must have that can be actualized in no other way than by their coming together to make the compound substance put me out of conscious existence. No amount of chemical examination in the laboratory, so far as I know, would indicate that the two would unite and make a substance that would have such a remarkable effect.

I raise the question of whether this striking example of chemical transformation is more or less typical of all chemical transformation. Is there anything about the phenomenon that we can say intelligently, other than that chemical transformation in general is a process of bringing into actuality the potential qualities that the elements have, which can be discovered in no other way than just that of their acting on one another; and that when they have made a compound substance, the action of that substance can be discovered in no other way than by trying it on a living being more or less like myself?

I wonder if this sort of thing which is now common knowledge to us moderns, does not throw some light on the seemingly endless speculation of the philosophers and theologians, not to say some expert scientists, with reference to what the idea of substance really amounts to.

It looks to me as though the idea of potentiality, of which Aristotle made much as to that particular meaning of the Greek *dunamis,* has been overly neglected in the natural knowledge of the modern era.

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THE CONQUEST OF LEPROSY

IN 1927 my wife and I visited Dr. Douglas Collier and his wife, Dr. Mary Collier, at their mission station at Nan, Siam. We also went to Chiengmai, where Dr. J. W. McKean was in charge of the admirable institution for the care of lepers. These medical missionaries worked under the auspices of the Presbyterian Board, and we felt that their work was of the utmost importance to the country, and a credit to their American supporters.

The years have gone by, Dr. McKean has retired, and now lives in California; Dr. Collier has moved to Chiengmai, and taken up the work with the lepers. All this might not call for special comment were it not that at last after long years of investigation, it appears probable that leprosy may be actually conquered. The experimental work at Chiengmai, in its present form, was initiated by Dr. M. J. Oberdoerffer, a young German who had worked in Africa under the British Empire Leprosy Relief Association. It appeared that the eating of colocasia predisposed to the development of leprosy, apparently due to a toxic substance also found in partly decomposed fish. Using this method, it was found possible to cause monkeys to acquire leprosy, something which it had seemed impossible to do before. The conclusion was reached that injury to the adrenal glands was the more immediate cause of trouble, and short-wave radiation was used to stimulate these glands, with satisfactory results. However, it was suggested that possibly the use of diphtheria antitoxin might be beneficial, as in diphtheria a toxin is liberated which damages the adrenal glands. In diphtheria, antibodies are formed, but this seems not to be the case in leprosy. When the work had reached this promising stage, Dr. Oberdoerffer, on account of poor health, felt obliged to leave Siam. Dr. Collier continued the work, now using toxoid instead of the old antitoxin. The results have been extraordinary, and Dr. Collier states:

> In the use of toxoid and antitoxin we have a treatment which far exceeds any method yet known. Results are obtained in a few weeks, which formerly were seen only after months or years of treatment. While the early cases are less spectacular in response, all types seem to be benefited.

It is reasonably hoped to immunize the children and associates of lepers, and so in time eradicate the disease. All these matters are set forth in a paper just received, published in the *Journal of the Thailand Research Society* (Bangkok), February, 1940.

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SCIENTIFIC BOOKS

THE KOSHER CODE

The Kosher Code of the Orthodox Jew. Being a literal translation of that portion of the sixteenth-century codification of the Babylonian Talmud which describes such deficiencies as render animals unfit for food (Hilkot Terefot, Shulhan 'Aruk); to which is appended a discussion of Talmudic anatomy in the light of the science of its day and of the present time. By S. I. LEVIN, senior rabbi of Minneapolis, and EDWARD A. BOYDEN, professor of anatomy, University of Minnesota. xx + 243 pp. Minneapolis: University of Minnesota Press. 1940. $4.50.

THE anatomist and embryologist must visit, if not frequent, the slaughter-house. The late Professor Minot remarked, in his quiet way, "It is hell," as he sent the reviewer there. Dr. Boyden's errand, fifteen years ago, was to find how often partly divided and supernumerary gall bladders occur in calves and sheep

—2,500 of each. In the abattoir "kosher cutters" from the local synagogues were on hand, inspecting viscera and mysteriously accepting as kosher or kasher the carcasses ritually fit, but occasionally rejecting one as terefah or terephah ("torn of beasts"). They told Dr. Boyden that such anomalies as he sought "were already described in the Shulhan 'Aruk"—the code of Jewish law under which they served. This code consists of text written by a sixteenth-century Palestinian rabbi of Spanish origin (published in Venice, 1564), with notes inserted in the text by a Polish rabbi, also of the sixteenth century (published in Cracow, 1571), and several layers of commentaries surrounding the text, added in the seventeenth, eighteenth and nineteenth centuries. A formidable sample page of the Shulhan 'Aruk, Vilna ed., 1873, serves as frontispiece. Undismayed, and believing that the critical inspection of myriads of animals for nearly two thousand years must have yielded important anatomical observations, Dr. Boyden made light of the labor. The French version of the code by Pavly and Neviasky (1898) was found to be neither literal nor anatomically dependable. In no other modern language were the terefah sections available.

It happened that Professor George F. Moore, theologian, sometimes accounted the most learned member of the Harvard faculty, had been puzzled by the Scriptural and Talmudic references to a "redundance upon (or of) the liver," to be burnt upon the altar. Its various interpretations as omentum (caul), diaphragm or "finger" of the liver caused him to make personal inspection. All that he wrote of this λοβός in an essay (1906) with title in Hebrew, Greek, Aramaic, Arabic and Syriac appears correct, save that he identified it with "the caudate lobe" rather than "the caudate process of the caudate lobe"—a nomenclatorial error which he humbly confessed. At Dr. Boyden's request, Professor Moore called in a rabbinical scholar of Boston who reviewed for him the entire Talmudic and later Hebrew descriptions of the gall bladder, which was the stimulus for the larger project. "Eventually," writes Dr. Boyden, "it became my good fortune to enlist the aid of the senior orthodox rabbi of Minneapolis"—Rabbi S. I. Levin. Rabbi Levin undertook to translate all the 32 sections of the treatise on Terefot, with summaries of such portions of the extensive later commentaries as seemed appropriate, making the book an authentic English version of the regulations now in force, sound from the viewpoint of orthodox Jewry. With diverse but non-conflicting objectives—namely, the production of an orthodox manual and the presentation of everything of anatomical interest in this extensive literature—the joint authors collaborated until their difficult and valuable work was happily concluded by the publication of the rather small volume before us.

"The reason why slaughtering must be done at the neck and the knife must be inspected," writes Rabbi Levin in the Introduction, "is that the animal or fowl should not be made to suffer: the Lord has permitted us to use the animal or fowl, but not to cause it to suffer needlessly." Emphatically the Pentateuch enjoins, "Ye shall eat no manner of blood, whether it be of fowl or of beast—for the life of the flesh is in the blood: thou shalt pour it upon the earth as water." Accordingly, the throat must be cut, and "lost in tradition" is the source of the further precept regarding the gullet and windpipe, that "most of one of them in a fowl, and most of both of them in cattle, should be severed at the time of slaughtering."

This method of slaughter, which differs from the classical Greek and Roman in requiring a sharp smooth knife without a nick and in not allowing cattle to be felled with an axe, has been described by Dr. Isaak Dembo, of St. Petersburg, as "ideal," if that word could be applied to the killing of an animal. The cut "is entirely painless," he finds, and consciousness is lost within "three to five seconds." Dr. Dembo's approval of "The Jewish method of slaughter compared with other methods from the humanitarian, hygienic, and economic points of view" was published, in authorized translation, in London, 1894. In prefatory letters, Virchow hopes that the researches will "at last bring comfort to distressed minds," and Professor Preyer finds the Jewish method "the safest and most expeditious." Ten years later, in 1904, the British Government appointed a distinguished committee, Mr. Arthur H. Lee, Civil Lord of the Admiralty, *chairman*, "to ascertain the most humane and practicable methods of slaughtering animals for human food." Its report (Parliamentary Papers, Cd. 2150) recommends that "all animals, without exception, must be stunned, or otherwise rendered unconscious, before blood is drawn." In collaboration with two such eminent physiologists as Sir Michael Foster and Professor Starling, the committee was forced to conclude that "the Jewish system fails in the primary requirements of rapidity, freedom from unnecessary pain, and instantaneous loss of sensibility, and that it compares very unfavourably with the methods of stunning." In view of these diverse verdicts and with no comparable deliverance by American physiologists, the reviewers can perhaps agree that the slaughter-house is not yet a place of twilight sleep: improvement may not be impossible.

The Kosher Code is an intricate system of regulations and practical measures for determining whether or not an animal is healthy and fit for food. The origin of these laws is a brief statement in the Pentateuch that an animal torn by a beast of prey is not to be eaten. Out of this, these laws developed along the same lines as all the other oral laws of Judaism.

There must have been a nucleus of supplementary oral traditions existing by the side of the written law from its very inception. In course of time, with the appearance in Judaism of general principles of interpretation of the written law, the theory was evolved that the written statement of the Mosaic law should not be taken in a strict and narrow literal sense as a prohibition to eat the meat of an animal that has been actually torn by a beast of prey, but should rather be understood in a more general way as prohibiting the meat of any animal that has been mortally wounded or ravaged by some disease. Since the marauder *punctures* with his claws, the Mosaic law was interpreted as prohibiting all similar perforations, whether by needle, thorn or disease; and difficult decisions must be made when the apertures are closed by adhesions or scar tissue. The neat round holes in the wall of the aorta are orifices of intercostal branches and can be disregarded. "If the heart is perforated, and the hole does not reach the cavity, the animal is kasher if the perforation is due to disease; but if it is made by a thorn or needle, it is terefah."

Predatory animals tear out organs; and missing parts, whether from disease or congenital absence, may disqualify. So also the anomalous doubling of certain organs, on the principle that "every addition is considered an absence"; but always there are exceptions. In kosher animals the spleen or kidneys may be absent; or two spleens or three kidneys may be present. Some rulings, perhaps, depend on hypothetical cases. The finest description of normal and diseased bovine lungs in antiquity is prominently presented. The lungs, indeed, receive special attention: they should be inflated in searching for adhesions and solidifications, but with more fear of punctures than of tubercles. Without discriminating clearly between small and large intestines, Meckel's diverticulum is evidently recorded. Aristotle's *echinus* receives its current name *omasum*.

Thus the free interpretation of the Mosaic law has led to the study and observation of the animal body, its structure and its functions; and religion, here as elsewhere, thus became indirectly the incentive of scientific observations and generalizations. But the scientific interest was subservient to the religious interest and its scope was limited by the special religious needs. In the literature produced in Judaism between the second and fifth centuries after the Christian era, *i.e.*, in the Mishnah and Talmud, the body of accumulated scientific observations and notions, together with their practical application, was committed to writing, and from that time on it remained substantially unchanged.

The medical conceptions in this literature, as has been observed by Professor Boyden, approach those of the Hippocratic school, though, it must be added, there is no evidence that they have been formed under the direct influence of Greek medical literature. They undoubtedly represent a native development, under the exigencies of religion, of certain rudimentary elements inherited from the ancient Semitic world and perhaps also of certain elements absorbed from the later Hellenistic environment.

But in the meantime the science of the structure and functions of the animal body grew apace independently of religion, and the results of the findings of this independent science are not always in agreement with the traditional religious science. To the student of religious institutions the question may, therefore, occur whether it would be possible in Judaism to replace the old traditional science by the new science to be used in the service of its laws with regard to *terefah*. The question was actually raised in the twelfth century by Maimonides, who, besides being a great codifier of Jewish law, was also a great philosopher and scientist, and was especially acquainted with the writings of Galen and the Arabic medical literature. It is interesting to note that, while in the purely speculative elements of religion Maimonides did not hesitate to interpret the most fundamental beliefs of traditional Judaism in terms of what he believed to be the true scientific principles of philosophy, in its practical observances relating to the laws of *terefah* he openly expressed himself in opposition to replacing the old traditional regulations by the new findings of science. In Judaism, as in any other religion, there is always a greater plasticity in abstract ideas than in concrete observances and institutions. The code under consideration, therefore, though written in the sixteenth century, represents the early native Jewish medicine and does not reflect the Greek and Arabic medical knowledge which by the time of its writing had already been accessible in Hebrew translations, as well as in original Hebrew works, for about three centuries.

It would be, however, wrong to assume that the observance of the orthodox Jewish laws of *terefah* would ever come into actual conflict with modern regulations concerning the same matters. With all its insistence upon the traditional methods of determining the health of animals, orthodox Judaism can have no objection, on purely religious grounds, to have those methods supplemented by modern scientific methods, whenever the former methods prove to be scientifically inadequate and ineffective.

Much more might be said. A code of laws is seldom entertaining literature. We have here no masterpiece of prose, but a source-book of extraordinary interest. We commend it to the consideration of the Book of the Decade Club.

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