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*THE DEVELOPMENT OF PURE FOOD LEGISLATION.**

IT has become customary for the retiring President of the Chemical Society of Washington to present an address on some subject of interest to chemists. If the theme happens to be one which is attracting the attention of thoughtful people generally it is none the less welcome for that reason. We are American citizens first, then chemists.

For the honor of addressing the Pure Food Congress this evening I am indebted to a happy coincidence, in point of time of the meeting of the Chemical Society with the assembly of this Congress.

The chosen topic will not, I trust, prove uninteresting to the larger audience, though it was selected and much of the material collected before the call for the present Congress was issued. I ask your attention for a short time to a review of legislation concerning food adulteration.

The foods and food stuffs of the most civilized people of early historic times were, as compared with ours, few and simple. They had no market filled with all manner of foods in an advanced state of preparation. The food materials they sold and bought were mainly raw and crude,

* Address of the retiring President of the Chemical Society of Washington, delivered before a joint session of the Society and the Pure Food Congress, March 2, 1898.

and their preparation for use was a duty of members or servants of the family. They had neither potted meats nor canned vegetables. When there were 'two women grinding at the mill' the meal was made of such grain as the householder furnished. Spices came to them unground and with none of their virtue extracted. The list of fine family groceries was a very short one. Our far-away fore-bears lived closer to nature and knew less of art than we. Food adulteration as a great evil follows manufactures and commerce and flourishes in the train of a broadening civilization. A disposition to defraud was not wanting to the ancients, but skill to invent and large opportunity to apply are modern.

Early Greece had inspectors of wines to prevent adulteration. Pliny records that that in Rome bread was sometimes adulterated with mineral matter, and says that sophistication of wines was prevalent and pure wines difficult to obtain, but it does not appear that corrective legislation was attempted or proposed.

We find sanitary regulations concerning the sale of food, however, among the teachings of Moses in the wilderness and in the Rabbinical laws which were given to the Jews at a very early date. The early Jews, be it remembered, were distinctly a people of this world. They had practically no conception of a future life. Moses scarcely referred to a future existence. His life was devoted to the elevation of his people, and it is not conceivable, with all his versatility and breadth of judgment, that he did not have in mind the sanitary bearing of the laws he gave to his nation. Rather, is it probable, that he sought to elevate simultaneously the physical, moral and spiritual natures of his followers. And considering the low state of their civilization, it is suggested by high Jewish authority that he deemed it best to surround his directions with the glamour of mystery and superstition. "Ye shall do no unrightousness in judgment in mete yard, in weight or in measure; just balances, just weights, a just ephah and a just hin shall ye have." This command had reference to commerce in general, but I feel warranted in mentioning it here because similar requirements have commonly been included in pure food laws. It was commanded that the animals which were offered as sacrifices, portions of which were used as food by the priests and Levites, should be without blemish, and that no meat should be eaten more than two days after the slaughter of the animal. It is probable that this was intended to influence the Jewish nation as a whole to eat only fresh meat and that from sound animals. In fact, the Rabbinical law comes to our assistance and requires that all animals used as food by the Jews shall be slaughtered by a priest, who shall carefully examine the lungs and other vital organs to determine if any disease be present, and that no meat shall be eaten more than two days after the slaughter of the animal. It is further provided by both the Biblical and Rabbinical laws that meat shall not be eaten from any animal which died otherwise than at the butcher's hand.

The range of possible adulterations at this time was necessarily very limited and required for its development a corresponding growth of commerce and manufacture.

Passing to the eleventh century we find the world emerging from the Dark Ages. The schoolmen were occupied with metaphysics and theology. Their discussions seem to us unimportant and often trivial, and they were never utilitarian, but they mark an advance toward systematic, scientific thinking. Under their influence new universities were established and those of earlier origin received a fresh impetus. A beginning was made in the literature of the Romance languages, the study of the ancient languages was revived and the Arabian

schools of Spain worked over and added to the conglomeration of unclassified theories and facts from which the various departments of science have been developed. Feudalism, whatever its faults, had averted the chaos which for a time threatened to follow the death of Charlemagne and was fostering and augmenting personal honor, the spirit of independence and the love of liberty. Of course, no general laws were possible or necessary at this time, but we find regulations enforced in some cities forbidding the adulteration of wine and beer. Of all foods these were the most important from a commercial standpoint and were most commonly adulterated. Since then there has never been a time when their adulteration was not restricted by legislation and each succeeding period increased the list of foods thus protected until the entire field was covered.

With the dawn of the thirteenth century we find eastern Europe greatly advanced in education and civilization. The Crusades have broadened the minds of their participants. Manufactures have become more diversified, commerce has made a corresponding growth, and a spirit of exploration has sprung up, opening new lands to the advancing civilization. In England and in France the common people have been given a voice in the legislative bodies, and it is worthy of note that contemporaneously with this popular quickening and awakening, or as a direct and immediate sequence, the protection of foods was made a subject of frequent legal enactments.

In 1202, thirteen years before the signing of the Magna Charta, the 'Assize of Bread' was enacted in England. In 1266, the year following the formation of the House of Commons, a statute was enacted forbidding the sale of unwholesome wine and meat. This law was in force more than four hundred years, when it gave place to a more general law. In 1286 the 'Assize of Bread' was repealed by a more comprehensive act known as the 'Statute of Assize.' This statute was intended to control the size and weight of the loaf, not to prevent adulteration. Its effect was naturally to increase adulteration at first, but additions were made from time to time, as their necessity became apparent, to include all frauds in bread.

During the latter part of this century the adulteration of beer was forbidden in France, and in London it was unlawful to adulterate spices by substitution with foreign matter or inferior goods, or by increasing their weight with water.

In the fourteenth century numerous incidents are recorded of punishment by pillory for short weight and for selling bad bread and putrid meat. Early in the fifteenth century Henry V. issued a proclamation against the adulteration and mixing of wine, prescribing the pillory for offenders. In France it was decreed in 1336 that adulteration and exhausted drugs should not be offered for sale nor used in the preparation of any compounded article. The police departments of French cities adopted food and sanitary regulations, and in 1382 the Prevost of Paris declared it illegal for millers to employ cheaper cereals for admixture with their flour, a form of adulteration most difficult to deal with and most dangerous to commerce at the present day. Fourteen years later the artificial coloring of butter was forbidden as well as the mixture of old butter with new. A few years later it was ordered in Paris that butter should not be sold in the same shop with any article having an offensive odor.

In Germany at this time the food supply was controlled in the various cities by trade organizations, which seem to have had full power to adopt standards, pass judgment and punish offenders. These guilds, as they were called, existed in a large number of trades and regulated the workmanship

of their members as well as the quality of goods sold. The penalties they inflicted were often severe and always humiliating. Among them may be mentioned expulsion from the guild, exposition in the pillory, emersion in muddy water and public whipping. Indeed, instances are recorded in which the offenders were burned at the stake. Finally, a Biebrich dealer was sentenced to drink six quarts of the adulterated wine with which he supplied his customers, an early instance of making the punishment fit the crime.

The fifteenth century brings with it the mariner's compass, the practical application of the art of printing, the organization banks, important maritime discoveries and a rapid growth of manufactures and commerce. In this century, however, and in the three succeeding, comparatively little progress was made in pure food legislation, though the practice of adulteration increased with the growth of commerce. From time to time the wine and beer laws were made more stringent. In the sixteenth century Censors appointed by the College of Physicians in England were empowered to investigate and punish irregularities in the sale of drugs and in the practice of medicine. Clauses prohibiting the sale of adulterated goods were included in the Danish code, and pharmacopœias were compiled in England and Germany in the seventeenth century, and in the eighteenth century laws were passed in England which had for their purpose the increase of the revenues by means of regulating the adulterations of coffee and tea.

In four centuries, however, no great progress in food legislation was made, nor was it possible till iatro-chemistry had ceased to exist, till the phlogiston theory had become a thing of the past, and the balance and the microscope had enabled us to judge of the purity and quality of the food we examine. Before the present century it would have been impossible to enforce a general food law because of the lack of methods to detect adulterants. A single illustration of the crudeness of the early methods will suffice. In the sixteenth century Ale-tasters were appointed in England, whose duty it was to examine all ale before it could be sold. They were instructed, among other things, to pour a little of the ale they were examining on a bench and sit on it, and if their leather breeches stuck to the bench the presence of added sugar was definitely proven.

In 1802 the Conseil de Salubrité was established in Paris, and similar organizations in other cities and some of the provinces soon followed. These committees gave close attention to the question of food adulteration and the progress made in this direction in the first half of this century was largely due to them. During the same period laws were passed in England relating to the adulteration of several articles of food. The penal codes in the Netherlands and in the Scandinavian peninsula contained clauses regulating the sale of adulterants and damaged goods, which have only been rigidly enforced within the last forty years.

The middle of the present century marked a new and most important era. The methods of quantitative analysis had for the first time been effectively applied to the examination of foods. The microscopist had made great progress in his field, and more than a beginning had been made in the study of vegetable histology. Adulterants which might and did pass without suspicion twenty or ten years earlier were then detected with certainty, and the analyst could follow the manufacturer and discover each new cheat as it took the place of an old one which had been exposed. It must not be supposed, however, that all abuses were immediately corrected, or even that the progress of reform was easy and rapid.

In England advocates of a general and efficient food adulteration law were not wanting, but the people at large were apathetic and Parliament was more concerned with party questions than with measures that, while promising little party advantage, were threatened with strong opposition. Trained analysts were few and far between, and in the absence of standards there was no end of conflict and jealousy among the few experts.

The London *Lancet* has earned the gratitude of the civilized world by its early, earnest, fearless, persistent and finally successful advocacy of food adulteration laws. It was in a position of commanding influence and it stood for public welfare. The *Lancet's* Analytical Sanitary Commission, established in 1850, with Dr. Arthur Hill Hassell as chief analyst, waged a determined warfare on food and drug adulteration for a period of nearly twenty years, in fact until comprehensive laws had been enacted and their efficiency demonstrated. The Analytical Sanitary Commission made reports from time to time of the analyses of a large number of foods, drinks, drugs, confections, tobacco, etc., it being the first to undertake this work in any systematic way. Naturally, opposition in every form was excited and became active, vigorous and determined. The Commission and the editor of the *Lancet* were threatened with legal prosecution and personal violence. In the House of Commons Sir Charles Wood, Chancellor of the Exchequer, quoted as the opinion of the 'most distinguished chemist of the day' the assertion that 'neither by chemistry nor by any other means' could the admixture of chicory with coffee be detected, the falsity of which assertion Dr. Hassell demonstrated with the microscope. The protection of coffee from adulteration by chicory which itself had been adulterated with parsnips and other roots was the first practical achievement of the Commission, although the question of coffee adulteration and the sale of coffee substitutes was considered from the standpoint of revenue rather than of fraud.

In 1854 Dr. Hassell published 'Food and its adulterations—comprising the reports of the Analytical Sanitary Commission of the *Lancet* for the years 1851 to 1854 inclusive.' Before the publication of these reports in the *Lancet* it was notorious that many articles of food were generally adulterated, but nothing was known with the precision necessary to suppress fraud. Conclusive evidence of the value of the Commission's revelations, which had a wide circulation in Dr. Hassell's book, is found in the fact that reforms in food laws were immediately pressed in Parliament.

Nor was the movement confined to England. In 1855 the French law relative to foods, which had been in force since 1851, was amended to include drinks, and progress was made in Spain, Denmark and other countries. In the same year the Select Committee on the Adulteration of Food was appointed by Parliament and began an investigation, summoning before it a large number of witnesses, embracing chemists, microscopists, manufacturers, wholesale dealers and consumers, but no general law was passed until 1860. In the same year, 1855, Dr. Letheby was appointed Medical Officer for the city of London, a position which had been sought with much earnestness by Dr. Hassell, both of whom had been prominent in the agitation for pure food laws.

A work 'On the Composition of Food, and how it is Adulterated, with Practical Directions for its Analysis, by W. Marcet, M.D., F.C.S., etc., appeared in 1856. Dr. Marcet devotes a considerable space to disparaging the work done by Dr. Hassell, and the *Lancet* reviews Marcet's book with marked severity.

Jealousies among the advocates of reform

in food laws are noticeable in all the discussions of this period, and doubtless they had no small effect in delaying the passage of an efficient food law. At the least they furnished weapons for an open opposition which drew its inspiration from the profits of adulteration.

In 1857 Dr. Hassell published a second book entitled 'Adulterations Detected: or Plain Instruction for the Discovery of Frauds in Food and Medicine.'

During this period of discussion and waiting in England the French were dealing with offenders under their national and municipal laws forbidding the preparation and sale of adulterated articles of merchandise and the use of incorrect weights and measures. The penalties under these laws were publication, fine and imprisonment. Dealers convicted under municipal laws were compelled to post conspicuously in their places of business large placards with a confession, in detail, of their guilt.

In 1860 Parliament passed the 'Adulteration of Food and Drugs Act,' which made it illegal, first, to sell any article of food or drink with which, to the knowledge of the seller, any article or ingredient injurious to health had been mixed; second, to sell as pure or unadulterated any article of food which was adulterated or not pure. The appointment of analysts was optional with boards of health, church vestry and other bodies. The prescribed fees, ranging from a half crown to ten shillings, were hardly sufficient to pay the cost of materials required for the analysis.

The law was a beginning, but scarcely more. The failure to establish standards and provide for the certain appointment of inspectors and analysts, and the provision making proof of 'guilty knowledge' necessary to conviction, insured the failure of the law as a practical measure. Indeed, these defects were plainly and persistently pointed out before the passage of the act, and it is difficult to escape the conclusion that among those who voted for its passage were some who knew how to 'run with the hare and hold with the hound.' With only a few trained analysts, each of them jealous of the others, and with no recognized standards, it seems the time had not come for a more efficient food law in England than that of 1860.

The agitation was continued and in 1872 the Act of 1860 was re-enforced by the 'Act for the Prevention of the Adulteration of Food and Drinks and of Drugs,' (35 and 36, Vic. C. 74). This act provided for the appointment of inspectors, did not require the proof of 'guilty knowledge' for conviction under the charge of selling adulterated foods, and was applicable to drugs as well as foods. In correcting one of the flaws in the Act of 1860 by not requiring the proof of 'guilty knowledge,' a serious mistake was made in affording no protection to retail dealers, and much injustice resulted.

The dissatisfaction produced by the shortcomings of this act were called to the attention of Parliament by numerous petitions from all the larger cities. The result was the appointment, in 1874, of a second Select Committee, which advised that the act be amended. The committee also expressed the opinion that much of the injustice complained of was due, not to the act itself, but "to the want of a clear understanding as to what does, and what does not, constitute adulteration, and in some cases to the conflicting decisions and inexperience of the analysts."

As the result of the investigation and report of the Select Committee, legislation was again attempted the following year.

"An Act to repeal the Adulteration of Food Acts and to make better provision for the Sale of Food and Drugs in a pure state" (38 and 39 Vic. C. 63, 11th Aug., 1875).

Sec. 1. Repeals former statutes.

Sec. 2. The term 'food' is defined as including every article used for food or drink by man other than drugs and water. The term 'drug' includes all medicines for internal or external use.

Sec. 3. "No person shall mix, color, stain or powder * * * * * any article of food with any ingredient or material so as to render the article injurious to health, with intent that the same may be sold in that state, and no person shall sell any such article so mixed, colored, stained or powdered, under a penalty in each case not exceeding fifty pounds for the first offense; every offense, after a conviction for a first offense, shall be a misdemeanor, for which the person, on conviction, shall be imprisoned for a period not exceeding six months with hard labor."

Sec. 4. Prohibits the mixing of drugs with injurious ingredients and the selling of the same.

Sec. 5. Exempts in case of proof or absence of knowledge, and of ability 'with reasonable dilligence to obtain that knowledge.'

Sec. 6. "No person shall sell to the prejudice of the purchaser any article of food or any drug which is not of the nature, substance and quality of the article demanded by such purchaser, * * * * *."

Sec. 7. Provides for the sale of compound articles of food and compound drugs.

Sec. 8. Provides that the affixing of a legible label, stating that the goods are mixed, shall be a sufficient protection against conviction by this act.

Sec. 9. Prohibits the abstraction of any part of an article of food with intent to sell without notice of such abstraction, and the selling of such article without notice.

I refer to only a few of the sections of this law. As a whole it was far better than any legislation that had preceded it in England or in any other country, yet owing to the peculiar constructions placed upon it by the magistrates, convictions, even in cases of evident violation of the act, were difficult and often impossible to secure.

A clear idea of the chief legal difficulties which confronted those charged with enforcing the Sale of Food and Drugs Act can be given by quoting from 'An Act to Amend the Sale of Food and Drugs Act' (42 and 43 Vic. C. 30, 1879):

Sec. 2. "In any prosecution under the provision of the principal act for selling to the prejudice of the purchaser any article of food or any drug which is not of the nature, substance and quality of the article demanded by such purchaser, it shall be no defense to any such prosecution to allege that the purchaser, having bought only for analysis, was not prejudiced by such sale. Neither shall it be a good defense to prove that the article of food or drug in question, though defective in nature or in substance or in quality, was not defective in all three respects."

Sec. 6. "In determining whether an offense has been committed under section 6 of said act by selling, to the prejudice of the purchaser, spirits not adulterated otherwise than by the admixture of water, it shall be a good defense to prove that such admixture has not reduced the spirit more than twenty-five degrees under proof for brandy, whisky or rum, or thirty-five degrees under proof for gin."

A few special acts have since been passed from time to time, but their importance is relatively insignificant. The Act of 1875 as amended in 1879 constitutes in greater part the food law of England as existing at the present time.

The enforcement of these acts at first was difficult and uncertain. As has been previously stated, experienced analysts were few, and the remuneration offered was not sufficient to induce reliable and competent men

to undertake the work. More than this, conflicting decisions by the magistrates before whom the cases were tried added to the difficulties of enforcing the acts. The word 'adulteration' itself received various definitions at the hands of those charged with enforcing the law.

As the intention of the law became more generally understood, standards in all classes of foods were adopted. Legal questions were settled and the machinery for enforcing the acts reduced to working order. In consequence, there has been a constant improvement in the quality of food in the English market, until at the present time there is no government which more completely protects its people from adulterations in food.

So much attention has been given to English law because of the important effect it had in influencing the legislation of other countries. An example of a good working law was offered, a law which had not only outlived the jealousies and misunderstanding of the friends of reform, but had overcome the most skillful, determined and persistent opposition of its foes. In the framing of all subsequent laws in other countries the English law has been carefully studied and the experience gained in the thirty years' contest between the friends and foes of pure food legislation has saved much loss of time and misspent effort.

The machinery for enforcing the law must necessarily vary with the form of government. Sometimes standards have been included in the laws, again other provisions have been made for the adoption of standards.

Since 1880 governmental supervision of the food supply has become general among the nations of the world. In some countries we find scarcely any article of food left unprotected by general enactment. In others the laws are less comprehensive. Where modern civilization is just superseding the ancient order the laws are confined to city ordinances, while in outlying districts where only simple foods are used there is no occasion for restriction.

It is my conviction that in centralized governments the state of a nation's civilization may be judged with accuracy by the protection it affords its people in the quality of the food sold. The absence of national food laws hitherto in the United States may not be well understood in other countries, but it is plain to all who understand the limitations of our federal government. Municipal and State laws, in some cases models of their kinds, we have; but the necessity of a national law, covering the whole question in its relation to manufacture and commerce in the District of Columbia and the Territories, the commerce between the States and between the States and the District of Columbia and the Territories, and to our foreign commerce, is becoming apparent to all thinking men. By no other means can we hope to secure laws uniform in their scope, requirements and penalties among ourselves, and for our foreign commerce nothing less can avail.

We have come upon an era of intense competition and consequent small profits in manufacturing. It often happens that the success, even the life, of an honest business depends on protection from the competition of debased or otherwise fraudulent products. Without protection it becomes a question with the manufacturer whether he shall give up his business or his integrity. Never before did the adulteration of food present so strong temptations to the manufacturer. It is true, indeed, that the fraudulent manufacturer often employs his chemist to help him perpetrate and conceal fraud, and thus adulteration has become a fine art. But there are always honest manufacturers and dealers ready to come to the aid of the health officer. Never before was protection so sure. We can almost say that

if any food adulterant runs more than a short course now, the fault must be charged to inefficient food laws.

Let us protect the honest manufacturer and dealer at every point against the unfair competition of dishonest rivals. Let our products stand on their own merits—stand or fall. And let the same rule apply to imported goods.

I have tried to obtain refined cotton-seed oil from our leading grocers, but have rarely succeeded except at four times its value and under another name. Our native wines, superior to the common wines of any other country, are creating for themselves an increasing demand in foreign countries under their proper labels. Why, then, should we allow them to receive fictitious names at home? Let us by all proper means promote the use of American maize at home and abroad, but always as maize —not as wheat! Let us eat plain American herrings, if we choose, but not 'French sardines' from the coast of Maine. Let us stop the sale of 'pure imported Lucca oil' from the cotton fields of Georgia. Whether as a matter of morals or from policy, let us have honesty.

W. D. BIGELOW.

COLOR VISION.

OF late years the subject of color vision seems to have been specially stimulating to students of psychology, if a judgment may be based upon the rapid increase in the number of hypotheses advanced to explain it. The last of these is briefly outlined in a recent issue of SCIENCE (Feb. 18, 1898), having been brought forward by Professor Patten, of Dartmouth College, at the meeting of the American Physiological Society during Christmas week, and based upon his observation of the fibrils in the eyes of invertebrates. On the assumption "that the length and angular relations of a fibril determine the amount of its response to a wave of light of a given length and plane of vibration, it is possible to offer a logical explanation of many phenomena of color vision."

Every investigator recognizes the necessity of hypotheses as antecedent to theories. The contrast between these may be briefly expressed in the definition of Flourens: "A hypothesis is the explanation of facts by possible causes; a theory is the explanation of facts by real causes." The wave theory of light was a hypothesis until it became fortified by a mass of evidence, mathematical and experimental. The most important single experiment was that of Foucault, who showed that on passing from air into water the velocity of propagation of light is diminished, as it should be according to the wave theory, while according to the emission hypothesis it should be increased. This crucial experiment alone would have been sufficient to change the wave hypothesis into a wave theory. Professor Patten's view of color vision is announced as a 'new theory.' This word is, indeed, so generally employed as a synonym for hypothesis that it may, perhaps, be as well to accept the mandate of usage, insisting always, however, upon a distinction between established and unproved theories. No existing theory of color vision has been established upon evidence comparable with that on which the wave theory of light rests. This fact should not prevent psychologists from forming and testing new hypotheses; but when there is so large a number of these offered for choice in relation to a single subject all persons other than the originators have good excuse for conservatism. Any one whose domain is not psychology should be content with indefinite suspense of judgment until psychologists quite generally agree upon one theory of color sensation, as physicists have agreed upon one theory of propagation of the waves which give rise to color.