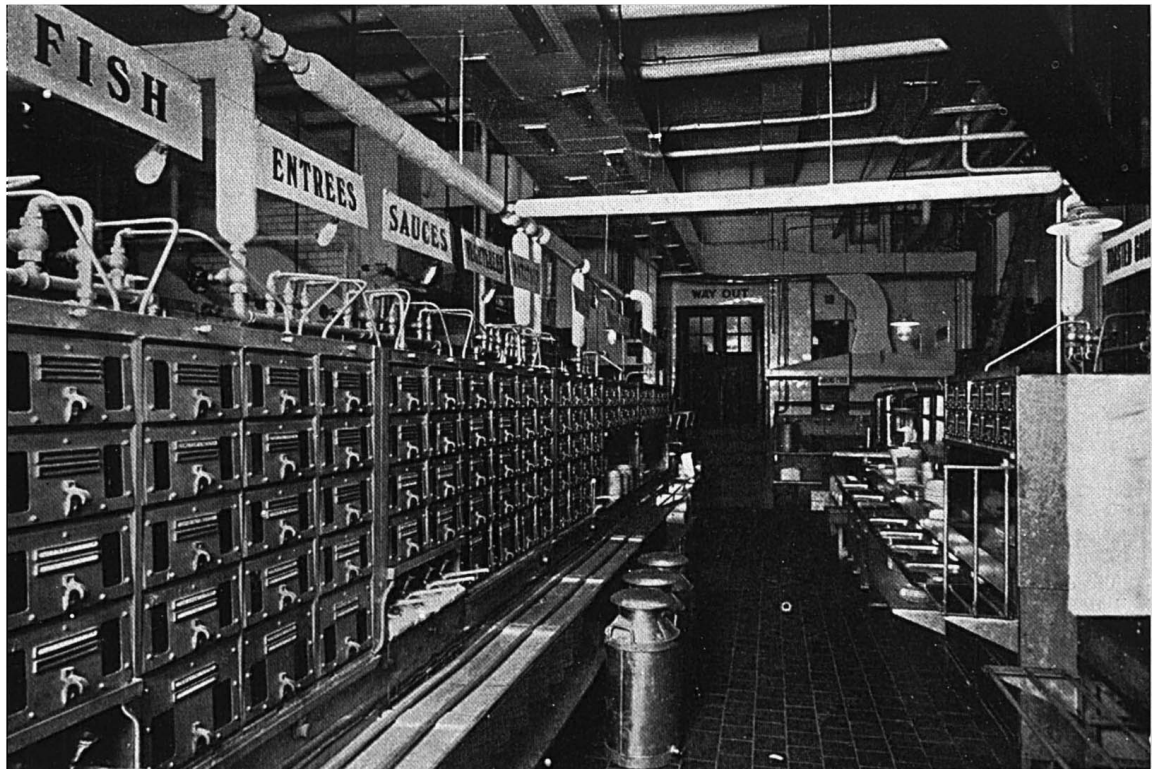
But manifestly a completely satisfactory food supply for mankind is only possible when we know what is to be scheduled as completely satisfactory food. Scientific food control awaits the advance of physiological science. Until such schedules are produced, legislation must aim mainly at the suppression of misdescription and leave the individual, with such guidance as his doctor can give him, to choose among his poisons. We must still have our substitute lemonade, perhaps—but with a plain intimation of the bones or other refuse from which it derives its refreshing acidity. In the place of that green and yellow picture of a lemon, if a decorative label is still felt to be necessary, a slaughter house or a knacker's yard must be pictured as attractively as the artist can contrive.

§ 6. *Dining and Drugging*

A new chapter opens, and the reader's appetite is revived when we turn from the caterers' stores and the substitutionists' problems to the dinner table.

And here we have to consider not merely what people eat but how they eat it. One interesting change challenges our attention, the gradual replacement of the private dining-room by the restaurant that is now in progress. I do not know if anyone has yet attempted to trace and measure this steady replacement of private by collective feeding.

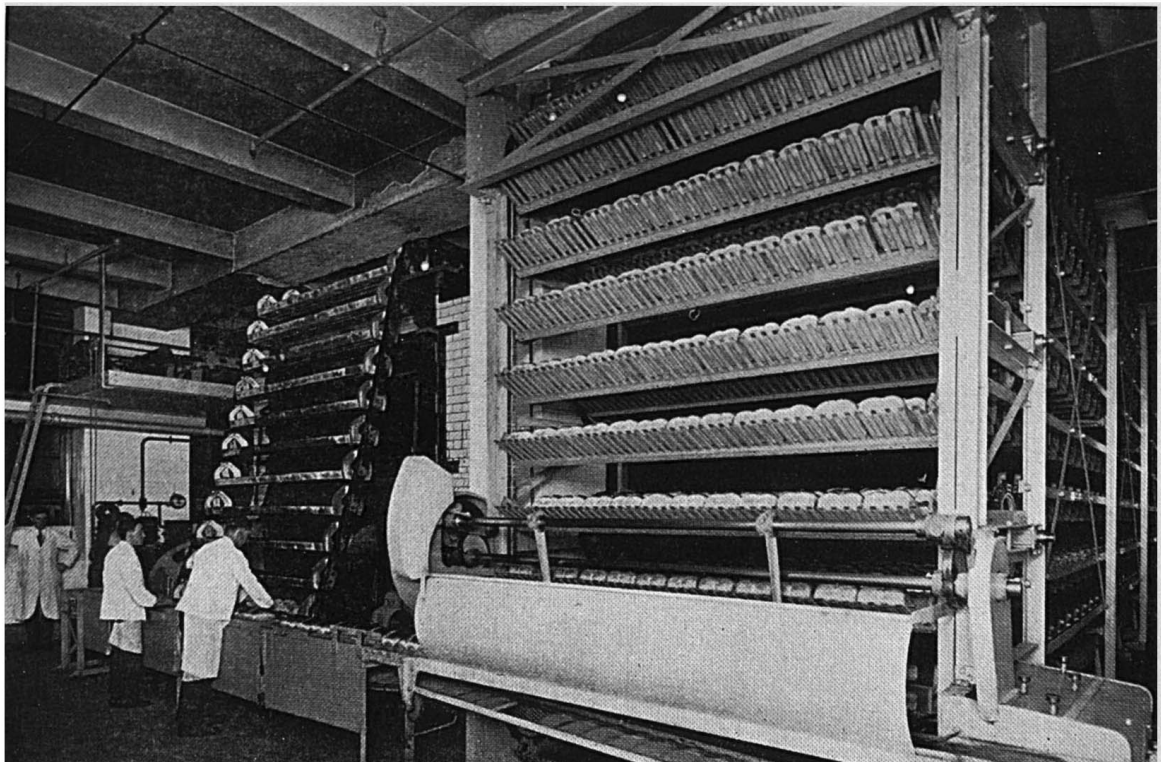
Feeding used generally to be a very unobtrusive and intimate affair. Even cats and dogs like to turn away from us a little to finish up a bone. The peasant, the small householder of only fifty years ago, either never fed abroad, or on such rare occasions as he did, took his little packet of food with him. The employee brought food with him to his work or went home to eat. Large classes of inferior people were too shy and awkward to eat in strange company, and the banquets of the rich were private. People ate together in the refectories of monasteries and nunneries, in military messes, in university college halls, at public banquets and city feasts. They ate at the dreadful tables of boarding houses. There were almost always associative links to bring the eaters together, except when one was travelling—and travel was rare. But now everywhere the little tables of the restaurants increase, and so does the proportion



(By courtesy of Messrs. J. Lyons & Co.)

HOW THE WORLD EATS TO-DAY

How food is stored in a popular restaurant; the result of the "change of habit from secret to open eating" (p. 175)



(By courtesy of Messrs. J. Lyons & Co.)

OUR DAILY BREAD

A corner of one of the world's largest bakeries, where the plant can deal with 6,000 lbs. of loaves an hour

of meals taken by the average man in promiscuous company.

A pleasant subsection of our encyclopædia or museum would deal with table furniture and decoration. We should see tablecloths and mats and serviettes, china and glass, forks and fish knives and flowers, replacing bit by bit the dipping in the bowl, the loving cup, the trough-like habits of the past.

Equally interesting and laborious would it be to get together a comprehensive account of the large-scale catering connected with this change of habit from secret to open eating. Our encyclopædist would have to go behind the scenes of a great restaurant and display the cooks at work and the organization of the service. For the present the interested reader will find much quite trustworthy information in Arnold Bennett's novel, *Imperial Palace*. Is there a limit to this increase in collective feeding? That we shall be better able to discuss after we have dealt with the development of collective housing, as we shall presently do.

Another specialized section would be necessary for our tobacco and cigars. Carmen no doubt will demand a place on the scene. We should have to tell how far machinery and the machine-made cigarette have superseded Carmen's nimble fingers. In the days of Dickens most cigarette smokers rolled their own cigarettes; it was a very foreign and rather sinister thing to do. Now few have the skill, and there are hardly any private cigarette machines. I doubt if you could buy one. Who put the pocket "cigarette machine" on the market, and who or what has hustled it out of existence again?

And after all that spectacle of feasting it would be necessary, I feel, to call for doctors and drugs—and here more particularly drugs. Diet from the point of view of health and medical treatment has been dealt with in the *Science of Life*, but if our detailed survey is to cover the whole complex of human activities, the work of the medical man must have proper attention. I have found very great difficulty in weaving the doctor and surgeon into this scheme of human living so far as their normal professional activities go. And the dentist. But I think here is a place for them so far as they are to be considered *vis-à-vis* with the eating individual.

Much of the physician's work can, of course, be considered and dealt with when the organization of the modern city and the public control of public health is again considered. Surgery again may be made a sort of side chapter to a treatment of scientific research.

And there must be a little world of admirable human beings making the beautiful apparatus and instruments that subserve such work. I do not know where we should place it in our encyclopædia, and I find it ungracious and impossible to ignore it. Here, at any rate, with a sort of logic we can note the preparation, manufacture and distribution of drugs. It is, I believe, a very neat and interesting industry indeed. The unobtrusive tabloid and the urbane ingratiating capsule have banished most of the horrors of the dose. The comic writer can no longer wring any laughter from the black draught. We live in a time when the black draught is forgotten. But in the eighteenth and nineteenth centuries it was almost as cardinal in domestic life as "washing day." We still talk of a man "taking his medicine" when he has to face the consequences of some rash act, but in this age that phrase has none of the suggestion of nose held and bold gulping, that it once possessed.

How far the drug industry interlocks with the manufacture of meat and vegetable extracts and with condiments and perfumes, I do not know. To find out and tell the public would be a task as fascinating as it would be laborious. And since no one would read a complete description of this matter all through unless in preparation for an examination, we need not set ourselves to the task. We need do no more than think of the various groups of factories and laboratories, the clean and skilled workers, the bottling machinery and canning machinery busy with ever-increasing efficiency upon these myriads of supplementary products.

§ 7. *The Peasant, the Basis of the Old Order*

Having eaten, drunken, and rectified ourselves we can face certain fundamental issues that underlie our description of food production. These issues are indeed fundamental to the whole process of social and economic evolution.

We can no longer dispense with detail by waving the reader to imaginary encyclopædias. We must sit down here to direct and exact discussion.

We will imagine that we have really looked over various voluminous and well-pictured descriptions of scientifically planned plantations and that the picture of the organized production over large countrysides, of this or that item upon the daily menu of

mankind, is before us. But when the reader goes about the world, particularly when he is in an aeroplane over Europe, southwestern Asia, India or China, he sees no such widely conceived and widely handled areas of production. For the most part he sees the best soil and the most convenient regions parcelled out into extraordinarily small patches and being cultivated by methods that any full rendering of the possibilities of modern production will assure him are antiquated and obsolete. He will find if he enquires into the matter that these little patches are held individually and managed independently. He is in the presence of the most obdurate obstacle to the effective modernization of the world, the peasant. The peasant is the type, symbol and substance of localized traditionalism. He is the basis of the old order and a misfit and anachronism in the new. He, with his whole family, works upon and lives upon his holding of land. He and his family constitute an almost autonomous social unit.

A couple of centuries ago, practically all mankind was living on local produce. Foreign trade was a trade in luxuries, superfluities, and accessories. Fosdick, in his *Old Savage in the New Civilization*, cites an account written by a Massachusetts farmer of the year 1786 of his economic life, which has happily been preserved for us. All his meat, bread, vegetables, fruit and (maple) sugar, he grew himself. His clothing came from his own wool and flax and leather of his own tanning. His house was built from his own trees, and he had his own forage. All he needed from the outside world were a few such things as salt, pepper, lead bullets, gunpowder, tools and weapons, and few of these things came from overseas. These needs he satisfied easily by selling a fraction of his wheat or cattle. The human world, save in the regions given over to nomadism, was a world of such small localized cultivators, and its towns, industries, churches and monasteries, courts and armies, such as they were, were all resting in the last resort on the indefatigable toil of the man with the plough and spade, *working in the vicinity*.

There was one important breakaway from this generalization before the modern era, the case of Rome during the mightier phase of the City-Empire. Then the subjugated provinces, and especially Sicily and Egypt, sent a great tribute of foodstuffs in exceptionally large ships to the capital. The economic life of all

Italy indeed during the days of imperial expansion, shows a movement of essential produce unequalled in quantity and distance elsewhere in the ancient world. Where there are very large rivers there had also been, since the very earliest days, an important concentration of produce to aliment city aggregations at crucial vantage points. Since the beginnings of history there have been such pre-railway great cities, for example on the Nile, on the Euphrates and Tigris, on the Ganges and the great Chinese rivers.

But these were exceptions to the general state of human affairs. The immense majority of the race was dispersed in a village plus small-town pattern, and each repetition of the pattern was economically autonomous and capable of carrying on by itself, if necessary, for an indefinite time. Indeed, it had to be so autonomous, because there were no means of either taking away or bringing produce in bulk. If production failed, the district starved. In the past men could die of famine in Cheshire while Kent had a glut. And the fundamental dots in this stippled pattern of human society, the individual dots that made the circles of relationship, made the rosette of villages and township, were the hand cultivator, the peasant. Alterations in the status of the peasant there have been again and again. In the story of Pharaoh's dream of the lean kine and the fat kine we have the memory of a deal in which the burthen on the peasant is increased. And the château-burning of the first French Revolution finds its parallel in most of the social cataclysms of the past. The superincumbent pressure is thrown off, and the peasant recovers his surplus produce. But whether the peasant was getting a greater or lesser share out of his total yield, whether he was serf or debtor or free and prosperous small farmer with no master above him, did not in the least alter the fact that the economy of the community was entirely based on him. He conditioned the lives of his tyrants and masters and parasites. They might come or go, they might vary widely, but he remained. He was the essential thing. Nothing in the nature of industrial England or industrial Belgium was possible before the nineteenth century, no countryside carrying millions of industrial workers and having a food production out of all proportion smaller than the needs of the population it carried.

§ 8. *The Passing of the Peasant*

Essentially the modernization of food production means the supersession of this small localized self-directing cultivator, peasant or peasant-like. Here we will speak only of the mechanical organization, the material pressures, concerned in the process. It will be more convenient to leave until later the mental and social stresses this supersession involves.

We have mentioned already the expropriation of peasants in favour of an estate system with slave labour, as a phase in the Roman development. This probably diminished the total output per head and thinned out the population of the countryside, but concentrated a large share of the produce as profit in the hands of the slave owner. The decline and fall of the Empire, the cessation of the slave supply, meant the restoration of the soil to the peasant.

It was a thousand years later, in the British Isles and under entirely new conditions, that the supersession of peasant holders appeared again. In the south and east of England the dispossession of the peasant was associated with sheep-farming for wool export, but it was also directly related to the appearance of new agricultural methods that superseded the strip husbandry and common grazing of the ancient traditional system. It was not merely that the peasant was dispossessed in England; the more important fact is that his methods were set aside. His labour was economized by production on a new scale. Specialization ended his autonomy. Cultivation was less and less for immediate use and more and more for the market. And his home industries were overwhelmed by town products. In this new process of estate aggregation the countryside population was actually reduced while the surplus of production was greatly increased.

It is unnecessary to trace in detail here the phases of the process that replaced the English peasant almost altogether by the agricultural labourer. It is one typical local instance of a world-wide struggle that is still going on, with many fluctuations and setbacks. It is a fight between the individualist "family farmer" on the one hand and organization and (later) machinery on the other. In Denmark the small cultivator has persisted by a surrender of much of his individual freedom to co-operative organization. He has

survived by combination. The English peasant was extinguished before he and his world had reached a level of knowledge and education that made such a voluntary association for collective purposes possible. The English smallholder to-day is a new social type still upon its trial and still learning the lessons of co-operation that the Danish peasant mastered two generations ago. He is not in the old tradition. He is a return to the land.

We may pass very illuminatingly from the story of the disappearance of the English peasant to the struggle that is now going on in Russia. The Soviet government is trying to pass at one stride from conditions that prevailed in fifteenth-century England to an organization of agriculture comprehensive beyond anything hitherto known in the world. A strenuously modern conception of social organization is seeking to impose itself upon a mediæval peasantry, and there is a conscious and acute struggle between peasant and estate—which in this case is a government estate. Upon its issue depends the whole future of Russia. A successful resistance by the peasant spells regression and defeat to that vast experiment. A triumph of large, co-ordinated cultivation means, on the other hand, an educated countryside, dominated by schools and research stations, and playing a large part in the establishment of a new social order throughout the world.

This primary problem of the Russian revolution, the problem of the peasant, was the main topic in a conversation between the present writer and Lenin in 1920. Lenin was then very hopeful of a progressive organization of publicly owned estates, district by district and province by province. The peasant method of life was to be fought and beaten in detail, first here and then there. The peasant, said Lenin, has great resisting power in his own place, but he has not the nation-wide solidarity nor the alertness to bestir himself to combat an attack on his dearest habits and prejudices when it is going on in another part of the country. So that by concentrating all the resources of the Soviet government first in one province and then in another, all Russia would at last be won to modern agriculture and reconstructed from the ground up. Special, specially favoured, regions were to be chosen for the establishment of great communal estates, which were to produce upon modern lines, and the peasants of unregenerate districts were to be won over to submit in their turn to communal organization by the spectacle of

the super-productivity, comfort and vitality upon these estates.

That was the project of Lenin in 1920. It seemed to me a quite reasonable and hopeful method. But it was never pursued. The famine year of 1920-21, the economic blockade of Russia by Western Europe, and the crippled state of Russia's industrial plant, delayed its realization. The necessary machinery was not at hand. The peasants under-produced because they got no satisfaction out of their extra production. The Western world, with its conservative traditions, held aloof, and no machinery or commodities of any sort could be got to stimulate the peasant to toil. The N.E.P. of 1921, the new economic policy, was a desperate attempt to save the immediate situation, a reversion to many of the liberties of private accumulation and ownership that had been abolished. Trading and production for profit reappeared in the towns, adventurers with foreign capital came bargaining into Russia, and the abler peasants grew richer than their fellows again. In a few years Russia began to resemble the United States of a century ago. Profits and social inequality developed on a scale that threatened every ideal and hope of constructive communism.

This temporary arrest of socialization began in 1921. For reasons entirely obscure to me, the development of a socialized estate system in chosen localities did not go on, as it could and should have gone on. There was a delay of eight years. There was a distinct drag in the modernization of Russia for those eight years. The temperamental Slav was, it seems to me, in a phase of lassitude. He dislikes measured steady work; he likes to take things by storm—and many things cannot be done in that way. So, I say, it seems to me; but reputable observers see in that interlude of eight years a period of recovery, necessary for the accumulation of energy for a fresh push forward. Trotsky and Zinovieff protested in 1927 against the gradual recession from socialist ideals, but the protests were set aside. Their protests, said Stalin, Lenin's successor, were premature. The time was not ripe.

Then, in 1928, Stalin awoke to an extravagance of energy. Not by parts, but as a whole, should Russian agriculture be made over. The N.E.P. was disavowed and set aside. The richer peasants, who had been evoked by the N.E.P., were suddenly denounced as the enemies of Russia. They were persecuted, and their children were persecuted and denied ordinary educational facilities. The time

was ripe at last. Russia was to be made over by the Five Year Plan, which was to abolish the peasant for ever in favour of the collectivist estate, scientifically controlled. Russia was, in fact, to do in five years what the capitalist system has been painfully feeling its way towards for centuries. Was it, is it, an impossible undertaking? We must remember Russia has the experience of those centuries to help her, American machinery, American agricultural experts in prairie cultivation, and a very real but rather incalculable fund of enthusiasm to draw upon.

We are still watching that effort. It is the most interesting thing in contemporary history. Such pioneer reporters as Henri Barbusse, Maurice Hindus and Frazier Hunt tell of great changes and enthusiasm, infectious enthusiasm; they seem to have felt success in the air. And we get excellent propaganda films full of sunshine, hope and promise to tell us of the Five Year Plan sweeping ahead of schedule time. The screen displayed the building of the railway from Turkestan to Siberia very vividly and told me in continually increasing type:

TURK-SIB WILL BE READY IN 1930
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Possibly it is something old or cold or bourgeois in my blood, that mingled a broad streak of scepticism with my appreciation. A question of temperament comes in here, and the reader should know of it. I do not like Dostoevsky or Tolstoi; I dislike the epileptic temperament; I am the antithesis of a Slav, and I bore away at things. I like things done without haste and without delay. I do not like things in front of schedule time any more than I like them behind time. So I doubted. But in May I learnt that my scepticism in this instance was unjustified. Turk-Sib was ready—and seven months of 1930 had still to run. Turk-Sib is running. Good for Russia! Good for Stalin! So far.

So far, because witnesses also return to testify to a terrible misuse of the new machinery, of harvesters taken to pieces out of mere childish curiosity and rusting in the fields, of the new wine bursting the old bottles and then running to waste.

In March, 1930, the Western world became aware of a check in

this big thrust that was to carry rural life in Russia with one stupendous rush from mediæval to ultra-modern conditions. The young communists in charge of the transformation were rebuked for excess of zeal; they had driven too hard, and they must relax. All over Russia the kulaks, the richer peasants, were slaughtering the stock they had accumulated rather than surrender it; their persecution had been not merely unjust but intolerable, and they were in revolt.* The attempt to foment a "class war" between the peasant with a dozen head of stock and his neighbour or his brother or his cousin with less or none, had failed, and the peasants were holding together. Perhaps this was only a first assault and a first repulse. Perhaps these Russian revolutionaries who have been in so extreme a hurry and so convulsive in their methods have learnt deliberation from this check and thrust forward all the more effectively for the lesson.

The Russian experiment will be an enormous stride in the modernization of the world, if it succeeds; but even if it is heavily checked and delayed, or even if it fails altogether, it is only one part of a world-wide thrust towards the single organized human community. Russia is a very forward country because it is also a very backward country. Its issues lie bare and plain. There is none of the complex closeness, the elaboration and masking of conflict between the scientific and instinctive forces, that one finds in the Atlantic communities.

Soviet Russia is double-faced. She is communist and instinctive on the one hand, and she is state-socialist, scientific-planning and organizing on the other. She is mediæval and modern, revivalist and cold-blooded. There are, for example, two entirely different types of experiments going on there in agricultural reconstruction, experiments with a curious parallelism and a curious indifference to each other; these are (1) the "Kolkhozy" and (2) the "Sovkhozy." They serve to illustrate a curious two-sidedness that runs through all this Russian revolution. The Kolkhoz (1) displays the old sentimental unwashed sweating "democratic" side, all natural virtue, brotherhood and kisses. The rich peasant is dispossessed, the poor are exalted above him, and the whole village attempts collectivist democratic management—with, however, as Hindus and the propa-

* Between March, 1929, and March, 1930, sheep decreased by one-third, and pigs by two-fifths, and horned cattle by one-fifth. There was a famine of meat and dairy produce. Farbman in *Piatiletka. Russia's Five Year Plan*

ganda film make clear, a bright young man from Moscow as persuader, adviser and redeemer. On the other hand (2) the Sovkhoz is a state plantation, a really scientifically planned and directed modern large-scale organization of production with disciplined and trained workers—the big cultivations in Turkestan, for example, or the "Gigant" in the Caucasus, the vastest wheat-growing estate in the world, measuring fifty miles from north to south and forty from east to west. One thing cripples the Sovkhozy greatly. The best lands are already thickly settled by peasants, and so they have fallen to the Kolkhozy. The Sovkhozy have to take up lands hitherto uncultivated, either because they are poor lands or at a grave distance from consuming areas. They carry no village population; they are run to produce wheat (or some other single crop) for the towns or for export. The two thousand square miles of the Gigant have a total population, including engineers, families and subsidiary staff, of 17,000—of which, by the by, over 16,000 were under thirty years of age in 1930.

These Sovkhozy make straight for a new world order, but it is very doubtful if the Kolkhozy do anything of the sort. The Kolkhoz seems to be the old Tsarist Mir in a state of emotion. It is Rousseauism pretending to love machinery and taking it to pieces out of sheer childishness, misusing and destroying it. Recently Russia has been sending out admirably made, good-humoured, and attractive films about the new departure, in which peasant beggar women or social outcasts of a highly idealized sort, are represented as suddenly taking control of affairs, adopting all the latest devices of scientific agriculture, and founding and organizing elaborately mechanical co-operative estates. It is quite charming nonsense, but it seems to be sent out in perfect good faith.

Socialism did not originally include and does not necessarily include now any insurrectionary or "primitive" element. Its essence is scientifically planned construction as opposed to individualistic "*laissez faire* and all will come well." It was Marx whose mind was dominated by the prevalent political democracy of his time, who twisted up progress with crudity, and determined this curious Russian "squint," so that we are never quite sure to what Russia is looking and what her next step will be. Russia is, in fact, a vast area of moody and fluctuating economic experiments distracted by two points of view, and for that reason alone even her warm well-

wishers—and I am one—are left doubting whether her constructive effort will succeed or will relapse finally into a mere barbaric chaos of insecure petty cultivation at the present Chinese level.

The change in the Russian landscape is at any rate remarkable. Joan Beauchamp, who visited Russia in 1927 and again in 1930, describes it very vividly in a pamphlet, "Agriculture in Soviet Russia," as she noted it from the train. In 1927 the age-long tradition of strip cultivation still held sway, "implements of the most primitive kind" prevailed, "a third of each family's land lay fallow each year," and "each peasant wasted much of his working time walking from one to another of the many strips into which his holding was divided." In 1930 a great proportion of the strips had vanished; they survived mostly close to the towns and villages (no doubt for vegetable growing and townsman odd-time cultivation). Elsewhere the small peasant holdings have been replaced either by vast state farms using the most up-to-date machinery, or by "peasants' collective associations which have gathered together all the horses and machinery they could beg, borrow, hire or confiscate."

"I travelled from Moscow down to the Northern Caucasus during the recent harvest, and it was fascinating to sit at the carriage window and observe all the different methods of agriculture in use as the train sped on. Sometimes we passed through districts where all the land was divided into tiny strips on which men, women and children were working by hand, aided only by the simplest implements. Here a peasant was cutting a strip of perhaps a tenth of an acre of wheat with a sickle, handful by handful, while his wife followed after, gathering the handfuls into sheaves. Next a lad ploughing half an acre or so with one horse. Then we would run into a district where already the strip system had been abolished and fields of wheat, barley, or oats of a reasonable size began to appear. There we passed long lines of reapers, with scythes sweeping rhythmically, followed by women in bright head-scarves, bending down to tie the sheaves. At times we travelled for kilometre after kilometre through uncut wheat, waving far away into the distance. On the edges of some of the larger stretches of corn horse-drawn reapers, such as those still used on many English farms, were at work, often following one another in squads of three or four. Some-

times we came upon large pieces of land which the peasants were bringing into cultivation for the first time. In one such field, at seven in the morning, I counted no less than eighteen horse machines about to start work. Wherever the strip system had been abolished a good deal of machinery of the most assorted types was in use, and the method of traction varied almost as much as the type of machine—here and there a tractor, more often a pair of bullocks, occasionally a camel, but most often, horses.

"Most of the villages seemed to consist of one-storeyed mud houses with barns or cowsheds attached, though a number of the newer houses were made of wood with red zinc roofs. In many districts new houses were being built of bricks with zinc roofs, but all appeared small, and very few had more than one storey. Not far from the villages, running along beside the railway for a kilometre or so, there was often a strip of rough grazing land where herds of cows or bullocks grazed, watched by children. Harrowing also seemed mostly to be entrusted to the children, who hailed us joyfully as they sat perched on the harness of whatever animal happened to be dragging the harrow. . . ."

The expropriation of the peasant as it occurred in Britain through enclosures and a change of scale in farming, and as it is being attempted in Russia through governmental socialization, are extreme instances of the release of production from petty individualism. Changes in cultivation over the rest of the world have for the most part been of a less drastic type. In the older countries, still under the sway of the traditions of a long past of peasant culture, we find a great variety of peasantdoms still prevailing, more or less mitigated to fit modern exigencies; here the peasant enslaved by the usurer, here grown larger into an acquisitive free farmer, here in barbaric regions the slave cultivator of a local chief, here sharing profits and here paying rent in kind or money to a landowner inheriting from some sort of expropriating brigand. One widespread result of the war in eastern Europe, in Esthonia, for example, has been the breaking up of great estates and a relapse towards—if not actually to—peasantdoms.

In vivid contrast to the ancient deep-rooted peasantdoms of Europe and Asia are the conditions of cultivation in the new lands that have been opened up to cultivating occupation in recent years:

the modern ranch and farm in America, Australia and New Zealand, and the exploitation of new irrigation lands. There the cultivator, starting *de novo* with modern appliances, works directly for the market and not for his own consumption, just as the new Russian Sovkhozy do, whereas the primitive peasant worked entirely for consumption and at most traded only, or yielded reluctantly, the small surplus of his output.

The story of New Zealand is particularly illuminating. As that very modern community rushed into being there was extensive land grabbing. It seemed probable that a big private estate system would be established, with tenant cultivators. Vigorous legislative opposition, and particularly graduated taxation, has checked this tendency. The great estates have to a considerable extent been broken up. But the proportion of small cultivating holders, that is to say, holders of less than half a square mile, has not increased. The increase is in holdings of from half a square mile to eight square miles. With modern co-operative methods of machinery and selling, an active Agricultural Department and state electric power, New Zealand seems to be working out a satisfactory and prosperous modern agriculture with owning cultivators farming upon that scale. Neither peasant nor landlord appears in the scheme, and the stratum of modern-spirited farmers exercises very considerable political power. For many types of cultivation the large farmer, who will be in effect neither complete owner nor debtor nor rent-payer, but a fairly free occupier, financed through phases of difficulty by a state cultivators' corporation, selling mainly to its marketing board, assisted by its laboratories, sustained by its common services and in the ultimate resort under its control, may prove to be the final best through long ages in the future before us.

Different climates, differences in contour and soil may vary the optimum area for unified farming, from the hundreds or even thousands of square miles possible over prairie regions to the few acres of an orange farm or a vineyard. New Zealand, it must be remembered, is a sheep-farming country where the farms rule large. The unit of enterprise may prove to be much smaller in urbanized regions, where fruit, vegetables, flowers, poultry, and highly manured, intensely cultivated dairy farms will be at a convenient distance from a market. But these are differences in scale rather than differences in spirit. The smaller holdings contemplated will

be something very different from the strips of the past, and the worker altogether different in quality and outlook from his peasant predecessor. He will be growing for the market as an item in a comprehensive scheme. The general principle of a limited, controlled and directed individualism with an overriding state landlord runs through all the most hopeful schemes for agricultural reorganization.

§ 9. *The World's Catering Is Still Unorganized*

There are two other questions, both very speculative, that we have to consider before we leave this subject of the world's eating. The first is how far our present reorganization of our food services upon world lines is still incomplete. It is vast and elaborate, but it is still haphazard. Immense economies and readjustments will have to be made before the constructive intelligence can be satisfied by the state of affairs. Let me quote again from Raymond D. Fosdick who in his *Old Savage in the New Civilization* has said already exactly what has to be said here.

On the surface of the earth there are to-day living 1,900,000,000 people.

"We know precisely the quantity of food necessary for this vast population. That is one of the additions to our knowledge which the new science of statistics has given us. We know, moreover, where this food is grown and raised. We know the quantity of exports and imports for each of the sixty-five nations of the world. We know the primary and secondary sources of supply for particular countries. We know, for example, the amount of wheat that Germany would ordinarily import from Russia, and Russia failing as a granary, the amount that has to come from the United States or the Argentine. We know the dependency of the United States upon other nations for coffee, tea, cocoa, sugar and many other products, and the dependency of other nations upon us for wheat and beef. In other words, through modern statistics we are able, in our generation, to get a complete picture of supply and demand in relation to the world's food.

"And yet is it an orderly process that we see? Is it a process that has been worked out to obtain a maximum of benefit for the human

race and a minimum of suffering and waste? Has organizing intelligence been applied on a world-wide basis to the production and distribution of food? The question answers itself. In spite of all our knowledge, this essential phase of the world's work is a chaos, a haphazard, drifting arrangement in which sheer chance plays far too prominent a part. As if natural hazards like crop failures or animal diseases were not enough, the human race adds to its own confusion by tariff wars and discriminatory regulations and cut-throat competition and a hundred other exhibitions of international folly. Consequently, part of the world is hungry while the rest of the world has food in quantity. Eastern Europe starves while the farmers of our Middle West burn their corn for fuel. Asia is underfed while North America hunts a market.

"Here is a vast problem that is calling for the organizing intelligence of mankind. The field has been surveyed and the factors are known. What we need now is synthetic thinking, constructive brains, a plan, laid down in world terms, that will disentangle and weave together in a common system the complex details of our present arrangement."

There is one powerful argument for a revision of the legal, political and educational traditions that at present rule mankind. That such a revision is pressing upon us is the conclusion to which all this review of human work and wealth is taking us. The next section will reinforce that argument very strongly and underline it with a note of urgency.

§ 10. *The Limits of Plenty*

The second wide question we cannot ignore is the possibility of a progressive exhaustion of essential supplies. As we have shown in the *Science of Life*, every species has hitherto eaten (or starved) according to the current year's resources. A limiting factor in the expansion of life, lies in the restricted and diminishing supply of available phosphorus. And we are now beginning to take nitrogen from the air in the manufacture of artificial fertilizers, a process that may easily attain such a scale as to produce within a few score centuries a perceptible change in the composition of the atmosphere. "The solution of the nitrogen problem by Crookes,"

says Professor Armstrong, "has brought us nearer to destruction rather than saved us, by hastening the depletion of irreplaceable phosphatic stores. We can clearly foresee in phosphorus the limiting factor to the world's progress." Professor Armstrong is not a miracle of judgment or knowledge, but these words of his command respect. Man is able to do what no other animal species has done: he is able to draw upon the accumulations of energy in the past and to anticipate his normal periodic supplies. He is doing so now, and it is a task awaiting the early attention of research students in economics to assemble and summarize everything that may illuminate the problem of how far man's consumption of food is exceeding his proper income and invading the capital upon which his future depends. In the *Science of Life*, in the Book on Ecology and in the Book upon Human Biology, attention is drawn to this fact that for the last two centuries *Homo sapiens* has been increasing at a rate that almost justifies the phrase "a breeding storm," and it is suggested that even now the human population may have passed the security point and be greater than it should be for a prosperous sustained biological equilibrium.

We have already raised this question in our outline of a Book of Substances. But now we are able to put the matter in a more concrete form, as a picture of all this feeding and feasting we have displayed, the smoking and wining and drugging, going on without apprehension, prevision or guidance upon dwindling supports over an abyss. It is a primary issue of unknown urgency, calling aloud for earnest and sustained study and for collective controls, conceived not upon national or imperial, but upon absolutely comprehensive world-wide lines.