

**The Jewish method of slaughter compared with other methods from the humanitarian, hygienic, and economic points of view / by J. A. Dembo.**

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THE  
**Jewish Method of Slaughter**

COMPARED WITH OTHER METHODS

FROM THE

HUMANITARIAN, HYGIENIC, AND ECONOMIC  
POINTS OF VIEW

BY

**J. A. DEMBO, M.D.**

PHYSICIAN TO THE ALEXANDER HOSPITAL, ST. PETERSBURG; MEMBER OF THE  
ST. PETERSBURG MEDICAL SOCIETY; MEMBER OF THE SOCIETY  
FOR THE PRESERVATION OF PUBLIC HEALTH, ETC.

*Translated from the German with the  
Author's Amendments*

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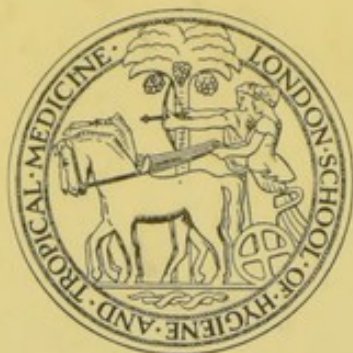
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TO PROFESSOR  
EMIL DU BOIS-REYMOND  
THE PRESENT WORK  
IS RESPECTFULLY DEDICATED



BERLIN, *May* 25, 1894.

*To* DR. DEMBO, *Berlin*.

I have followed with keen interest the progress of your diligent and painstaking investigations, and on the occasion of the completion of the book in which you bring them under the notice of the public I have much pleasure in expressing to you my sincere appreciation of them.

You have approached the vexed question from a new side by submitting to a direct examination the quality of meat from animals killed by the method ordained by the Jewish law. Let us hope that the practical conclusions which the legislators of our time will draw from your researches will at last bring comfort and peace to distressed minds.

I have no objection to your publishing these lines.

The Director of the Royal Pathological Institute,

RUDOLF VIRCHOW.



To DR. DEMBO, at present in Berlin.

DEAR SIR,—I have read the book, the proof-sheets of which you sent me, with keen interest, and I am happy to say that I am in perfect agreement with you on the main points of the slaughtering question.

As I have declared in a report based on observations and experiments in the laboratory and in the slaughter-house, the method of *shecheta* which is practised by the Jews with remarkable success is superior to all other methods of killing, because it is the safest and most expeditious, because the animals killed by it are subjected to the least amount of pain, and because by it the removal of the blood is effected in the most complete manner.

Inasmuch as you have, not only by means of your own extensive investigations, pursued during several years, arrived at just the same results, but have also, by careful experiments, established a fact of such practical importance as that the meat of animals slaughtered in the Jewish manner is hygienically superior to all other meat, you have rendered undeniable services to the cause, and I heartily congratulate you thereon.

I am too little acquainted with the history of the Jews and with the Jewish Ritual Law to understand why they have for centuries adhered to the latter with astonishing pertinacity; but that this consistency is well justified from the standpoint of physiology, that it much better answers the humane purpose of the protection of animals than the uncertain methods of the Christian butchers, and

that it is better calculated to further the wellbeing of the nation than the other—this you have proved and established.

If you think that this recognition of your profound and laborious work will serve as a recommendation of it and will help to introduce the book, the first part of which at least is within the comprehension of everybody, to a wider circle of readers, I have no objection whatever to its being published.—Yours faithfully,

PROFESSOR DR. W. PREYER,

*University of Berlin.*

WIESBADEN, *Jan.* 20, 1894.



# CONTENTS

	PAGE
PREFACE . . . . .	xiii
A.—SLAUGHTERING FROM THE POINT OF VIEW OF HUMANITY. . . . .	3
THE METHODS OF SLAUGHTER WITHOUT STUNNING—	
1. THE JEWISH METHOD OF SLAUGHTER . . . . .	4
2. TRANSFIXION . . . . .	15
METHODS IN WHICH SLAUGHTER IS PRECEDED BY STUNNING—	
1. STUNNING WITH THE MALLET . . . . .	16
2. SLAUGHTERING WITH THE POLEAXE . . . . .	24
3. THE ENGLISH PATENTED SLAUGHTERING METHOD . . . . .	26
4. BRUNEAU'S MASK . . . . .	27
5. SIGMUND'S SHOOTING MASK . . . . .	32
6. THE NECK-STAB . . . . .	34
7. KILLING BY ELECTRICITY . . . . .	40
8. ANÆSTHESIA BY MEANS OF NARCOTICS . . . . .	40
GENERAL REMARKS.	
LAYING-DOWN METHODS . . . . .	43
REPORTS OF THE SWISS CONSULS IN NEW YORK AND ST. PETERSBURG . . . . .	48
EMPLOY OF THE JEWISH METHOD IN CHRISTIAN SLAUGHTER- HOUSES . . . . .	49



	PAGE
B.—SLAUGHTERING FROM THE POINT OF VIEW OF HYGIENE .	56
THE KEEPING QUALITIES OF MEAT . . . . .	56
THE ESCAPE OF BLOOD IN THE DIFFERENT METHODS OF SLAUGHTERING . . . . .	56
THE PHYSICAL AND CHEMICAL PROPERTIES OF MUSCLE . .	57
THE ONSET OF "RIGOR MORTIS" AND THE REMISSION OF "RIGOR MORTIS" IN THE DIFFERENT METHODS OF SLAUGHTER .	62
THE PRODUCTS OF PUTREFACTION . . . . .	66
THE EXAMINATION OF MEAT FOR THE PRODUCTS OF PUTREFACTION (AMMONIA). . . . .	67
CAUSES OF THE BETTER KEEPING OF THE MEAT . . . .	72
1. THE QUANTITY OF BLOOD REMAINING IN THE BODY . .	72
2. OXYGEN REMOVED WITH THE RAPIDLY OUTFLOWING BLOOD	79
3. THE EPILEPTIFORM CONVULSIONS . . . . .	81
<i>a.</i> THE INFLUENCE OF THE CONVULSIONS ON THE FORMATION OF LACTIC ACID . . . . .	82
<i>b.</i> THE CONVULSIONS DIMINISH THE ALKALINITY OF THE BLOOD . . . . .	84
<i>c.</i> CONVULSIONS AND THE ESCAPE OF BLOOD FROM THE SMALLEST BLOODVESSELS . . . . .	85
<i>d.</i> THE EPILEPTIFORM CONVULSIONS AND THE RAPID ONSET OF RIGOR. . . . .	85
4. REMOVAL OF WATER FROM THE MUSCLES IN THE JEWISH METHOD OF SLAUGHTER . . . . .	87
CONCLUSIONS FROM THE CHEMICAL AND PHYSIOLOGICAL EXAMINATION OF MEAT. . . . .	95
C.—SLAUGHTERING FROM THE POINT OF VIEW OF ECONOMY .	96
RECAPITULATION . . . . .	98
CONCLUSION . . . . .	103
THE SLAUGHTERING QUESTION AND THE SOCIETIES FOR THE PREVENTION OF CRUELTY TO ANIMALS . . . . .	103

## P R E F A C E

FOUR years ago I was invited, by the Standing Central Committee of the Russian Societies for the Prevention of Cruelty to Animals, to prepare a report on the different methods of slaughtering for the Congress of the said Societies, which was held at St. Petersburg on January 21, 1891. In compliance with this request, I read a paper before the Congress, and as a consequence of it, as well as of the papers of some other gentlemen, which did not point to the same conclusions, the Congress decided to appoint a Special Commission for the purpose "of deciding on the best method of slaughtering." The Commission, which included several professors of physiology and veterinary science, as well as myself, began the investigation in October 1892, and during four months of assiduous labour studied the matter theoretically and practically in the public slaughter-house of St. Petersburg, examined it in all its bearings, and in particular made the Jewish method the subject of most careful and detailed investigation. Now, although the work of the Committee had thus been soon brought to a conclusion, the matter seemed to me to be of such importance and gravity that I felt prompted to pursue my investigations still further and even to undertake a journey abroad for the purpose of studying the methods used in the slaughter-houses of England, France, Germany, Switzerland, Italy, and other countries.

I propose to give a full account of the observations made during four years in a vast number of slaughter-houses, and my experience there and in the laboratory, as well as an historical survey of the question of slaughtering since the middle of the present century, in a more complete work shortly to be published. But in view of the noisy agitation set on foot by almost all Societies for the Prevention of Cruelty to Animals in Germany, Switzerland, and other



countries, an agitation which does not shrink even from so preposterous a demand as the total suppression by law of the Jewish method of slaughter, I deemed it necessary to publish at once the chief points of my investigations in a concise form, in order to enable every educated layman to judge for himself which method of slaughter deserves to be regarded as the best. Those readers who are interested rather in the scientific aspect of the question, I must refer to two papers of mine, dealing especially with the neck-stab, read before the Medical Society of St. Petersburg on the 1st and the 15th of December, 1892, on "The Anatomical and Physiological Data of the Different Methods of Slaughtering."

Thus, although the present publication does not attempt to deal with the matter in any exhaustive way, yet I thought its immediate appearance of great importance, with the view that every impartial reader might be able to convince himself how far the efforts of the so-called protectors of animals are likely to bring about a change for the better in the lot of the animals.

## THE JEWISH METHOD OF SLAUGHTER

AT first sight it would seem to be easy enough to decide which method of slaughter should be preferred, but in my opinion it is not at all so trifling a task. It is not every one who is qualified to decide as to the superiority of one or the other method, though, unfortunately, it has lately become quite a customary thing to do so. For this purpose there is, first of all, required a thorough knowledge of veterinary science and physiology; and, secondly, a wide acquaintance with the facts of surgery and medicine, coupled with a practical experience that is to be gained only within the walls of the slaughter-house. Thus it happens even with eminent physiologists, notwithstanding their thorough acquaintance with the matter, that, though generally agreed as to the main facts of the Jewish method, and the great part which the circulation of the blood plays in it, they nevertheless commit themselves now and then to false opinions they could certainly have avoided by a careful and practical research in the slaughter-house.

As to the veterinary surgeons and the chief managers of slaughter-houses, I must say that, on the one hand, their time is too much taken up with the performance of their duties to allow them to spend several hours in watching carefully all the symptoms which follow a certain method of killing; while, on the other hand, many of them have not a sufficient knowledge of physiology, surgery, &c., to guide them to a right interpretation of the phenomena seen.

As an excuse for the veterinary surgeon, it must of course be remembered that neither physiology nor veterinary pathology is, properly speaking, concerned with the question of slaughtering.



The reason of this is very clear. Physiology has for its object the investigation and explanation of the vital phenomena in the organism, when normal and perfectly healthy ; whereas pathology considers only the morbid changes that take place therein. Now, from the moment the deadly blow has been struck on the head of the animal, or the bloodvessels of its neck have been severed, it is obvious that physiology has nothing more to do with that organism ; nor does pathology concern itself about its treatment since death must ensue within a few minutes. Does it not indeed appear to a superficial observer to be entirely needless to waste time and money, and to take pains to study the vital symptoms of an organism, which after two to five minutes will all the same be merely a lifeless mass of meat ? This is the only explanation of the fact that even great authorities in veterinary science were at a loss to state with certainty which part of the brain was penetrated by the usual stab in the neck. It is obvious that the opinions of that method were of necessity erroneous.

During the last few months I spent for the sake of investigation in all the chief slaughter-houses of Europe, I repeatedly called the attention of the veterinary surgeons to many facts and symptoms connected with the different methods of slaughter, so that they themselves expressed their astonishment at not having noticed them before during a practice of many years.

And as for myself, I may add that although I have particularly studied and investigated this question during four years in every variety of slaughter-house, as well as in the laboratory ; although during four months I have, in common with the members of the above-mentioned Commission for Selecting the Best Method of Slaughtering, discussed the question in all its aspects ; and although I have witnessed the killing of nearly 4000 animals, yet I may say that at almost every further visit paid to a slaughter-house, I discovered some new point or aspect in the question. Therefore I thought it necessary to embody in the following pages the results of my numerous investigations, placing them under three distinct heads—viz., Humanity, Hygiene, and Economy.

## A.—SLAUGHTERING FROM THE POINT OF VIEW OF HUMANITY.

On examining the present question from a general point of view the methods of slaughtering lend themselves for division into two classes only :

1. The direct bleeding by severing the carotids and the other bloodvessels of the neck (the so-called Jewish method) ; and

2. The preliminary stunning of the animal required by the Societies for the Prevention of Cruelty to Animals, for the purpose of sparing the animal the alleged pains from cutting the throat. To stun, or render the animal insensible, different means are employed : in one slaughter-house an iron hammer is used to strike the animal's head ; in others a mask with an iron bolt is put on the animal's head, and the bolt driven into the brain through the forehead, or the shooting-mask of Sigmund is applied and the brain of the animal destroyed by bullets, &c.

In order to decide which of these two classes deserves to be preferred from a humanitarian point of view, every one possessed of a logical mind will first of all put to himself the following two questions :

- a.* How soon on an average does the animal become unconscious after both carotids and the other bloodvessels of the neck have been divided simultaneously ?

- b.* How soon does unconsciousness supervene in cases in which stunning methods are used ?

I say on an average, because single and exceptional cases cannot be taken into account in the decision of such a question. Likewise, what I look upon here as of crucial importance is not



the moment of death, but the moment of loss of consciousness: only the latter can be of interest and value to the humanitarian, as with the loss of consciousness the animal no longer feels any pain. And besides, how are we to tell physiologically the exact time of death, since we have no criterion to judge by and since physiology itself cannot state exactly what life is, where it ends, and where death begins. If the contention of the protectors of animals that the animal continues to live as long as contractions of its muscles are to be seen were correct, then it would have to be regarded as living even after its head is cut off, for, as is often to be observed in slaughter-houses, entire groups of muscles sometimes contract after the carcass has been sawn through and the pieces hung up.

## THE METHODS OF SLAUGHTER WITHOUT STUNNING.

### 1. The Jewish Method of Slaughter.

With regard to the time at which unconsciousness sets in after all bloodvessels of the neck have been severed by a sharp knife, I have sufficiently shown in the papers and reports above mentioned\*—that the function of the brain and in particular of its grey matter—the seat of consciousness—ceases *immediately* after the blood-supply is cut off—*i.e.*, immediately after the arteries of the neck are cut through, and that the consciousness of the animal is lost within the lapse of three to five seconds, and, in the case of dogs, even sooner.

The important influence of a fresh arterial blood-supply on the function of the brain—in man and animal alike—can easily be recognised, even by the layman, by a very simple experiment. If the abdominal aorta, the vessel which carries the blood to the lower extremities (in animals to the hind legs), is compressed through the belly walls against the spinal column, the extremities become paralysed for the time being—*i.e.*, they lose the power of movement and also of sensation; but the latter reappear as soon as the compressing hand is taken away and the impediment to

\* J. A. Dembo, *Anatomisch-physiologische Grundlagen der verschiedenen Methoden des Viehschlachtens*. (Papers read before the Medical Society of St. Petersburg on the 1st and 15th of December, 1892.)



the flow of blood removed. Now, if the spinal cord is so much in need of a constant supply of fresh blood for the performance of its functions, and ceases to do its work because of an interruption of that supply, how much more must that be the case with the brain, which is made up of a far more subtle and sensitive matter than the cord? The influence of the blood-supply on the function of the brain can also be proved by the following very interesting experiments: On a wheel, which is placed horizontally and turns around a vertical axis with a certain velocity, a small animal, say, a rabbit, is placed in such a position that its head lies towards the centre and the hind legs towards the circumference of the wheel. If the wheel is put in motion the animal very soon lies as if it were dead.

Now, if it is turned round with its head towards the circumference and the legs towards the centre, it will soon revive. That may be repeated with the same results as often as desired. The explanation is simple enough. During the rotation of the wheel the greatest velocity is at the circumference, the least at the centre, and a centrifugal force is developed, with the result that the movable parts (in this experiment the blood) are driven towards the circumference. Thus, during the first half of the experiment the blood is expelled from the brain, and the animal is unconscious; during the second stage of the experiment, the blood returns to the head from the hinder parts of the animal, and life and consciousness return with it.

Not less instructive is the experiment carried out by Brown-Séquard. He revived the head of an executed criminal by filling the arteries of the neck with blood which had been previously defibrinated.

The same experiment was repeated on animals by Professor Vulpian.\* He found that if a dog is guillotined, or killed in some other way, and its head cut off, and as much as ten minutes are allowed to elapse, so that all phenomena of life have entirely disappeared, it is still possible to obtain, within two or three minutes, signs of life in the head by injecting into the arteries of the head, and through them into the brain, defibrinated blood containing oxygen.

\* Vulpian, *Physiologie du système nerveux*, p. 459.



But for the smooth working of the cerebral centres, or, in other words, for the psychical functions of the brain, it is not only necessary that the element which contains the food for the brain—*i.e.*, the blood carrying oxygen, should be supplied regularly and uninterruptedly, but it is also essential that the blood should be continually circulating in order to carry away waste products and replace them by fresh material.

Of all parts of our body, the outer layer of the brain is that which is most in want of food, and which is least able to stand even the slightest interference with its supply. This, too, is the reason why, in the case of great excitement, when the heart stops for a time, and the circulation of blood in the cerebral centres is brought to a standstill, we often lose consciousness and all power of motion (fainting fit). Nay, sometimes the plugging of a single vessel in a certain part of the brain is sufficient to cause instantaneous loss of consciousness, a fact which is often seen in an apoplectic fit.

Many persons who are not sufficiently versed in physiology, and who are unacquainted with the important part which the pressure of the blood plays in regulating the functions of the brain and in maintaining the life of animals, are likely to make here the objection that, after severance of the vessels of the neck, two of them, the vertebral arteries, which branch off below the point of section and run more deeply, still remain entire and can carry blood to the brain. It is not difficult to show the worthlessness of this argument. The bloodvessels of the body constitute a system of elastic tubes or pipes, the walls of which are always more or less stretched according to the amount of pressure which is brought to bear upon them by the greater or lesser bulk of blood contained in them. The system is closed from without, but within forms a complete circle for the flow of the blood. If now an opening is made in one of the parts of the system—*e.g.*, in a vein for bleeding, the pressure in the whole system immediately falls, and sinks lower and lower in proportion to the quantity of blood which is allowed to escape. If such large bloodvessels as the arteries of the neck are cut, whereby the blood is thrown out in a mighty jet as from a fountain, it is clear that the blood pressure within the arteries, and consequently also within the brain, must fall very considerably. The small amount of blood which is still carried



onward to the brain by the vertebral arteries runs immediately to the place of least resistance—that is, to the gaping ends of the cut, arteries—and there escapes. Thus, the vertebral arteries, although not severed themselves, have no power whatever once the chief arteries of the neck are cut through.

How little weight the same objection has when subjected to the criticism of the physiologist is also evident from the following consideration. The brain of man and animals being constructed in such a manner that for its regular action it requires to be fed with blood through a channel as big as the carotids and vertebrals put together, it cannot possibly continue to discharge its functions properly if suddenly made to depend on the small supply of the vertebrals alone, the diameter of which is three to four times less than that of the carotids. A simple experiment on man will prove this point. If you press the carotids against the vertebræ (the tubercle of Chassaignac) and thus cut off that part of the blood-supply of the brain which is derived from the carotids, the person immediately faints. Now what would you expect when, besides, the vessels are cut through and the shock is heightened by the sudden and copious loss of blood? The fact underlying this experiment is well known to and often turned to account by certain skilled criminals for the purpose of making their victim senseless for a short time so as to rob him. That the vertebral arteries take a far smaller part than the carotids in the nutrition of the brain is also shown by the fact that in recent years surgeons have begun to treat epilepsy by the ligature of the vertebrals without in way interfering with the health and mental activity of the brain. Thus, the surgeon Roman von Baracz, of Lemberg, published a case in which he ligatured both the vertebrals of an epileptic subject without any injury to his health.\* This method is not even new, as Dr. Alexander, of Liverpool, had performed this operation in thirty-five cases as long ago as 1882. The vertebral arteries can evidently be of no great importance for the blood-supply of the brain.

That the blood-pressure falls very soon after the arteries of the neck have been cut has already been proved by the well-known physiologist Professor Schiff. In a paper read before the Congress

\* *Wiener med. Wochenschrift*, 1889, No. 7, 8 and 9.



of Physiologists at Bâle in 1889, he says: "When the circulation in both carotids is interrupted even without causing any loss of blood, the blood-pressure in the vertebrals is much diminished. But when the carotids are cut through the blood-pressure falls much lower."

Where the arteries of the neck are divided in such a manner as in the Jewish method of slaughter, so enormous a quantity of blood escapes from the four gaping mouths of the vessels during the very first seconds and the blood-pressure in the brain falls so rapidly that consciousness is at once and irretrievably lost. In hundreds of cases I observed in slaughter-houses and in all controlling experiments in the laboratory, I invariably found that unconsciousness came on after three to five seconds, and with it, as a matter of course, sensibility was abolished; for the moment consciousness is lost the animal is naturally unable to feel anything. And is not the same thing also seen in man? A person who has fainted from loss of blood is unable, after regaining consciousness, to tell what has happened to him in the meantime. The loss of blood need not even be excessive. In my midwifery practice it has often happened to me to carry out the most difficult and painful operations without chloroform on women who had fainted from previous hæmorrhage, which I am sure it would have been impossible for me to do had the patient been conscious. Afterwards they told me that they had not felt the slightest pain during the operation. The hæmorrhage in this case, it must be said, was infinitely small in comparison with the fearful gush of blood when the carotids are divided, and yet unconsciousness was profound and insensibility absolute. After this no man in his senses could seriously imagine that an animal, unconscious from a profuse hæmorrhage from the carotids, could still continue to feel pain.

Nor can I attach much value to another objection made by some non-specialists. They point out that on touching the eye of an animal with the finger ten to fifteen seconds after the throat has been cut, the animal shuts its eye, and they conclude from this that the animal is not unconscious. Well, to my mind, everybody who has learnt the first principles of physiology must know that reflex actions of this kind can by no means be regarded as symptoms of consciousness and sensibility. These reflex actions one may often see in patients when unconscious under the



influence of an anæsthetic, as chloroform, ether, &c., unless the degree of anæsthesia is very profound. In the slaughter-house at Frankfort and elsewhere, I have shown, by a very simple experiment, that those muscular contractions which are produced by touching or rubbing certain muscles and nerves do not at all prove that consciousness still exists. If the head of an ox is entirely cut off from the body and certain points of the head are touched, the dead head can be made to open its mouth, to put out the tongue in any direction that may be desired, &c.

A further attack on the Jewish method of killing is based on the fact, that some time after the division of the arteries of the neck the end of the divided vessels are closed by a certain substance (clotted blood), and, that the escape of blood being hampered, it is necessary to make a few further cuts for the blood to flow out more quickly. This objection is, to speak plainly, mere nonsense. According to the laws of blood-pressure, a cut bloodvessel can be plugged by clotted blood *only when the blood-pressure has already fallen so low that the flowing blood is no longer strong enough to wash away the obstacle* ; but by that time *the animal has long been unconscious and utterly indifferent to any treatment*. This question was carefully investigated by myself and the other members of the Commission for the Selection of the Best Method of Slaughter, and was decided in the sense above indicated. In Russia, indeed, the useless after-cutting just referred to is never done, except in those abattoirs where the blood is preserved for the manufacture of albumen. With every fresh cut of course a new quantity of blood pours forth, because more vessels and tissues are divided, but at the same time you diminish the blood coming from the first cut, and if you finally compare the quantities of blood obtained from two slaughtered animals of similar size, you will find them exactly alike, whether after-cutting has been done or not.

At any rate, the question whether the blood should run out from one vessel or from all vessels equally, has absolutely nothing to do with humanity, and is at most a matter for economical consideration, in some places at least. Besides, it depends entirely upon the butcher to make the blood pour forth with more or less visible force, according to the taste of the members of the Societies for the Prevention of Cruelty to Animals. Practice in the slaughter-houses has convinced me that when the cut is made



somewhat deeper and nearer to the chest (to which the Jewish law is not opposed) subsequent cutting is quite unnecessary, as in that case there is a gush of blood copious enough to satisfy the largest demands. The gush is so powerful, that where the blood is wanted for albumen factories and carefully collected, the butcher, not wishing to have it scattered all over the place, grasps the cut vessels with his fingers and compresses them as much as he can. This practice is based on anatomical reasons, into which I cannot enter here more fully. I have already called attention to this circumstance in many slaughter-houses. It is true that when the cut through the neck is made lower down, the butcher, in selling the heads at the same price he gets now, will perhaps lose the value of three to four pounds of meat which goes with the head, but the poor man who buys the head will have the benefit of it. If that, however, is any inconvenience, it can be settled in some way or other, rather than that a good and humane method of slaughter should be given up.

The further contention, that the death of an animal slaughtered in the Jewish manner is really death from suffocation, is anything but founded on facts. Death from cut bloodvessels cannot be mixed up with death from suffocation, because in the former case unconsciousness takes place much earlier than any symptoms of suffocation could possibly develop. Besides, the windpipe of the animal is fully opened at the same time as the bloodvessels, air has thus free admission to the lungs, and there is not the slightest hindrance to respiration.

Is it not well known that during prolonged surgical operations on the neck and in certain diseases of the throat, when respiration through the mouth and nose is impeded, the patients are made to breathe through a tube put into an opening made in the windpipe? And they manage it very well indeed. Certainly every kind of death from loss of blood, whether with or without previous stunning, may physiologically be regarded in the last instance as a death from suffocation, as the blood is the chief carrier of oxygen, without which life is impossible. But if that is true of the Jewish way of slaughtering, is it still more true of stunning. This can easily be proved. It is generally known that the more oxygen there is in blood the brighter it is, and the less there is in it of that gaseous body the darker is the colour of the blood. Now one need



only witness a few cases in which the one and the other method is applied to be convinced that in the Jewish method the blood is of a bright scarlet colour, and in all methods of stunning dark purplish red.

The attempt to prove that consciousness is retained by instancing the fact that sometimes epileptoid convulsions follow the act of slaughter does not seem to me at all more reasonable. Those who regard this symptom as a real proof of their contention must, seeing that the same convulsive movements take place in the case of stunning with the hammer and the application of the mask with the iron bolt, concede that no loss of consciousness is induced by these methods either. When the animal is stunned the convulsions are observed *as often as three different times*: first, with every repeated blow on the head; secondly, when the knife, not being sufficiently sharp, is brutally thrust in, not immediately after the stunning, but after some time (in both these cases the convulsions have the character of voluntary contractions of the muscles); thirdly and lastly, after a great quantity of blood has already been lost (epileptoid and unconscious movements in consequence of the anæmia of the brain). The last kind of convulsions is that seen in the Jewish method.

Now although these epileptoid convulsions are less marked in the case of stunning, that does not by any means imply that stunning is a better method. To the animal that is already deeply unconscious, it matters nothing whether its muscles are convulsed or at rest; but for the complete escape of blood the convulsions are important, as they help in pressing out the fluid from all the small vessels. Apart from this, the involuntary movements help to make the meat more tender and to keep better, a point to which I shall have to return further on in the chapter in which I give the results of my chemical investigations. Experienced butchers for the same reason try to prolong these movements by rubbing the extremities of the animal. Sometimes, where the animal was killed with Bruneau's mask, I have seen the butcher repeatedly push the cane into the spinal canal, and by so doing cause stronger convulsions, his purpose being to obtain a more complete escape of blood.

That the epileptoid movements have nothing to do with consciousness, is easily proved in the case of man. Everybody knows that exactly the same convulsions constantly occur in epileptic fits



(this is why the convulsions are called "epileptoid"), and, as a matter of fact, the patient is quite unconscious, feels no pain, and on awakening knows nothing of what has happened.

I have already pointed out, in my paper read before the Medical Society of St. Petersburg, that the only pain felt by the animal is that caused by the cut through the soft parts of the neck. That pain can only be very slight, as the knife used is exceedingly sharp, and we know that even man *may be cut in a part very plentifully supplied with nerves without feeling too great pain*, provided that the instrument be very sharp. Apart from this, the sensibility of mammals—and particularly that of the herbivorous mammals—is far below that of the human being. Dogs, for instance, can bear an operation, without struggling against it, that would cause the strongest man to give violent signs of pain. Moreover, the anatomical fact that in the Jewish method of slaughtering the pneumogastric nerve (n. vagus) is divided below the point where its sensory branches to the larynx are given off, that thus the sensory branches need not be divided at all, is a circumstance which of course goes far to lessen the pain of the animal. The student of the Jewish ritual law, when carefully reading the directions on this point, will find that the incision is allowed to be made lower but never higher than the level of the lower edge of the larynx. It is difficult to decide whether this rule has been laid down lest the knife be damaged by the cartilage of the larynx, or because the teachers of religion had already a knowledge of the above-mentioned anatomical distribution of the pneumogastric nerve. At any rate, it is a fact that those very sensitive nervous filaments are not severed by the knife in the Jewish method of slaughtering.

Recently it has been alleged against the Jewish method that it has happened that an ox has risen on his legs after his throat had been cut. Now it cannot be denied that such a thing may happen, especially if the animal has not been properly tied; but, according to all my experience, I can positively assert that if only five seconds have elapsed between the cut and the jumping up, this movement can no longer be regarded as a conscious and voluntary act. It is in the knowledge of everybody that turkeys run about for a long time after their heads have been cut off, and that a duck is able to swim without its head; but nobody will assume that these acts are conscious. If the fact alleged is a defect at all, it is so only from



an æsthetic point of view, and can easily be remedied by the outlay of a few pence in the purchase of a strong rope.

Besides, how often have I not seen that oxen, who were felled by three and four knocks of the head, suddenly spring up again fully conscious?

Another, to say the least, very futile objection adduced against the Jewish method, is that the wound in the neck is sometimes befouled by the vomiting of the animal. Everybody who has made observations in the slaughter-house is aware of the fact that the same thing also happens when other methods of killing are adopted; the difference being that, in the other methods, where the cut for the letting out of the blood is carried downwards far enough to open the cavity of the chest, there is a chance of the latter also being befouled by the contents of the stomach; this can never happen in the Jewish method.

Some members of the Societies for the Prevention of Cruelty to Animals base their aversion to the Jewish method of slaughter on the "mental agony," the "anguish of soul" which the animals experience whilst they are bound and laid down, perceiving the approach of the fatal hour. I have already pointed out in my paper, read before the Medical Society of St. Petersburg, that the "mental faculties" of an ox are not exactly of a very high order. It happened to me, that an ox, after having received the stab in the neck, and while lying on the ground with a complete loss of power of the extremities, took from my hand some bread and salt. Well, after that it is rather difficult to say that he was in great fear of the impending death. My subsequent observations only served to confirm me in the opinion that the mental capacity of these animals is very low. Once I saw a bullock, in the very room where the animals were slaughtered, make an attempt at coitus; it is not very likely that the sexual instinct could have arisen had the animal had the slightest perception that death was impending.

When Professor Pettenkofer was told of the terror of approaching death which the animals slaughtered in the Jewish manner experienced, the great savant smiled and said that, as far as four-legged oxen are concerned, there is no reason to speak of a terror of death.

The feebleness of the psychical faculties of an ox is easily conceivable from a physiological point of view. Depending as these



faculties do on the quantity of the grey matter of the brain (the nerve-centres), the weight of the latter as compared with the weight of the whole body may fairly be regarded as a true measure of the mental capacity of an animal. As we shall show later on, this ratio in the ox is at the best as 1 to 186, whilst in man it is 1 to 36. We can easily see from this how far one is justified in speaking of "the faculties of soul" in an ox.

But granting even that the ox is endowed with those high mental qualities with which he is credited, would it really arouse in him feelings of a more agreeable nature when he sees that one man ties him to a ring, while another stands by with a club in a threatening position, or when he gets repeated blows on his skull? Would he not then and there have the same "evil forebodings" as when he is laid down for the cut of the *shochet*? \*

Finally, the charge is brought against the Jewish method of slaughtering that it is not ethical. One need only visit a slaughter-house more often, and keep one's eyes open to all that goes on there, to be convinced that this accusation has the least foundation when brought against the Jewish method. It seems to me more than strange that people should look for ethics in the slaughter-house when it is often not to be found outside the cruel place. You may slaughter in whatever way you like. The act is in itself an unethical one, and ill to be justified by the requirements of our stomach; therefore the slaughter-house will never be the proper educational sphere as far as ethics and morals are concerned. As to which method of slaughter is likely to rouse the most disagreeable sensations in the onlooker, that is altogether a personal matter. The members of the Society for the Prevention of Cruelty to Animals assert that it is the Jewish method that produces this effect; but on me and many persons I know, the spectacle of the blow struck on the animal's head, and particularly when it has to be repeated more than once, has a far more distressing effect. A cold shudder seizes me whenever I witness it.

How differently the sight of a cruel scene may affect different persons is known from many cases that come before the Law Courts. Murderers, who have taken the life of their fellow-beings in a most cold-blooded manner, have experienced a terrible shock

\* The Jewish slayer.



at the sight of a kitten being killed, or on seeing some other cruel treatment of an animal. It is more than probable, therefore, that the method of stunning, so much recommended and praised by the Societies for the Prevention of Cruelty to Animals, will produce on many persons the impression of an act quite as cruel and unethical as the Jewish method. Those who talk big of ethics would be better advised to take care that no strangers, and particularly that no children, be admitted into slaughter-houses. Such a rule excluding all those who have no business to be in the slaughter-house from entry there exists only in a very few towns; in most places the performance of the slaughter-house is much frequented by outsiders. In Zürich and elsewhere I saw street boys eagerly volunteering to drive in the oxen in order to spare the butcher the trouble.

In concluding the description of the Jewish method of slaughter, I cannot pass in silence over another method that is in some respects very similar to it, since it is based on the same principle of direct bleeding. This mode of slaughter is known as

## 2. Transfixion.

This method, with few exceptions, is used in nearly all slaughter-houses of Europe for killing sheep and calves, and is particularly in vogue in England. It consists in plunging a pointed knife or a narrow two-edged dagger into the soft parts of the neck. The further steps vary in the different slaughter-houses; the knife (or dagger), after having penetrated into the soft parts and injured the leading bloodvessels, is either left in the wound, and the animal is allowed to slowly bleed to death, or the knife, immediately after transfixing the neck, is made to cut through the front part of the throat from within outwards, or rather from behind forwards.

The simple transfixion without following division of the soft parts is practised chiefly in those places where the blood is collected for the manufacture of albumen. The slowly outflowing blood is caught directly in the tanks. After the transfixion, with or without subsequent cutting as above described, in some abattoirs of Europe (in London, Paris, &c.) it is also usual to cut the spinal cord, in order to put a stop to those distressing convulsions



that are so usual in this method, especially in the case of slow bleeding.

I do not hold it necessary to enter here upon a critical analysis of this method, since the reader himself will see that although the principle underlying it is the same as in the *shecheta*—i.e., direct bleeding—yet this method is entirely at variance with the demands of humanity, since the loss of consciousness takes place so much more slowly than in the Jewish method. But apart from its being much inferior to the latter method as regards humanity, it is also not commendable from a hygiene standpoint, since by the stab in the spinal cord the vasomotor centres become paralysed, and the meat soon becomes tainted.

If we compare the Jewish method of slaughter with other methods in common use—e.g., stunning, Bruneau's mask, the mask for shooting, the pole-axe, &c.—we shall see that as far as humanity is concerned, the matter has an aspect quite different from that which the opponents of the Jewish slaughtering method are anxious to represent it as having. The hygienic shortcomings of the above methods I shall have occasion to consider later on when speaking of the quality of meat in relation to different methods.

## METHODS IN WHICH SLAUGHTER IS PRECEDED BY STUNNING.

### 1. Stunning with the Mallet.

Theoretically it cannot be denied that a blow struck on the head of a man, and capable of producing concussion of the brain, will indeed cause immediate loss of consciousness. But, as I have pointed out scientifically, the brain of the ox is comparatively very small as compared with the big skull in which it is contained—this striking fact is best seen when the head is sawn through—and is protected by a double bony case. As the brain is thus not so easily concussed, it would indeed be a feat of skill to unfailingly stun the animal at the first blow. The efforts of the Societies for the Protection of Animals to introduce this method were either based on the observation that a heavy blow on the head of a man immediately produces unconsciousness—the important fact that the human skull is only very *thin* being overlooked—or on a few cases



which happened to result successfully, from which they were led away to sweeping generalisations. Both the premiss and the conclusion are wholly unfounded, and do not in the least agree with the practical experience gained in the slaughter-house. In the Russian slaughter-houses I long ago came to the conclusion that it is quite impossible to fell an ox in every case with a single blow. In fact, this method of killing has been recognised to be a most cruel one, and has therefore been abandoned long ago in towns like St. Petersburg, Moscow, Charkoff, Kasan and others.

But thinking that this might possibly be due to our butchers not being skilful enough in delivering the fatal stroke, I went abroad to see how matters stood there. There I had plenty of opportunities of seeing the "work" done by experienced and skilful men, who had been practising this method for ten years and more, and there I was confirmed in my view that there is no certain means of felling an animal with one or even two blows on the head. The success does not depend solely on the skill and strength of the man, but on a whole series of accidental circumstances—*e.g.*, the angle at which the blow falls on the head, the evenness of the skull, and other points differing in different oxen.

These observations of mine were made mostly in the presence of professors of the veterinary science, or in that of the veterinary superintendents of the slaughter-houses, and I wish it to be distinctly understood, not on a few occasions, but hundreds of times. Thus even the most zealous member of an Animal Protection Society cannot reproach me with not having studied the question practically—an accusation which they are only too fond of launching against every scientific authority that chooses to plead for the Jewish method of slaughter. My experience in the abattoirs has taught me that those cases in which an ox is stunned by one blow only, are the exception rather than the rule. And besides, even if the animal falls at the first stroke, that does not in the least prove that it has lost consciousness and does not feel the subsequent blows. On the contrary, it happens that an ox, after having been felled by the first blow, and having received three or four blows more, suddenly jumps up fully conscious. In a slaughter-house at Berlin, and once in another place, I saw an ox, after four or five heavy blows on the head, suddenly manage to free its head from the hands of the men holding it, and make



straight for the door. This fact is also maintained by veterinary surgeons employed in slaughter-houses. In the Report of the Meeting of the Veterinary Officials of Slaughter-houses in the District of Arusberg, I find the following statement made by Veterinary-Surgeon Goldstein: "Striking with the club is very unsafe. All of you know that the animal often receives many blows, and has to suffer intense pain before it is stunned."\*

Besides, every butcher knows that the ox, even when felled by the first blow, is not necessarily stunned, and therefore the butcher is never satisfied with dealing him one blow only, but considers it better to strike him four, five, or eight times more before commencing the slaughtering proper—*i.e.*, the opening of the bloodvessels.

In the abattoir of Lucerne, two oxen were killed by stunning in the presence of the veterinary surgeon of that establishment, M. C. Rosselet, and myself. On one animal the first blow had no effect whatever; after the second it fell down on its knees, but remained standing on its hind legs, and only after five further blows did it fall down entirely. The second animal, which was only two years old, fell at the first stroke. That the ox feels every succeeding blow is proved by its conscious movements, by the bellowing and groaning to which it sometimes gives vent, and by its turning round from one side to the other. The butchers know that very well, and continue to strike the animal until the movements cease—*i.e.*, until they are sure that he will not jump up any more. One must see the deep holes made with the hammer in the bones of the skull to form a right conception of the agony the animal has to suffer in this method of killing. Amongst my notes there is a case (and I could give the name of the slaughter-house if necessary) where the animal was struck with the hammer *eleven* times before it fell. Such barbarous ill-usage may make the animal furious, and in small provincial towns where in the slaughter-house there are no iron rings to fasten it to, the saddest accidents may sometimes occur.

The following case I quote from the *Crimean Gazette*. The Yekaterinosslaw correspondent of that journal writes:—"At noon of October the 31st, the inhabitants of this town were alarmed by the news

\* See *Zeitschrift für Fleisch u. Milchhygiene*. Edited by Prof. Ostertag. Feb. 1894.



that an ox had become mad, and escaped from the very old jerry-built wooden slaughter-house in which the horned cattle are killed in an inquisitorial fashion by tying their feet and beating them on the forehead. The forehead of this bullock proved to be very resistant, and not only did the blows not stun him, but through the concussion of the brain the nervous system of the animal became excited to such a degree that he tore the ropes, shattered the shed, broke through the fence and rushed into the town. Running about the streets and boulevards in a furiously mad state, he knocked down several people with his horns, and trod on them. An Italian was gored in the loin, and had his skull fractured when knocked down. The poor man had to be carried to a hospital, and his condition is almost hopeless. The people in the boulevards were greatly alarmed until the animal at last was shot down on one of the town commons."\*

It must here be remarked that it is by no means the rule that a young ox is more easily stunned than an old one. On the contrary, I have often noticed that in young animals of three or four years concussion of the brain is not less difficult to obtain. This fact is well known amongst the slaughtermen, as I was told by a wholesale butcher. It would take me, I fear, too far away from the subject if I were to consider this point in all its possible scientific aspects, it is sufficient here to mention that the most probable reason is the greater elasticity of the young skull.† We know that children and young people can sometimes stand hard knocks on the head without concussion of the brain, whilst elderly persons in the same circumstances easily lose consciousness. To the question why, as a rule, an ox cannot be stunned at the first blow, and why so successful a case is rather exceptional, an answer can be found by considering first the relations of brain and skull in oxen, secondly the functions of the brain in man as well as in animals. The weight of the human brain is on an average as much as a 36th part of the weight of the whole body, and the brain being contained in a comparatively small skull, the walls of the latter must necessarily be very thin; in mammals, on the contrary, the average

\* Many more accidents of this kind have been described recently.

† In old bullocks naturally the converse phenomenon is often seen—i.e., an extreme ossification of the skull, and therefore eight or more blows are required to stun them.



weight of the brain is only  $\frac{1}{180}$ th part of the body weight (in oxen still less), and the bony skull is much larger in comparison with the body than in man, so that the bulk of the large head must consist of thick bones. Under such conditions, it must necessarily be very difficult to produce concussion of the brain and unconsciousness by one blow on the very thick case. As far as the functions of the brain are concerned, the following points must be noted: all organs of sense in man as well as in animals have their centres in the brain, or rather in the outer layers, the cortex, of the brain. Thus, H. Munk, a great authority in this branch of science, has proved that the centre of sight lies in the back part of the brain, the centre of hearing in the temporal (temporo-sphenoidal) parts, &c. If the hinder parts of the brain of an animal is wounded or even cut away, the animal becomes blind; if the temporal lobe of the brain is injured, it loses the power of hearing and so forth. But for the intelligence there is no special centre in the brain; it has its seat all over the cortex.

"The intellect," says Munk, "has its seat everywhere in the cortex of the brain. An injury to the outer surface of the brain is the more damaging to the intellect the wider the injured area is."\*

If the extent of the loss of intellect depends on the extent of the injury, the same rule must hold good as regards the loss of consciousness. And, indeed, if intellect and consciousness are not identical in all respects, everything postulated for the former must essentially be applicable, even with a higher degree of probability, to the second. Consciousness is possible without intellect, but intellect never without consciousness, therefore consciousness must be an essential condition for the intelligence. An animal, for instance, can be in full power of its consciousness without being intelligent, but the reverse is quite impossible. Now if complete loss of the intellect is only possible when the whole cortex of the brain has been injured, it is evident that for *complete loss* of consciousness to occur at least the same extent of injury will be required. Or, in other words, the greater the extent of the injury, the more will the consciousness suffer. Apart from this, I may here call attention to the fact, long ago discovered by Flourens and Vulpian, and proved by numerous experiments, that the

\* H. Munk, *Ueber die Function der Grosshirnrinde*, 1890, p. 59.



corresponding parts are similar in structure in both halves of the brain, arranged for the same function, and can replace each other if necessary. Complete unconsciousness can thus be caused only by an extensive injury of both hemispheres of the brain. Consequently the animal, having been struck by the first and second blows of the butcher, may still not be sufficiently injured to lose consciousness completely, although it may appear to be unconscious.

This fact is equally true of man. The illustrious surgeon Pirogoff, who exhaustively treated the subject of injuries to the head, long ago contended that the severest injuries of the skull are not always accompanied by loss of consciousness.\* "Many traumatic cases prove," says Pirogoff, "that severe injuries of the brain do not always disorder its functions. I have seen cases in which the bones of the skull were deeply depressed into the substance of the brain and the patients were not unconscious." From this he concludes that even the most extensive injuries of the brain may occur without loss of consciousness.

This famous surgeon, whose name is known to the medical profession all over the world, by reason of his long and wide experience in hospitals and on the battlefield, gives the following classification of grave injuries of the skull:

1. Cases in which the patient, after the injury, either does not lose consciousness at all, or losing it only for a few moments, recovers immediately.

2. Cases in which consciousness is not lost immediately, but some time after the accident.

3. Cases in which the patient instantly falls unconscious, recovering from that state only after a long lapse of time.

4. Those cases in which the patient loses consciousness immediately after the accident and never recovers it.

Many further cases are recorded in medical literature, in which extensive lesions of the cortex of the brain passed off without any disturbance of the psychical or motor powers of the brain.

The following cases are recorded in Professor Alberts' "Treatise on Surgery": A labourer being engaged in the blasting of rocks had his skull pierced by a steel-pointed iron boring-rod,  $1\frac{1}{4}$  inches thick. He recovered from the injury, and when he died thirteen

\* N. Pirogoff, *Principles of Field Surgery*. Dresden, 1865. In Russian.



years later from some other cause, the post-mortem examination proved beyond question that the brain had been pierced. His skull is preserved in the Boston Museum. A second case happened during the battle of Landrecies. Twenty-two soldiers had lost a part of their skulls by horizontal sword cuts. In twelve of these cases the wounds were as broad as a man's hand, and considerable portions of the membranes of the brain and the brain itself were carried away. All of them marched six days and then had their wounds attended to.

That an injury of the brain does not always cause loss of consciousness is also illustrated by the case, mentioned in Stromeyer's "Surgery": During one of the Afghan wars an English soldier received a sword-cut from an Afghan, which carried away a part of his skull and brain; but he continued fighting none the less.

I could quote from surgical and medical works many more cases in which injuries to the brain did not cause loss of consciousness at the time of infliction, but I assume that those I have cited are sufficient to prove that neither injuries to the skull nor to the brain itself necessarily cause unconsciousness.

In medical practice we often have the opportunity of convincing ourselves that consciousness is not always really lost where it would seem to be so from the appearance of the patient. It has happened that patients, who were thought to be unconscious by all present, have, after recovering from the disease, related how they had overheard the whole of the conversation of the medical men, and how they were seized with despair on hearing themselves condemned to die, &c. They had been conscious of all that was going on around them, but powerless to make known their state and their feelings.

Seeing that even in man with his thin skull, severe injuries cannot invariably cause unconsciousness, we may conceive that in cattle it would occur still less frequently.

The fact that an injury to one or the other part of the brain causes the animal to fall down or to lose the power of motion or sight cannot be regarded as proof that it has lost sensibility also. The animal may be conscious enough, but at the same time it may have the appearance of being unconscious, because it is unable to give expression to the pain which it feels.

Only lately I myself witnessed a scene by which I was consider-



ably struck. It was in the laboratory of the Veterinary High School of Berlin. In the presence of some physiologists I was going to kill two rabbits, one by stunning and the other in the Jewish manner, in order to compare the effect of the different methods on the outflow of the blood. To spare the first rabbit as far as possible all unnecessary pain, I took an iron hammer, weighing 650 grammes, and with all my strength dealt the rabbit a blow with it on the front part of the head. But we were all greatly amazed when the little animal, which itself weighed but three times as much as the hammer (1950 grammes), not only remained standing after that heavy blow, but retained its consciousness and even its ocular reflexes.

My statistics, compiled from many hundred cases observed in the slaughter-houses of Germany and Switzerland, show that on an average five to six blows are required to stun an ox completely. If we assume that the lifting of the hammer, the blow and the interval between one blow and the other, each occupy but one second, the animal's suffering must last not less than twelve seconds before it ceases to feel.

But how often have I not seen that it was impossible to count these operations by seconds only. Now and then it even happens that after a long and fruitless trial, the slaughterer, tired out, is sent away to be replaced by another man, and the animal in the meantime has to suffer extreme pain from the blows which it has already received. If things of this kind happen in the largest and best regulated abattoirs of Europe, where naturally the most skilled slaughterers are employed, we are justified in asking what is to be expected from this method of killing in the country with the primitive arrangement of the slaughter-houses there? In what agonies must the animal die after these unsuccessful attempts to stun it! How could any man in his senses compare this pain with that caused by a single cut through the bloodvessels of the neck, which causes loss of consciousness within five seconds? My estimate, that on an average five to six blows are required to stun an ox, is confirmed by several veterinary professors and directors of abattoirs, as Professors Chauveau, Gerlach, Adam, Zaugg, Hertwig and others, whilst an estimate given by the Board of the Butchers' Guild of Frankfort-on-the-Main, on December 5, 1885, even exceeds the numbers given by myself. This document



states that in the presence of the Board seventy-one blows were required to kill nine oxen, which makes nearly eight blows to one animal.\*

Watching the further steps in slaughtering with previous stunning, we see that between the act of stunning and that of bleeding, a certain time, as a rule, is allowed to elapse, because, as experienced butchers know, the escape of blood immediately after stunning is too scanty ; therefore, they are not in a hurry to start the slaughtering proper. In such instances, when the knife, and particularly when a somewhat blunt knife, is plunged into the animal, or when the butcher, in order to open the cavity of the chest, uses the knife too much, I have often had the opportunity of seeing that the animal, which had been lying quietly till then, made distinctly "conscious" movements. But when the interval between stunning and bleeding had for some reason or other been too long, I saw signs of consciousness so distinct that they could not escape even the eye of a person not trained in medicine. A few times I heard the animals groan with pain in a most distressing manner.

Thus on analysing all these symptoms with critical and experienced eyes, and on taking into account all the facts of physiology, surgery, and medicine relating to the subject, one is driven to the conclusion that, from the humanitarian standpoint, *the method of slaughtering with previous stunning cannot bear comparison with the Jewish method of slaughtering.*

## 2. Slaughtering with the Poleaxe.

In London and Paris cattle are felled with a special implement known as the poleaxe, a blow with which is supposed to result in fracture of the animal's skull and loss of consciousness. The poleaxe is formed of a wooden handle about a yard long, surmounted by an iron head of two branches, one thin and straight, and from  $2\frac{1}{2}$  to  $3\frac{1}{2}$  inches long, and the other about 7 inches in length and curved at the end in the form of a hook. Slaughtering with the poleaxe has long been in vogue in England, and according to information I obtained in French abattoirs its use in France dates from 1872.

\* *Frankfurter Intelligenzblatt*, No. 286, Dec. 6, 1885. Second supplement.



The mode of procedure is as follows: A heavy blow is struck with the implement on the animal's head which fractures the skull, driving the thin and uncurved branch of the axe deep in. Some butchers strike this blow in the middle of the animal's forehead, others at the nape of the neck, and others finally strike at both places in succession. Into the gap thus produced a cane about a yard in length is thrust, for the purpose of destroying the medulla oblongata and the spinal marrow. When the animal ceases to struggle, the bloodvessels of the neck are severed, and the blood allowed to escape.

I do not think it necessary to examine this method from the scientific point of view, as the considerations into which I have entered in dealing with felling methods as a class will admit of a general application here. It is evident that in consequence of the thickness of the skull-bones in an ox, and particularly in an aged ox, an unusual strength and practice is required to hit the exact spot and fracture the skull at the first blow. Cases in which several blows are required are very frequent. On my first visit to the Deptford slaughtering yards in London I found that the number of blows struck was five and more. In one case the ox, after having received several blows, became furious, and broke the massive iron chain which fastened him. In a slaughtering yard belonging to Messrs. Spiers and Pond I witnessed a most painful scene, and notwithstanding my long familiarity with slaughter-houses, I could not endure to the end the sight of the fearful sufferings which the poor animal during twelve long minutes endured. At the second blow, the ox sank on his hindlegs, but at the fourth he rose again with such a dreadful bellowing that all present turned to fly. The butchers tried long to hit it a deadly blow, but the maddened animal dashed its head about so violently that it was impossible for them to effect this until twelve minutes by my watch had elapsed, and six other blows had followed the first.

If such scenes are witnessed in London, where the slaughtermen are evidently experienced, and where all precautions are taken to guard against such accidents, what must we imagine this method to be when employed in small towns and villages?

The case quoted above is sufficient to condemn the method. The success of the operation depends on so many different con-



ditions—the muscular strength of the slaughterman, the condition of the instrument, the thickness of the animal's skull—that the method of felling with the poleaxe must be suppressed, as being cruel to the animal and dangerous for the slaughterman.

Moreover, as I have already said, there is nothing to prove that the felled animal has quite lost consciousness, still less that it is insensible to the fearful pain caused by the thrusting of the cane into the brain.

In short, *from the humanitarian point of view the method of felling with the poleaxe cannot bear comparison with the Jewish method*, which induces loss of consciousness in five seconds.

Viewed from the standpoint of hygiene, this method has still more drawbacks, for the injury to the brain causes paralysis of the vasomotor nerves, and the consequent accumulation of the blood in the veins results in the rapid decomposition of the meat.\*

### 3. The English Patented Slaughtering Method.

This method is in use in some towns in England, and yields what is known as "Patent Meat." It is as follows: The animal is first stunned by a blow on the head, after which an opening is made in the wall of the chest between the fourth and fifth ribs, through which the nozzle of a bellows is inserted, and a large quantity of air blown into the cavity of the chest. The lungs are thereby compressed, and the animal suffocates. In the meat yielded by this method symptoms of decomposition manifest themselves within a few hours.

A method without bleeding analogous to this is practised by the nomad peoples of Russia, among others by the Kalmucks, the difference between their method and the English being that the Kalmucks draw out the heart of the animal through an opening made in the left side, and tie up the vascular trunks running from it.

These methods are both of them equally cruel, and can in any case only be practised in places where there is a large demand for meat containing so much blood. For this reason this "English

\* It is only right to say that this method, of English origin, is employed in Paris under the name of "English system," with more success than in London no doubt because of the greater skill of the slaughtermen.



Patented Method" has already been abandoned in many towns where it was formerly in use.

Proceeding next to the examination of another method of killing, which is in use in some abattoirs of Germany and Switzerland (in Leipzig, Geneva, and Naples\*) and elsewhere, namely, the Bruneau mask, we shall see that "humanity" fares here a good deal worse still.

#### 4. Bruneau's Mask.

This slaughtering mask, or as it is also called "poleaxe with a mask," is made of leather or sometimes also of copper. When of leather, a metal disc with a round hole for the bolt is fixed in it. The mask is fixed on the head by means of straps in such a way that it covers the eyes of the animal, and the hole for the bolt lies exactly opposite the middle of the forehead. A bolt, with a button-shaped head, is now put in the hole, and driven into the brain by a stroke with a heavy wooden mallet. Then the bolt is removed, through the hole thus made in the skull a strong sound (sometimes a willow cane) is introduced into the brain for the purpose, as they say, of destroying the medulla. This operation lasts from thirty to forty seconds, sometimes even more. After that the bloodvessels of the neck are severed.

There is but a very superficial knowledge of anatomy and physiology required to see that the slightest deviation of the bolt, though it be no more than one millimetre, will be sufficient to prevent it reaching the medulla. Destruction of the brain, however, is far from enough to cause death or even unconsciousness, particularly when one hemisphere only is injured, since physiology teaches that symmetrical parts of the brain can take over each other's functions. And, on the other hand, that an injury to the brain does not always cause unconsciousness, we may see from a case recorded in the text-book of surgery of Professor Stromeyer, in which an English soldier had a portion of his skull and his brain cut away by an Afghan's sabre, and yet he continued fighting. Furthermore, we know that extensive injuries to the

\* In Rome the mask of Bruneau is only used in one slaughter-house (by a contractor to the army), and in Paris only in the slaughter-house of the inventor himself.



cerebrum are met with which give no symptom whatever during life, and are only ascertained at the *post-mortem* table. For a careful and unbiassed observer it is impossible not to see that the animal must suffer horrible pain when the most sensitive portions of its nervous system are being roughly handled with a cane, quite apart from the torture which is caused by the driving in of the bolt. I shall not speak of those hundreds of observations which I made myself, as it is quite sufficient to quote those instances in which I was in the company of some veterinary official of the slaughter-house.

On Sept. 15, 1893, in the abattoir of Leipzig, and in the presence of the veterinary surgeon, Mr. Theodor Schubert, and myself, three oxen were killed by means of Bruneau's mask. The first ox received seven blows on the bolt, the second five and the last three before they severally fell. After that the butcher thrust the Spanish cane into the brain, but as the head was lying somewhat at an angle with the trunk, he could not easily find the opening which unites the cavity of the skull with the spinal canal (the foramen magnum). The consequence of this delay was that from the first blow to the beginning of the bleeding not less than eight minutes passed. But the most interesting point in the matter was that when I opened the skulls and examined the brains of the first two oxen I discovered that, notwithstanding the painful poking about with the cane in the brain, the medulla oblongata was not injured at all. My companion was extremely astonished when he saw that the medulla had not even been touched.\* Thus, the theoretical assumption set forth in my paper, that in case of slightest deviation of the iron bolt the medulla escapes injury, was fully confirmed by what had happened in reality. But I do not hesitate to maintain, that in view of the direction of the bolt and the position of the medulla, it is anatomically impossible to injure the medulla with the bolt. At any rate the fact that in two instances not even the Spanish cane had injured the medulla is evidently of paramount importance.

In the abattoir of Geneva, where I made my observations in the presence of the sanitary inspector and veterinary official, Mr. Georges Sulmey, and many other persons, I saw the following case :

\* I have the parts in spirit.



In the slaughter-room No. 24, belonging to the butcher, Alexander Deleamont, *twelve blows had to be given* on the bolt before the skull of an ox was pierced. After the first blow the bolt flew out and was found to be in an unserviceable condition. The mask was replaced by another and four further blows were dealt on the bolt. Then the ox fell, but at the fifth blow he jumped up again, and seven more blows were required to bring him down. Thus altogether the animal was struck twelve times. The other animals received two to three blows each and only one of them fell immediately after the first blow. In another instance the bolt broke under the heavy blow of the mallet.

I witnessed similar incidents in the employment of Bruneau's mask in many other slaughter-houses. At Berne four oxen were killed with Bruneau's mask in the presence of the distinguished professor of the Veterinary College of that town, Mr. Alfred Guillebeau and myself. One ox fell only after the fifth blow, another remained quietly standing when the iron bolt of the mask had already penetrated into his brain, and the people had great trouble to get him down, and then only could they begin to destroy the brain with the Spanish cane.

And, indeed, it cannot be otherwise. In order that the bolt should pierce the skull of an ox at the first or at least at the second blow, a number of conditions must be fulfilled: the mask must fit well on the head of the animal; the point of the bolt must always be very sharp, which in large abattoirs where hundreds of animals are slaughtered daily, is next to impossible; the bolt must not be loose in the mask—but it is loose in all but quite new masks. I often saw a slaughterer after striking at the bolt eight to ten times, at last conclude that the bolt was no good and go away to get another, whilst the ox, wounded as he was by the numerous blows, was left to await his fate.

In the public slaughter-house of Paris, "La Villette," in the slaughter compartment of Bruneau himself, where the people surely know how to handle the mask, I saw, on my very first visit there, a case in which the bolt was fixed so firmly in the skull bones that two slaughtermen had great trouble to force it out again. Only after they had done this could they begin to destroy the brain.

How often does it happen that the bolt rebounds with the



heavy blow and springs right out of the mask, and a long search has to be made for it, the wounded and suffering animal meanwhile waiting for the blows which shall finally despatch him.

But after all the pain the animal has to endure whilst the bolt is driven through its skull, is the desired object attained in every case? Are we justified in expecting that loss of consciousness will immediately and infallibly end that most cruel procedure? My scientific investigations and practical experience enable me to answer that question with an emphatic negative.

I have already shown (p. 22) that the loss of an entire part of the brain does not always lead to unconsciousness, still less can it be expected to ensue in every case from the driving in of a bolt. Even in man, whose brain and nervous system are incomparably more sensitive than those of the lower mammalia, the result may sometimes remain negative, as is shown by the following case :\*

"A master tailor, aged sixty-seven, on November 27, 1891, drove five French nails into his skull with suicidal intent. He did it standing before the mirror, and after that quietly lay down. Two hours later he was discovered and immediately sent to the hospital (the 'Allgemeine Krankenhaus' in Vienna). He made the journey partly on foot and partly in a tram-car. The man appeared quite well, but on examination it was found that four nails were driven in the vertex (the top) of the head, one of which was bent to the shape of the letter S, and of the other three only the heads were visible. The fifth nail was driven in the region of the right temple, eight centimetres above the lobe of the ear. The four nails from the top of the head were easily extracted with bone-forceps, but the fifth, being bent near the top, could be drawn out only by following its curve. The nails proved to be 4·3 centimetres long and 2 millimetres thick. The wounds on the vertex healed by first intention (leaving no traces). *The patient had no brain symptoms whatever, although the brain must undoubtedly have been injured in several places, particularly by the bent nail in the temple. The patient left the hospital on January 3, 1892, in good condition and is at present perfectly in good health.*"

It might perhaps be objected that in this case there were only

\* Dr. Cissel, 'Attempted Suicide by driving Five Nails into the Skull :'  
*Wiener Klinische Wochenschrift*, 1892, No. 16.



tiny nails, whilst the bolt of Bruneau's mask is a heavy iron rod. But the difference between the human skull and that of an ox must be borne in mind. In the latter case the bolt, which is driven into the forehead, must first penetrate the large spaces in the bones (the frontal sinuses) before it can reach the brain, which is placed far away in the back part of the head.

The best proof that the mask is useless is to be seen in the fact that since it was invented there is no end to the improvements and modifications of the apparatus that has been proposed. Inventions in this direction are as "plentiful as blackberries," but they disappear as quickly as they appear, because a system founded upon false principles can never be improved. In recent years, for instance, a mask with a spring bolt has been patented. This has the advantage that the bolt can never spring out of the mask, but, thanks to the spring, the bolt rebounds and the poor animal must receive many blows before it is felled.

If there were need of further proof that the mask of Bruneau does not answer its purpose it would be afforded by the fact that not only has it not found application outside France, but that of all the 184 slaughtering compartments of the Paris abattoir, "La Villette," compartment No. 47, which belongs to Bruneau himself,\* is the only one where the mask is employed.

Quite recently the firm Boom, of Copenhagen, has placed on the market two new slaughter masks, one for large cattle, the other for calves, which are constructed on the principle of the poleaxe, only the manner in which they are attached to the head is new. But as to their efficiency it would appear, from the account given by the director of the abattoir of Copenhagen, Mr. Schwarz-Stolp, M.D., who has given them a fair trial, that they are much less reliable than the mask of the older system. He says:†

"Numerous experiments with both masks have led me to the following conclusion: The application of the masks in the case of

\* It is simply astonishing how little the protectors of the animals, who pretend to care so much for their *protégés*, know of what is really done in slaughter-houses, else it could never have happened that the Paris Society for the Protection of Animals should have awarded the first prize to Mr. Bruneau for his worthless invention.

† "On New Stunning Apparatuses for Cattle," by Schwarz-Stolp, M.D.: *Zeitschrift für Fleisch u. Milchhygiene*, June 1893, fasc. 9.



calves requires much more time than the usual way of stunning with the club. Apart from this, the animal striking, as it does, its head against one and the other side of the trestle on which it is placed, easily gets rid of the mask, which is therefore useless. . . . Both masks of Boom are very complicated in construction, with a good deal of small accessory apparatus, which is easily smashed by a wrong stroke or by rough handling. When the mask is put on with the lateral parts (the grips for the jaws) drawn out and the spring beneath the bolt-opening is pushed, the lateral parts slam together with a noise by which the animal, restless as it is, is frightened and highly excited."

Thus the result is that Boom's mask has no advantage whatever over that of Bruneau.

All the other masks (the Erfurt mask, Leinert's mask, &c.) have other drawbacks of a more or less similar kind.

Independently of my observations and experiments, many of these apparatuses have been tried by the Chief Veterinary Surgeon and Director of the Meat Inspection of Berlin, Dr. Hertwig, together with the Chief of the Veterinary Department of Prussia, Mr. Wolf, and found not to answer.

In Russian slaughter-houses also (St. Petersburg, Warsaw) experiments in slaughtering with masks have been made; the results, however, have been negative and the masks have consequently been abandoned.

Coming now to the consideration of the method of killing with the aid of the shooting-mask, we shall find that the animals are not only not better off, but that matters are even worse.

### 5. Sigmund's Shooting-mask.

This mask differs from that of Bruneau in that the metal disc in it is somewhat larger, and that after it has been fastened to the head the barrel of a loaded revolver is screwed on to it. This method has the advantage of not requiring any skilled hands and of dispensing with the necessity of introducing a cane into the wound for the purpose of destroying the medulla. But it possesses all the disadvantages of Bruneau's mask and some others besides.

It is hardly necessary to speak of the scientific and practical shortcomings of this mask, as it would appear that even in the



abattoir of Bâle, which is under the management of the inventor himself, inefficiency is now an established fact. And it is a notable fact that, in spite of all efforts of Mr. Sigmund, whose invention dates as far back as 1886, his mask should not have only not been introduced in the other slaughter-houses of Switzerland and Germany, but should not always be applied even in the slaughter-house under his own direction. Having spent a whole day in this slaughter-house, I observed that more than half the animals were killed by stunning blows on the head, a method which the butchers there prefer to the use of the shooting-mask. At first I believed that the butchers had to pay for the use of the mask and bullets ; but they said, with a significant smile : "That commodity we get for nothing, sir ; but we beg to be excused." That is the more significant as, according to the director's own words, the butchers have to pay a fine for every case coming under the director's notice in which the stunning is badly done. A special book is even kept for these fines. Still some butchers think it more profitable to run the risk of a fine than to use a shooting-mask. I have asked many butchers the reason of their aversion to the director's mask, and have always received the answer : "There is not sufficient bleeding with it," or "We cannot use the shooting-mask, because all the blood remains in the meat and it soon goes wrong."

The inventor himself, to whom I spoke about the matter, did not deny that immediately after the shooting the escape of blood is not satisfactory, but he expressed the opinion that by allowing some time to elapse before the bleeding this drawback would be removed. Mr. Sigmund, however, entirely ignores the fact that when the butcher delays the bleeding for some time after the shot the ox may recover from the first shock and regain consciousness to some degree. Are there not cases recorded in military practice in which persons who had received a bullet wound on the head had, soon after the injury, recovered from the unconsciousness thus produced ? During the one day I spent in the slaughter-house of Bâle, where certainly the people are more familiar with and skilled in the use of the shooting-mask than anywhere else, I had the opportunity of seeing an ox that had been shot, rush forward with the mask before his eyes and run his head against the wall, so that the shooting had to be repeated. In another case an ox jumped up a few seconds after the shot



and was struck down with a few blows from the mallet. But as all this had not been sufficient to make him unconscious and he again made an attempt to rise, a slaughterer at last gave him a stab in the neck, and only after that could they begin the bleeding. Finally, it must not be forgotten that in oxen the bones of the skull contain very large cavities, which can easily be seen on sawing through a skull. The bullet may remain in one of those cavities without piercing the inner wall and penetrating into the brain. Even in man, with his thin-walled skull, instances are recorded in which a bullet did not penetrate the bones and enter the brain, but went round the skull and made its exit through the skin wound. In the case of the thick-walled skull of the ox such an event would seem to be much more probable.

Thus the shooting-mask, notwithstanding the free advertisement of it by its inventor, Mr. Sigmund, can by no means be regarded as an ideal method of slaughtering either from the humanitarian or from an economic point of view. Besides the drawbacks already mentioned, there is one further defect—viz., that the report of the gun makes a very disagreeable impression upon the people present, and tends to frighten the cattle. Finally, as some veterinary surgeons have justly remarked, the shooting and the handling of the bullets is not altogether devoid of danger for the people employed in slaughter-houses.

All these drawbacks of the shooting-mask explain sufficiently why the inventor of it, in spite of all his efforts, has not succeeded in securing for it general acceptance, not even within his own immediate sphere of authority.

### 6. The Neck-stab.

This method is employed in the largest slaughter-houses in Russia (St. Petersburg, Moscow, Charkoff, Kasan), in some of Germany, Switzerland and Italy (Naples, and partly in Rome) and is as follows: The head of the ox is drawn down by means of a rope fastened to its horns and passed through a strong iron ring fixed in the floor; then a large iron hook held by a rope coiling on a windlass is made to catch the right loin in order that the animal should fall on its left side. After that they proceed with the killing proper. In order to enable the reader to better



understand the technical points in this method it must be mentioned that between the occipital bone and the first vertebra (atlas) there is a space which is called the oval hole (foramen ovale), which is covered by a strong tendinous layer (the nuchal band), by the muscles of the neck and the skin. The more the head is drawn down the more accessible this space becomes, and since in the upper part of the atlas of the ox there is a prominent arch, it is not difficult to get into the space when the knife is carried along the occipital bone from before backwards, and is made to cut through the skin, muscles and tendons.

The butcher, armed with a pointed dagger, 6 inches long, stands before the ox, and with great force thrusts the dagger into the space from before backwards. On the instant the animal falls motionless to the ground seemingly without any sign of life. After this the slaughterman moves the dagger, which has meanwhile remained in the wound, from before backward and from one side to the other for the purpose of destroying the medulla. Sometimes I could count ten such movements or even more; and at other times again the slaughterman, after having withdrawn the dagger, thrusts it in once more lest the animal should interfere with his work, as he says.

The principle of this method lies in the supposed fact that the dagger injures the medulla, a part of the brain which, since the investigations of Flourens, is regarded by all physiologists as the seat of the vital centres, for the action of the heart as well as for respiration, and consequently that death takes place instantly. This belief that the medulla is the part sustaining injury has been held not only by physiologists but even by eminent veterinary scientists, as, for instance, Prof. Gerlach, and it is maintained to this very hour by those who have failed to make themselves acquainted with the results of my investigations in the matter. The careful anatomical researches which I made in 1892 on frozen parts of oxen killed by the neck-stab have strikingly proved that, for reasons afforded by the anatomical structure of the first cervical vertebra and its relation to the occipital bone, it is *anatomically impossible to injure the medulla with the stab* AS USUALLY DIRECTED.\*

\* On the details of these researches I reported before the Medical Society of St. Petersburg on the 1st and 15th of December, 1892, and those interested in



The two accompanying illustrations (a photographic view of the section of the frozen head of an ox, and a drawing from nature) bring out clearly the relations between the bones of the skull and the medulla oblongata, and the impossibility of piercing the latter by the stab in the neck.

I have above laid special emphasis on the words "as usually directed"—*i.e.*, when directed from the head backwards, because this is the direction in which the stab is made in most slaughter-houses, it being then easy with a little practice to find the above described opening. If the stab were made in the opposite direction—*i.e.*, sloping towards the head—then the thick muscles and nuchal ligament which the dagger would encounter in this direction might necessitate several stabs being made before the opening were found, which would naturally be attended with great pain to the animal. In this is to be found the reason of preference being given to the first thrust in all slaughter-houses where this method is in use. If it has been once shown, however, that it is impossible to pierce the medulla then it is evident that this method is a very cruel one, since it entails the wounding of the posterior sensory nerve-roots of the spinal cord. The animal is brought to the ground by the wound in the spinal column, but paralysis of its extremities and all muscles below the injured part results from this wound, while not alone do respiration and the heart's action continue, but the animal is further in full possession of its consciousness.

During my experiments, carried out in the laboratory of Prof. Vulpian in Paris, for the purpose of finding the centres for uterine contractions, I convinced myself that the division of the spinal cord in rabbits (made, as a matter of course, much lower down) did not interfere with their becoming pregnant and giving birth to their young.

These physiological facts find confirmation in the case of man. A number of cases are recorded in surgery and veterinary surgery, in which stabs in the region of the neck were followed by paralysis of all four extremities, which however soon passed off (Brown-Séquard, Lobzick and others). Pirroni describes a case in which a knife had penetrated between the first and second vertebræ.

them are referred to my publication—*The Anatomical and Physiological Data of the Different Methods of Slaughter*, Berlin, 1894 (German).





THE TOPOGRAPHY OF THE SKULL-BONES AND THE BRAIN.

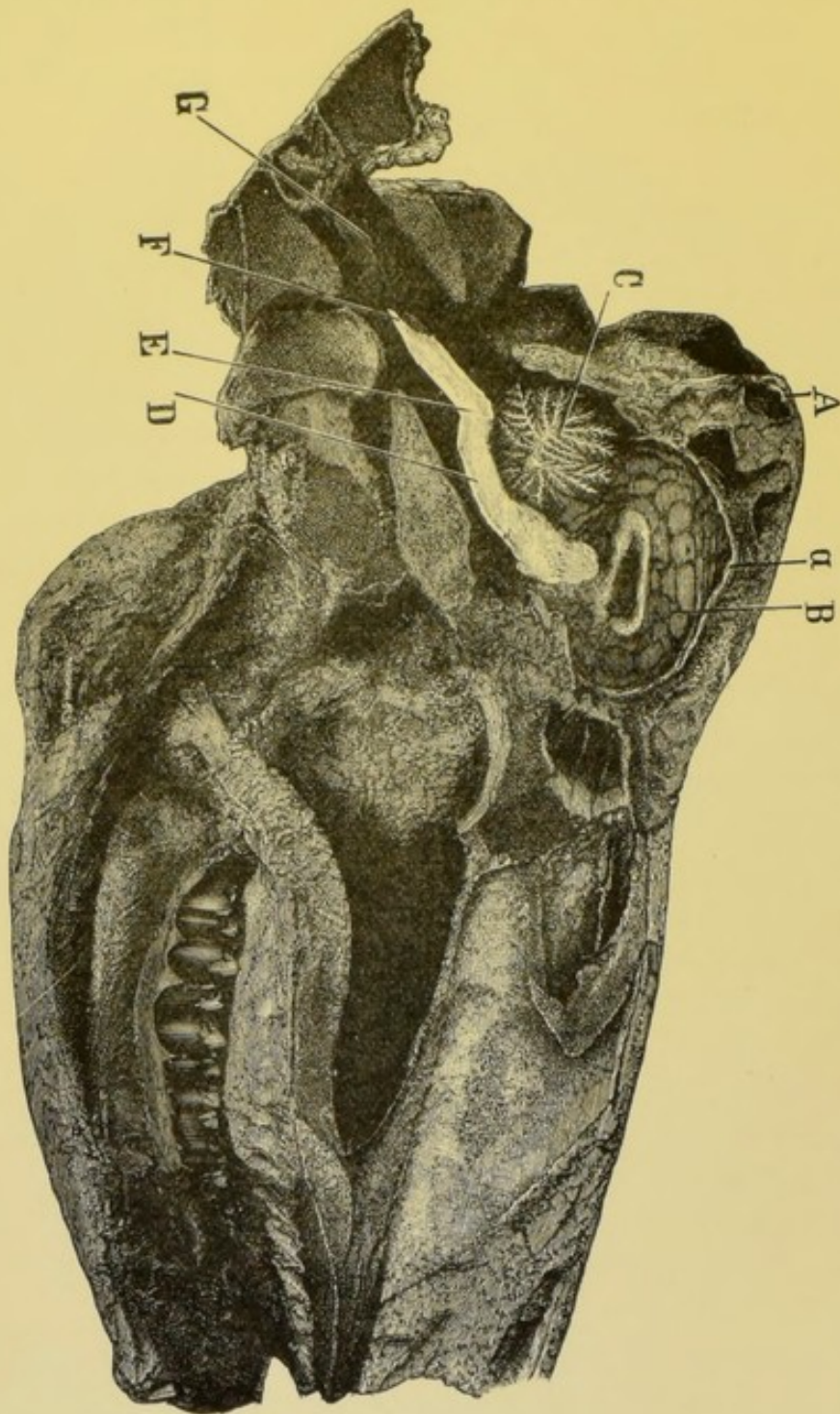


FIG. 1.—*Longitudinal Section through the Frozen Head and Neck of an Ox killed by the Neck-stab. (Photo from the preparation.)*

- |                            |   |
|----------------------------|---|
| A. Skull bones.            | D. Medulla oblongata.                               |
| a. Membranes of the Brain. | E. Commencement of spinal cord.                     |
| B. Cerebrum (cortex).      | F. Spot where the cord is injured by the neck-stab. |
| C. Cerebellum.             | G. First vertebra (atlas) bent slightly downward.   |

THE SEAT OF THE INJURY CAUSED TO THE SPINAL CORD BY  
THE NECK-STAB.

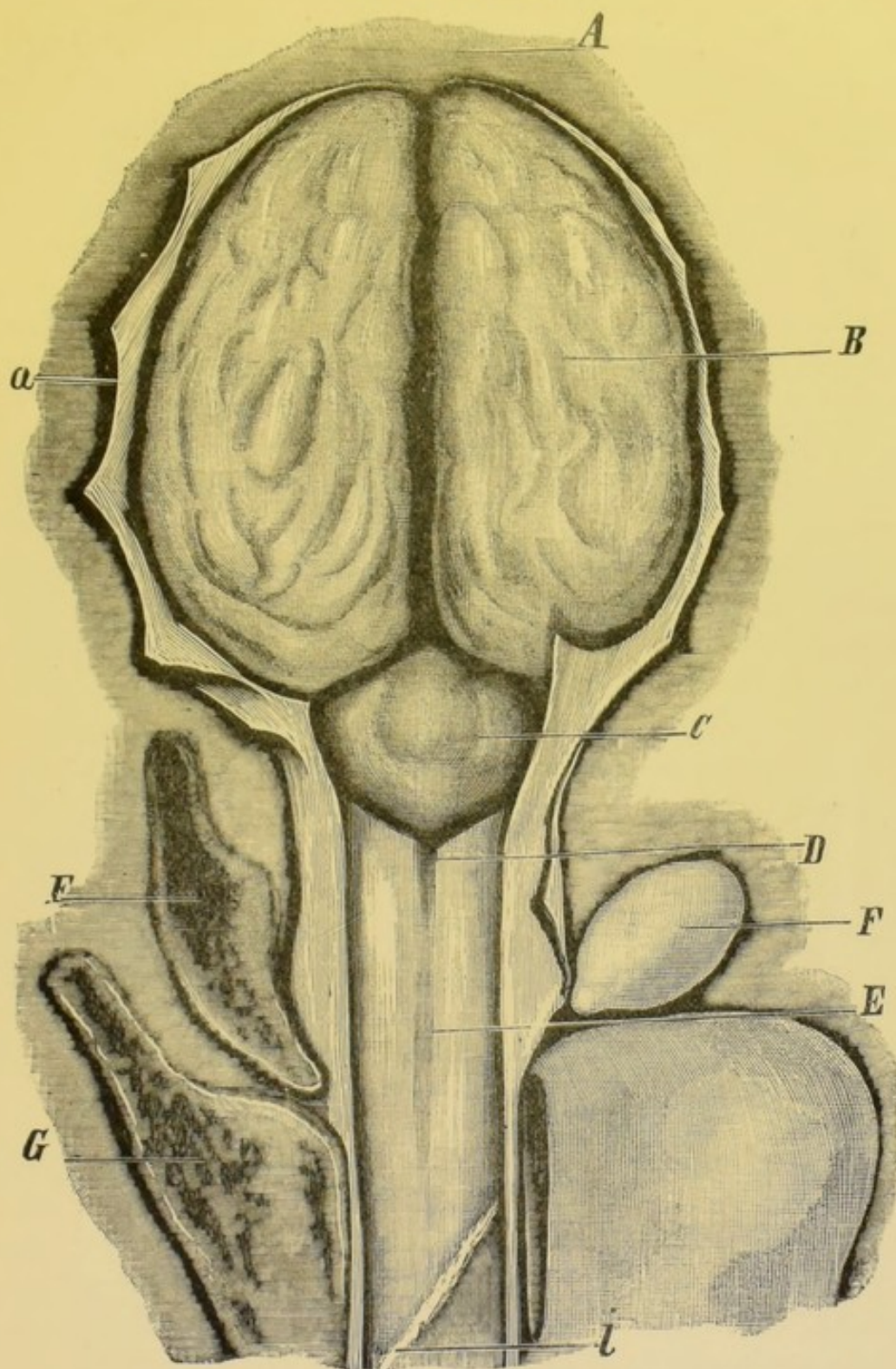


FIG. 2.—*The Brain, Medulla, and Spinal Cord in situ.* (Horizontal section,  $\frac{2}{3}$ ds of natural size.)

- |   |  |   |
|---|--|---|
| A. Skull bones.                           | E. Spinal cord (corresponding to interval between occipital bone and atlas). | G. First vertebra (atlas).                          |
| a. Membranes of the Brain.                | F. Condyloid process of occipital bone.                                      | i. Spot where the cord is injured by the neck stab. |
| B. Cerebrum (cortex).                     |  |   |
| C. Cerebellum.                            |  |   |
| D. Limit between medulla and spinal cord. |  |   |





During life the patient suffered only from paralysis of the right arm and occasional convulsions in the other extremities. At the *post-mortem* examination, however (the patient died from meningitis), it was ascertained that the brain had been pierced.\* Instances resembling this, and cases even of complete recovery, are within the experience of every surgeon and veterinary surgeon.†

After having fully convinced myself of the impossibility of an injury being inflicted on the medulla by the neck-stab, it remained only to watch in this method the symptoms subsequent to the stab. The last visit I paid to the slaughter-house established beyond all doubt that the ox remains fully conscious from the neck-stab until the bleeding. When I moved my fingers at a certain distance from its eyes the animal closed them energetically; the same was the case when I lifted my fist. The respiratory movements of the nostrils continued, although they were very feeble. A few oxen stunned in this way licked off the salt from a piece of bread, and one of them, in the presence of witnesses, even did me the honour of accepting bread and salt from my hands. In short, my observations led me to the conclusion that after having received the stab in the neck the animals remain in full possession of their consciousness and powers of feeling.

From what precedes it is evident that the neck-stab cannot be regarded as a method of slaughter, but only as a means of felling the animal, and a means indeed not at all painless, but, on the contrary, causing the animal much torture. Viewed in the light of these facts, the case quoted in which a "killed" animal took bread and salt from my hands need excite no astonishment. I have clearly set forth the glaring faults of this method in my St. Petersburg papers, and need therefore not enter on a full discussion of them here. The above-described phenomena may be even better observed in the case of the dog, as little success as is obtained in the case of the ox following the attempt to pierce with a stab the medulla of this animal. On cutting away the skin and flesh from the back of the neck of the dog and dividing the spinal marrow between the occiput and the first cervical vertebra—proceeding with the animal, in fact, as the slaughterman proceeds with the ox, we may soon observe that although we have inserted a finger between

\* Franz König, *Surgery*, p. 53.

† Herman Tilmans, *Chirurgie*, p. 545.



the severed portions to assure ourselves of their complete separation, yet the animal has not totally lost consciousness. It sniffs at a piece of meat held close to it, and thrusts out its tongue to lick it. On the meat being held out to it the animal seizes it in its jaws as if to devour it. On a threatening fist being raised above it the animal shuts its eyes with fear, and when another animal, to which it has an antipathy, such as a cat, is brought near it, the dog gives visible signs of displeasure. When called by its name the animal answers by a look of intelligence, which seems to say "I hear." These phenomena cannot be regarded as reflex, they must have their origin in consciousness. The experiments on the dog prove that the emotional faculties of an animal brought down by this method of "neck-stab" do not desert it till long after it has been "killed." After the dog has been submitted to every step of the above operation he will nevertheless refuse to take meat from a man for whom he had a hatred, but is perfectly well able to distinguish his friends, and will accept the meat from them. Experiments with the dog in this condition can be extended over a period of two hours if its respiration be artificially maintained; but even without artificial respiration the animal retains its consciousness for the space of about a minute.\* Another little incident may be recorded here, as it serves to illustrate the superficiality with which the merits of the various methods of slaughter are judged, and how inconsiderately people, actuated by motives of humanity, but lacking any special knowledge of the subject, invent or commend methods which are in reality only calculated to add to the sufferings of the animal slaughtered.

On October 9, 1893, I was in the laboratory of the Veterinary College at Berne engaged in a lively conversation with Professor Alfred Guillebeau of that college, the subject being the various slaughtering methods, when a Frenchman introduced himself to us as having invented a new machine with which the death of an animal could be caused "in a moment," through destruction of the medulla oblongata. This invention, it would seem, had been exhibited in Lausanne and the St. Gallen Canton before the members of the Animal Protection Societies there, these gentle-

\* These experiments were made by the Professor of Physiology, J. B. Pavloff, in the laboratory of the Military Academy of Medicine and Surgery of St. Petersburg, in the presence of myself and many others.



men being charmed with it, as the machine would not only instantaneously deprive an ox of consciousness, but was so effective that the animal would give no further sign of life. I examined the apparatus thoroughly, and soon convinced myself that it was nothing more than a convenient mechanical application of the method I knew so well, the "neck-stab." I nevertheless asked Professor Guillebeau to accompany the inventor and myself to the slaughter-house, for the purpose of testing the apparatus. This he kindly did, and the following was the result of the experiments.

Two oxen were stabbed in the back of the neck by means of this "newly discovered" apparatus. The first, which received in addition several heavy blows on the head as a gratis supplement, naturally lay without life or movement as the result. The second, however, the operation on which had at my request been confined to the action of the apparatus, gave most unequivocal signs of life. On being threatened with the fist he closed his eyes in fear, and within a few moments made distinct attempts to get up, so that it became necessary to quiet him with a few blows of the axe. The examination of this animal's brain made by Professor Guillebeau and myself showed that the medulla had remained quite uninjured, the spinal marrow only being pierced, as my experiments in St. Petersburg had long before proved would be the case.

It unquestionably follows from the above facts that this method of slaughter must be regarded as inflicting the most pain of all; but apart from its humanitarian aspects, it possesses an enormous disadvantage in the matter of the keeping of the meat. In order to understand the reason of signs of decomposition appearing in the flesh of animals slaughtered by this method sooner than in flesh obtained by any other method, it must be remembered that the nerve centres known as the vasomotor centres, which regulate the dilatation and contraction of the bloodvessels, lie chiefly in the medulla and the cervical portion of the spinal cord. These centres keep the bloodvessels in a state of tension, through which the blood is expelled from them after the slaughtering of the animal. The injury to the spinal cord in the "neck-stab" method results in immediate paralysis of these centres and the vasomotor nerves, the blood being in consequence accumulated in the swelling veins.



We know that the more blood meat contains the more rapidly will decomposition set in, it having been proved that the good keeping of meat depends upon the blood it contains. Schmidt-Mühheim, the well-known authority on matters of meat, therefore rightly remarks that "*the flesh of animals properly killed should contain no blood whatever.*"\*

For butchers, and especially those butchers who are able to find a rapid sale for their wares, it is easily seen that this method is the most profitable. Not alone does it allow of an ox being killed with fewer men and less trouble, the stab in the neck rendering the most obstinate animal powerless, but it further much augments the butcher's profits, since he sells many pounds of quite worthless blood at the same price as the meat.

### 7. Killing by Electricity.

Trials were made in England and America of the above means of slaughter, but were soon abandoned, it being impossible to eat the meat produced. The method could besides with difficulty be regarded as a humane one, examined in the light of the repeated attempts made in America to execute criminals by this means.

### 8. Anæsthesia by means of Narcotics.

It only remains for us, in conclusion, to describe the attempts which have in some places been made to deprive the animal of consciousness by chloroforming or more generally narcotising it before the throat cutting, but this process, though intended to spare the animal the pains of death, does not present any advantages. Only recently an experiment of this kind, consisting in injecting morphia under the skin of the animal, was made at Berne, but it appears that the experimenters were not at all acquainted with the disastrous effects produced by the drug on herbivorous animals, though to us it need not cause any astonishment to learn that the first animal on which the experiment was made died almost immediately. The disadvantages of this process are not at all confined to this, however. It is troublesome and expensive, and has, moreover, a deteriorating effect on the quality of the

\* I have entered more fully into this question in the section dealing with my chemical examinations of meat.



meat, which, besides having a wretched taste, is quite unwholesome. I have myself been able to observe that the flesh of a narcotised animal had a poisonous effect on other animals which devoured it. In 1882, when I was in the laboratory of Professor Vulpian in Paris occupied with investigations on the nerve-centres for contractions of the uterus, I dosed some rabbits with chloral. The flesh of these rabbits was given by the attendant to some dogs and cats kept for experiments. The results were not slow in showing themselves, some of the dogs dying, while many of the cats were for a long time stupefied.

Last winter experiments were made in Berne, Switzerland, to ascertain whether it was not possible to prevent the animal feeling any pain by introducing a certain quantity of alcohol into its system. Ten pints were required to stupefy one ox! This is not the place to point out the absurdity of these proceedings, nor the condemnation they deserve from a hygienic and economic, as well as a humanitarian, point of view; the Society for the Protection of Animals there has already rightly put a stop to them. I will only add that for such a performance there is too little time in the slaughter-house, which is also scarcely the place in which it would be safe to keep large quantities of alcohol.

On comparison of all the above described methods of slaughtering and stupefying with slaughter according to the Jewish ritual (*shecheta*), in which an extremely sharp knife is employed by a skilful and practised hand to simultaneously sever both arteries of the neck, producing immediate unconsciousness, and the strict carrying out of which as ordained is guaranteed by the fact that it constitutes one of the most sacred precepts of the Jewish religion, we must come to the conclusion that NOT ONE OF THE METHODS DESCRIBED CAN, FROM THE POINT OF VIEW OF HUMANITY, BE COMPARED WITH THE JEWISH.

Even guillotining, which on a superficial examination would seem to be the best method, must, when all attendant circumstances are more closely considered, yield the superiority to the Jewish method, since—apart from the difficulty of getting the animal's head properly into position and the impossibility of introducing the machine into small places, and passing over the serious economic difficulties\*—in guillotining the vasomotor centres

\* In Russia, taking into consideration only the damage to the animal's hides,



situated in the cervical portion of the spinal column are of course cut, and the consequence is that the vasomotor nerves are paralysed, and the outflow of blood seriously diminished.

In the matter of the invention of new methods there exists, strange to say, a striking similarity between slaughtering and medicine. When in a case of a disease new and different methods of treatment are constantly being proposed, the best proof is afforded that none of them are of any great value. Such was the case with the hundreds of remedies and treatments recommended for the cholera, none of which in practice gave results worthy of mention. On the other hand, mercury, which in ancient times was resorted to as a remedy for syphilis, is prescribed even to-day for this disease, a proof that it is an efficacious remedy, and only requires to be rightly employed. Precisely the same thing is noticeable with regard to the different slaughtering methods. In the course of the last ten years the most diverse slaughtering apparatuses and methods have appeared, each of them heralded with loud trumpetings, only to be found useless in turn when tested at one place, and thrown aside until some other place took them up with just as much noise. This is true of the "neck-stab," as it is of the Bruneau mask, and Sigmund's shooting-mask. The Jewish method, on the other hand, has been practised for thousands of years, and is in use not only among the Jews, but also, as we shall later see, among many other peoples. There is no doubt that were a practical and painless method to be found, every butcher would hasten to avail himself of it. But what are the real facts of the case? Each of these methods has been tried almost everywhere, each in turn thrown aside in favour of another, which latter in its turn has had to yield to a third, and so on. Such was the case, for instance, in Germany, where the "neck-stab," formerly so much in vogue, has long been replaced by the stunning method, the mask, and partly also by the Jewish method. In Russia, on the other hand, the "neck-stab" was until quite recently so much in favour that the Congress of Societies for the Protection of Animals in 1891 demanded its compulsory introduction everywhere; yet the investigations conducted by myself and the other members of the

the yearly loss from this cause alone would amount, as I, with the assistance of experts, have calculated, to from twenty to twenty-five million roubles, while the introduction of the guillotine everywhere would be attended with enormous cost.



"Commission for the Selection of the best Slaughtering Method," have conclusively shown this method to be the most cruel of all.

I have spoken above of two categories of slaughtering methods. But now that we have acquired a more exact knowledge of them, we may confidently assert, that notwithstanding the many *slaughtering methods* which exist, there is but one *way of killing*—that by *bleeding*—the fact being that in all the so-called methods the death of the animal does not result from the thrust, blow, &c., forming the distinctive feature of the method, for respiration and the heart's action continue afterwards, but is in truth caused by the subsequent bleeding. The operations previous to this serve only to get the animal down, and to ensure the safety of the butcher, as he can then proceed with more convenience and less risk to lay hand on his victim. But this end could be attained in a much less cruel manner. However unpleasant the getting down and tying may be for the animal, it nevertheless can by no means be compared, even in the primitive fashion in which it is at present practised in small places, with the fearful torture the animal suffers through the repeated blows on the head, the driving of the Bruneau bolt into the skull, &c. It can be easily proved that the getting down is not attended with such great pain to the animal as the opponents of the Jewish method with their affecting descriptions would have us believe ; for how often do we see that horses as well as oxen which have fallen on a newly paved road, certainly no less hard than a slaughter-house floor, get up and proceed on their way as quietly as before, having sustained no injury whatever. And if the getting down can at all be regarded as cruelty to the animal, then this cruelty is committed by many veterinary surgeons when they have to perform on a large animal an operation which absolutely requires it to be in a recumbent position. Lastly, an apparatus could be found which by fulfilling all requirements for laying an animal down, would do away with all objections on this score.

One of the most active agitators against the Jewish method of slaughter told me that, acting for the Berlin Society for the Protection of Animals, he had already circulated more than four million leaflets against the Jewish method among the public. If the Berlin Society really desires to alleviate the sufferings of animals, it should set aside the money expended on the printing and distribution of these leaflets to be offered as a reward for the



discovery of a suitable apparatus for placing an animal on its side, and I am convinced that the problem of finding one would soon be solved. Nay, the Jewish community in Berlin would, I firmly believe, have offered a large reward itself for this purpose, if the Society had approached it on the subject. These animal protectors should take example by their Russian colleagues, who have proceeded much more rationally in this matter. The Russian Central Animal Protection Society, as we have repeatedly remarked, appointed a commission of physiologists and veterinary surgeons to select the best slaughtering method. Among the members of this Commission, of whom I was one, were several who at first were passionate opponents of the Jewish method, but after exhaustive discussions of theories, during nine full sittings of several hours each, and, above all, after a detailed study of the question in the slaughter-house itself, the Commission drew up a resolution that the Jewish method *in itself* cannot in any way be regarded as violating the laws of humanity. Half the members of the Commission even *gave the Jewish the preference to any other*. On the 21st of March, 1893, on the very same day, by an irony of fate, on which in the preceding year the Administration in Saxony had, at the instance of the Veterinary Commission of that country, "suppressed the Jewish method as barbarous" (the 21st of March, 1892), the above conclusions were summed up in the Report of the Commission, to which the members and the vice-president of the Society who presided attached their signatures. The Russian Society then, after the information supplied by the Commission had proved the Jewish method to be in itself a good one, turned its attention to the matter of finding a suitable laying-down apparatus. But it soon appeared that even these exertions were superfluous, for such an apparatus has long existed for use in surgical operations on cattle, and was described by Hering as early as 1866, in his "Handbook of Operations in Veterinary Surgery," under the title of "Laying-down Apparatus, after Gurlt and Hertwig."\*

The following is a description of how this method is practised :

"At one end of a rope, about fifteen yards long, a noose is made which is slipped over the horns of the animal to be laid down ; the rope is then drawn back over the neck, in the middle of which a

\* See *Handbuch der Thierärztlichen Operationslehre*, by Edward von Hering, Stuttgart, 1866, p. 25.



second noose is formed, with the slip upwards; the rope is then run along the backbone of the animal, and a third noose made in the same manner just behind the fore-legs, round the chest, and a fourth round the belly in front of the hind legs, the end of the rope being held in a line with the spinal column and pulled to the right to make the animal fall to the left, and *vice versa*. This end is pulled by two men, a third standing at the animal's head if it is not bound. The pulling tightens all three nooses, and the animal in a few moments lies down gently and quietly on its side, and stretches out its feet, which can now be fastened in the usual manner. By rubbing the slipping parts of the nooses with soap or tallow, the friction is diminished and the work more easily done."

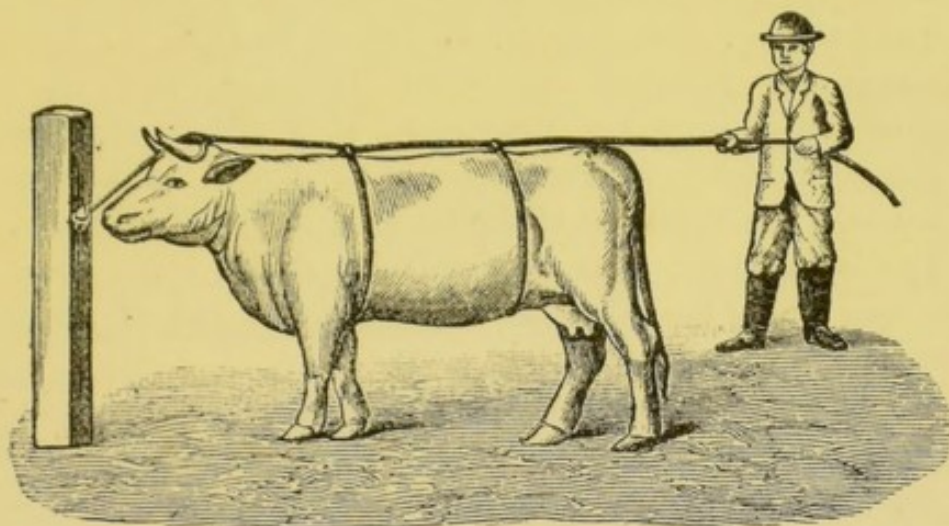


FIG. 3.

In Russia, to avoid further attacks on the Jewish mode of killing, the following modifications were introduced into this laying-down method: (1) instead of the three nooses described, only two, which are quite sufficient, are made, those round the chest and belly, because when a noose is also made round the neck the ox snorts loudly in being laid down, and this snorting, caused by the compression of the windpipe by the rope, makes an unpleasant impression on the onlookers, and might easily serve as the ground for fresh attacks; (2) a somewhat shorter rope is used, and the greasing with soap or tallow is dispensed with as unnecessary.

Very recently a further improvement was, at my suggestion, made in this method in several Russian slaughter-houses, by making a ring in the rope about three-quarters of a yard from



the noose round the horns. Through this ring the free end of the rope is passed to make the noose round the chest, the rope tightening then with much less difficulty.

I think it advisable to reproduce here in full the passage in the Commission's Report,\* dealing with the experiments made with this apparatus:

"LAYING-DOWN METHOD, exhibited in practice before the Members of the Commission, November 30, 1892, in the St. Petersburg slaughter-house.

"Among the experiments in slaughtering carried out by the veterinary surgeon Peterson in the slaughter-house court was the trial on five oxen of a method of laying-down similar to that described by Gurlt and Hertwig. There were present at this experiment Mag. Vet. Sci. N. J. Eckert and M. A. Ignatyeff, vet. surgeons Sawaïtoff, Sergeyeff, Dedyulin, and Sewitzky, slaughter-house inspector Maksimow, P. P. Shuwosky, head of the Russian Societies for Prevention of Cruelty to Animals, and at the last trial the President of the Society, P. W. Shukowsky.

"The laying-down gear consisted of a strong rope, about two yards long and of the thickness of a finger, one end of which was formed into a running noose.

"The animals on which trial was to be made were each in turn tied to a post in the court of the slaughter-house. The noose in the rope was slipped over their horns and the rope itself drawn straight along the back in a line with the spine as far as the fore-legs, immediately behind which another noose was made, slip upwards, encircling the chest of the animal; the rope was then again drawn back to the hind-legs, in front of which a fresh noose round the animal's belly was made. Two men then took hold of the remaining length of rope and pulled, and tightening the nooses in this fashion, they soon brought the animal down.

"Only a few seconds passed in each case before the ox's fore-legs sank under it, and the animal then lay quietly down on its side. This method permits of the animal being brought down on its right or left side, as the butcher may require, and one experiment proved that it may be applied with equal success in the slaughter-house itself or in the court.

"The members of the Commission who were present at these

\* *Bulletin de la Société Russe Protectrice des Animaux*, 1893, No. 7, p. 195.



experiments unanimously acknowledged that this method of laying down was a convenient and practical one, and, above all, that it was well adapted to replace the usual mode of preparing an ox for slaughter by the Jewish method."

The St. Petersburg Society, the leading Russian Society for the Protection of Animals, having now found this method of laying down an animal to be an "easy" and "gentle" one, immediately took the measures necessary to secure its introduction into all slaughter-houses in Russia where the Jewish method is in vogue, and its efforts in this direction have in many cases been successful. Recently the Society addressed itself to the Ministry of the Interior desiring the introduction of this laying-down method to be made compulsory when the Jewish mode of killing is employed. But independently of this the Society did more. In its sitting of May 1893, it resolved to offer a reward of 300 roubles (about £30) for the invention of a still better laying-down apparatus, and nominated an investigation committee of four Members, Mag. Vet. Sci. N. Eckert and Ignatyeff, Vet. Sci. Peterson, and myself.\* Only six months have elapsed since then, and I have already in my possession several dozen models and designs of laying-down apparatuses, which have been sent to me from all parts of Russia, Germany, and England. To console and pacify those sentimental protectors of animals who would fain see the Jewish method suppressed because of the bad method of getting the animal down, I may already say that some of the models under consideration really guarantee treatment of the animal more than humane and more fitly described as tender.

I have unfortunately not the right to give a detailed description of these methods here, as the committee have not yet brought their investigations to an end, and the methods are private property. I will publish the descriptions as soon as the committee have finished their labours.

I have besides seen some very good methods and apparatuses in some of the German slaughter-houses I have visited. The best of these I would point out as one the working of which was exhibited before me by Herr Stern in the slaughter-house at Fulda. This apparatus lays the animal down and at the same instant binds its feet, but it can only be used in slaughter-houses where a windlass

\* See *Bulletin de la Société Russe Protectrice des Animaux*, for May 1893.



is to be found, while the Gurlt and Hertwig method, for which the only requisite is a rope some twelve yards long, can easily be made use of everywhere.

Excellent apparatuses have also recently been found for getting the animal's head into position. Such, for instance, are the head-holders of Jacob, Thieleman, &c.

It is quite clear from what has been said, that the question of laying-down can be solved under very favourable conditions for the animal. And were the method chosen fraught with ever so much trouble to the butcher, it would nevertheless be impossible on this account to justify the tortures inflicted on the animal by striking it five or six blows on the head in one method, and by as bad or worse cruelties in another, all of them serving only to get the animal down. Much less could this be made a reason for banishing the *only rational method of killing* from the slaughter-house.

That the advantages of the Jewish method of slaughter are in no wise impaired by the method of laying-down at present practised is proved, apart from the scientific proof above adduced, by the fact that whole peoples and States adopt the method without being influenced by either religious or extraneous reasons. This is the case in Bulgaria, in most Oriental countries, in the State of New York, &c., it having been adopted in the last-named place at the recommendation of the Animal Protection Society.

During the sitting of March 27, 1893, of the Swiss National Council, a report was read from the Swiss consul in America to his Government, in which occurred the passage :

*"During the last few years, slaughtering as ordained by the Mosaic Law, i.e., 'shecheta,' has found its way into the Christian slaughter-houses here, it being the most rapid mode of killing and in full harmony with the spirit of the Animal Protection Societies' Regulations, which aim at the prevention of all cruelty to animals."\**

The report of the Swiss consul in St. Petersburg, Herr Dupont, also came up for reading during the same sitting, in which he informed his Government of the resolution of the Committee for the Selection of the Best Slaughtering Method, which had been com-

\* See *Amtliches Stenographisches Bulletin der Schweizerischen Bundesversammlung*. Sitting of the 28th March, 1893, p. 448.



municated to him by Kammerherr Shukoffski, President of the Russian Central Society for the Protection of Animals :

*"Almost all the members have recognised,"* said the report, *"that 'shecheta' is a method of slaughter which causes the animal very little suffering."*\*

An. Timoftiowiz, Director of the Veterinary Department of the Bulgarian Board of Public Health, and Member of the Supreme Medical Council, in a communication dated November 16th, 1893 writes as follows :

*"In Bulgaria, butchers of the most diverse religious persuasions kill everywhere by the throat-cutting method. This mode of killing is also to my personal knowledge in vogue in the neighbouring countries. In my opinion it will long remain in favour in Bulgaria, and will perhaps become permanent there if no more commendable method be found than the felling method, the mask, &c."*

Professor D. Illoway, Cincinnati, America, communicates the interesting fact that in several States of the American Union, as, for instance, in Nebraska and Idaho, petitions for the compulsory introduction of the Jewish method have been addressed to the authorities by various societies for the protection of animals.

Nay, in Germany itself, in spite of the vigorous war waged against it by the Animal Protection Societies, the method finds favour in the eyes of many Christian butchers, who use it to their own advantage.

When making investigations in the Berlin Central Cattle Market, I noted that in some slaughtering places the ordinary method of killing by means of stunning was set aside in favour of that by means of a direct cut through the arteries of the neck with a long and broad knife. This operation was performed by a Christian, and I therefore could not suppose that the meat was intended for Jewish consumption. In order, then, to ascertain the reason of these butchers choosing, unlike their fellow tradesmen, to slaughter by this method and whether the advantages they viewed it as possessing were humanitarian or economic, I wrote to them, requesting them to communicate their reasons, and received the following replies :

\* See *Amtliches Stenographisches Bulletin der Schweizerischen Bundesversammlung*. Sitting of the 28th March, 1893, p. 448.



“BERLIN, E., Sept. 28, 1893.

“To Dr. D. DEMBO,

“DEAR SIR,—In reply to your esteemed letter of the 22nd inst., I beg to make the following replies to your questions :

“1. Why I employ the Jewish slaughtering method? Firstly, because it combines the most humane treatment of the animal with the greatest safety in killing it. The ‘shecheta’ cut is indisputably the most rapid and safe mode of slaughtering. The fact that the cut is made with a sharp and good knife which occasions no swelling of the arteries and allows a great outflow of blood to take place in *a few seconds*, shows this to be the *most rapid* and at the same time *least painful* mode of slaughtering, for the sharper the instrument the less painful the cut. Stunning is attended with *much more danger* and too often with *much more pain to the animal*. It often, when the hand which carries it out is not a thoroughly practised one, results in *torture* to the animal. The slightest movement of the head by the animal at the moment of striking will cause the blow to fall wrong, the most skilful slaughterman being unable to prevent this, and no matter whether the ill-falling blow cause the animal pain or whether it be only frightened and excited to movement by it, the result in any case is that the killing is protracted and made more difficult.

“Viewed from the standpoint of economy, the stunning method is unquestionably more advantageous to me as a wholesale butcher, for every stunned animal yields a greater weight of meat ; this is because the blood remains stagnant in the veins as the result of the blows, and when the arteries are afterwards cut the blood flows out very slowly, the total loss of blood being always less than in the case of throat-cutting direct and the weight of meat consequently greater. But the consideration of the few pounds of meat less in the Jewish method is many times outweighed by its

“*Hygienic Advantages.*

“Every animal stunned and then cut must afterwards be washed, especially in the cavity of the chest, with pure water. But it is well-known that water has the worst possible effect on meat, especially during the hot summer months, when a great deal of meat spoils through this washing. The part of the meat with which the



water has come in contact will soon develop qualities distinguishing it from the rest, for it is a nutrient soil for fungi, and its spoiling is in consequence much hastened. The meat of animals killed in any way with blows is also much darker and always softer than that of cut animals, the flesh of which is in every case light in colour, free from blood, and firm. Every animal killed by the cutting method is clean in the cavity of the chest and there is no need to touch the flesh there or elsewhere with water. The flesh of cut animals is quite as firm in *two hours* as that of stunned or felled animals in *ten*, and the latter indeed *never* attains the firmness of the former.

"I am myself not a Jew, but, as is well-known in Berlin, I have for the last fifteen years had just the same instrument used for killing as the Jewish 'shochet' or slayer. I buy and kill exclusively good cattle. I have during these years weighed many animals when alive and their meat when dead, to ascertain the proportion of meat yielded by the different methods, and I have repeatedly proved to the cleverest and most experienced men in the trade, that the flesh of cut animals keeps much longer than that of stunned. My title to credit is furnished by the fact that as a wholesale butcher, I have for the last fifteen years brought meat to the market exclusively for old and regular customers, thorough experts in their business; I have also for the last nine years supplied meat to the Berlin Municipality. Such a result could only be attained by my supplying a steadily good quality of meat, that has further received careful handling. That confidence is placed in my ability to judge of cattle is proved by the fact that I have for many years past acted as judge in the Berlin Prize Cattle Show. I do not speak for my method in the interests of any party. I am ready at any time to furnish scientific authorities with proof of what I have said.—I remain, faithfully yours,

"CARL FRIEDRICH HOFFMANN,

"*Wholesale Butcher.*

"Member of the Berlin Society for the Protection of Animals, Member of the Sanitary Board for the 66th Police District, Berlin, Sworn Expert to the Berlin Butchers' Guild."



"BERLIN, *Sept.* 27, 1893.

"To Dr. J. DEMBO,

"DEAR SIR,—In answer to your letter of the 22nd inst., I beg to furnish you below with the reasons which induce me to have oxen, those for non-Jewish consumption also, slaughtered by the Jewish method of severing the arteries of the neck :

"1. An ox slaughtered by this method loses more blood, and the meat has a better appearance.

"2. The meat keeps in summer at least a day longer than that of oxen killed by stunning, &c., and afterwards bled.

"I have employed this method for about fifteen years, having found as a butcher that cutting the throat of cattle deprives them of life as quickly as does felling them or killing them by a thrust or stab.—Yours faithfully,

"HERMANN KERSTEN,

"*Wholesale Butcher, Berlin, Phärs., 58.*"

We may also notice among testimonials given as far back as 1884, the following : \*

"COLOGNE, *Nov.* 3, 1884.

"The undersigned butchers of Cologne, of the Christian faith, hereby declare, as the result of many years' experience and observation, that the flesh of animals slaughtered according to Jewish ritual keeps from one to two days longer in the summer than that of animals killed by any other method, in consequence of the more thorough draining-off of the blood.

"TH. SCHULTE.	CONRAD MONHEIM.
HEINRICH INVEEN.	HUBERT SCHAAF.
JEAN WEBER.	PHILIPP KIRCH.
THEODOR HERGARTEN.	JOSEPH SCHAFFROTH."

The master-butchers of Carlsruhe expressed themselves in the following terms :

"The undersigned Christian butchers of Carlsruhe hereby declare that they give the old methods of slaughter the preference to the new (shooting mask, &c.).

\* See *Testimonials to the Advantages of the Jewish Method of Slaughter.*



"Although the Society for the Protection of Animals have set a premium on the use of the shooting mask, yet it is employed in but a few rare instances, the method having proved to be one *not practical, and which further is fraught with great suffering to the animal.*

"*The good appearance and superior keeping qualities of the meat produced by 'shecheta' commend this method, which owes its advantages to its completely emptying of blood the body of the animal.*

" PHILIPP STETTER.	ANDREAS DRATZ.	HUGO MELDER.
AUGUST DENNIG.	HUGO BÖSCH.	GUSTAV. DIETRICH.
WILH. ERXLEBEN.	KARL DITTUS.	LOUIS SCHNEIDER.
WILH. HOFMANN.	FRIED. JOS. BOTT.	HERMANN HECHT.
JUL. MORLOCK.	AUGUST SCHERER.	FRIEDRICH GEYER."
	MICHAEL KERN.	

When I visited the abattoir in Cologne on the 22nd of May of this year, I was able to convince myself that the Jewish method is exclusively employed by many Christian butchers, who indeed proceed entirely in the Jewish fashion. The same is the case in many slaughter-houses in the Rhenish provinces. We may mention also that many preserved meat manufacturers (as those in Mayence, &c.), use the Jewish method in order to obtain meat with better keeping qualities.

After the exhaustive discussion to which the humane side of the question has been submitted in the preceding section, we may thus conclude: the killing of a living creature is *per se* to some extent an immorality, to be excused only in view of the requirements of our stomach, and in an immoral action the ideal is not to be sought. We may, however, say that everywhere, in village and town, alike for large cattle and small, the Jewish method can with equal facility be employed, without the necessity for any costly contrivances, for every one can easily procure a sharp knife and will know how to use it, while with stunning the most skilful hand is not, and indeed cannot, be sure of not going wrong. We must then acknowledge that the Jewish method is the best. NAY, WITH REGARD TO ITS HUMANITY, IF THE WORD "IDEAL" COULD BE APPLIED TO THE KILLING OF AN ANIMAL, WE WOULD NOT FOR AN INSTANT HESITATE TO DESIGNATE THE JEWISH METHOD AN IDEAL SLAUGHTERING METHOD.



*Table of the Slaughtering Methods employed in the Chief  
Slaughter-houses of Europe.\**

Country.	Place.	Slaughtering Methods.		Remarks.
		Oxen.	Calves and Sheep.	
FRANCE.	Paris.	Stunning with fracture of skull by pole-axe.	Direct bleeding without stunning (transfixion or Jewish method).	a. In one slaughtering compartment only (belonging to Bruneau) (No. 47) is the mask of Bruneau employed. b. Calves and sheep are placed by tens on a board and slaughtered one after the other.
ENGLAND.	London.	Pole-axe.	Transfixion or Jewish method.	
GERMANY.	Berlin.	Stunning with the mallet without fracturing the skull. In some slaughter compartments the Jewish method.	Ditto.	Those slaughterers who collect the blood for the manufacture of albumen use the transfixion, the others the Jewish method.
	Leipzig.	The mask of Bruneau.	Stunning with the mallet.	
	Frankfort-on-the Maine.	Stunning with the mallet.	Calves by stunning, sheep by the Jewish method.	
	Mayence.	Neck-stab.	Jewish method.	In the slaughter-house of the Meat Preserve Factory, the Jewish method is in use.
	Cologne.	Jewish method.	Jewish method.	

\* a. I have noticed here only the chief slaughter-houses of Europe, which I have visited personally, but there are many smaller places, as, *e.g.*, in the Rhine Provinces, where the Jewish method is in employ for large cattle.

b. In many States of America the Jewish method is exclusively employed for large cattle.

c. In many places, *e.g.*, in Naples, the small cattle are hung up on hooks by their hind legs and slaughtered in that position, so that the blood may be more easily caught up.

*Table of the Slaughtering Methods employed in the Chief  
Slaughter-houses of Europe—(continued).*

Country.	Place.	Slaughtering Methods.		Remarks.
		Oxen.	Calves and Sheep.	
RUSSIA.	<i>St. Petersburg, Moscow, and other large abattoirs in Russia.</i>	Neck-stab.	Jewish method.	Before the investigations of the Commission the neck-stab was regarded as the ideal method of slaughter.
	<i>Warsaw. Odessa.</i>	Jewish method.	Jewish method.	
SWITZERLAND.	<i>Bern.</i>	Stunning with mallet, also mask of Bruneau.	Stunning with mallet.	The shooting mask of Sigmund was used, but abandoned as ineffective.
	<i>Geneva.</i>	Bruneau's mask.	Partly non-stunning methods.	
	<i>Bâle.</i>	Shooting mask, partly stunning methods.		
	<i>Zurich. Lucerne.</i>	Stunning with Mallet.	with mallet. Mallet and transfixion.	
ITALY.	<i>Rome.</i>	Stunning with mallet.	Jewish method.	In the army slaughter-house the neck-stab is employed. I have never seen the neck-stab employed in so cruel a fashion as at Naples.
	<i>Naples.</i>	Neck-stab.	Jewish method.	
	<i>Venice.</i>	Neck-stab and mallet.	Jewish method.	



## B.—SLAUGHTERING FROM THE POINT OF VIEW OF HYGIENE.

OF all the tissues of the body, the blood is known to be the "youngest" and the least stable one, that is, a tissue which decomposes very early. But as long as it is contained within the walls of the tubes of the blood system—*i.e.*, as long as it flows within the bloodvessels—the blood remains unaltered. It is not the place here for a theoretical examination and explanation of this phenomenon, whether it be due to the influence the living elements of the walls exercise on the composition of the blood or to any other cause. At any rate, it is a well-known fact, that if the blood leaves the vessels, or if the body in which it is contained dies, the blood soon congeals and begins to decompose. Now it is obvious that the more blood there is left in the meat, the sooner the meat will become spoiled—this connection between the quantity of the blood and the preservation of the meat being an incontestable scientific axiom. It is for this reason that those who have special knowledge in the matter of meat prefer, as far as hygiene and good quality are concerned, the method of slaughter *which leaves the least quantity of blood in the meat to any other.*

It could be assumed *a priori*, without any practical examination and for theoretical reasons only, that the Jewish method is the one which leaves least blood in the body, since during the whole time of bleeding the nerve-centres regulating the flow of the blood in the vessels are not interfered with. Whereas in the case of stunning, and particularly in the case of the neck-stab with injury to the spinal cord, as in all other methods depending for their effect upon an injury to the brain, the case is different altogether, since, as Koch, Filehne, Wittkowsky and others have proved scientifically, destruction of the brain causes paralysis of the vasomotor centres, and this paralysis in its turn would entail a stoppage of the blood



within the bloodvessels. But in view of the importance of this point I could not and would not rest satisfied with conclusions, based in this manner, on theoretical argument only, but deemed it necessary to gain a more solid base for my contentions by experiments on animals.

I intend publishing a detailed paper on the results of these experiments with the necessary chemical formulæ in a periodical devoted to these branches of science, whilst in this publication, which is intended not for specialists only, but also for laymen interested in this question, I shall endeavour to avoid all chemical formulæ and all detailed discussion of matters that would be intelligible only to those conversant with physiological chemistry.

There is, in truth, no task more difficult than that of explaining chemical processes to readers not acquainted with the science, and therefore it is necessary for me, in order to render the following pages more intelligible, to make here a few introductory remarks on the physical and chemical properties of the muscle of an animal during life as well as after death.

### THE PHYSICAL AND CHEMICAL PROPERTIES OF MUSCLE.

The flesh of animals that we use as food consists chiefly of muscle. Every muscle is built up of bundles, which in turn are composed of larger or shorter muscular fibres arranged parallel to each other. A primitive muscular fibre, as seen microscopically, consists of a sheath, called the sarcolemma, in which is enclosed a contractile substance—the muscle-plasma. This latter substance is chiefly composed of an albuminous body, myosin, which is also the most important nutritive element contained in meat. Myosin is soluble in strong solutions of common salt (10 per cent. or more), in free alkalies or strong acids (lactic, hydrochloric acid), and also in a 13 per cent. solution of ammonia.

The muscles of animals that have just been slaughtered exhibit very lively contractions, which can be seen by the unaided eye. The colour of muscle is mostly dark red, but that of some animals, such as the rabbit and the pig, is of a paler hue. At death, in man and animal alike, certain processes take place in the body; the muscles become hard and of a duller colour, and the joints stiff. This condition of the dead body is called the *rigor mortis* or death



rigidity. The stiffness of the muscles (*rigor*) is the result of the coagulation of the contractile albuminous body in the muscles, myosin. If one of these rigid muscles be cut, a fluid, called muscle-serum, oozes out, which is that part of muscle substance or muscle-plasma that has remained liquid after the coagulation. Whilst the muscles in the living body have either a neutral or an alkaline reaction, a certain time after death—*i.e.*, at the commencement of the *rigor mortis* their reaction becomes acid.\*

The reaction of the muscles, as we shall later see, depends upon the method of slaughter and the more or less rapid outflow of the blood and, being either acid or neutral, greatly influences the commencement of the *rigor mortis*; meat which is already in a state of decomposition is, on the other hand, alkaline in its reaction.

The muscles remain in a state of rigor a certain time, which varies from one to several days, the period depending on the surrounding temperature, the degree of moisture, the access of air and other conditions. At freezing-point, for instance, and with complete exclusion of air, meat may resist putrefaction and even be preserved in a good condition for thousands of years. An instance of this may be seen in the case of the prehistoric mammoth, the body of which, with the flesh untouched, was found in the ice of the Lena River in Siberia. The method of slaughter, besides, has not only an unquestionable influence upon the commencement of the rigor, but also on its duration. As soon as decomposition sets in the rigor disappears and the joints become movable again. The phenomenon of the *rigor mortis* mainly depends upon the ap-

\* Every liquid and every chemical body may have an acid reaction or an alkaline, or a reaction that is neither acid nor alkaline—*i.e.*, neutral. For distinguishing the reaction strips of different test-papers are used, as litmus-paper, litmoid, &c. Each of these papers show different changes under the action of alkalies and acids. Most in use are the red and the blue litmus-papers. If a strip of red litmus-paper is immersed in some acid liquid, the colour does not change at all, but when dipped into an alkaline solution it immediately turns blue. On the contrary, blue litmus-paper is not changed by alkaline fluids, but turns red if dipped into an acid liquor. In a liquid of neutral reaction neither the red test-paper nor the blue one will change their colour. Thus, in these two sorts of litmus test-papers we have an excellent means of ascertaining the true reaction of a liquid or any other chemical body, provided they are well prepared and do not lead to mistakes and faulty results. But we shall see later on that in testing the reaction of meat with litmus-paper certain precautionary measures must be taken lest we be led into grave errors.



pearance in the muscles of lactic acid, which causes the albuminous body myosin to coagulate. Lactic acid is, therefore, also a factor of importance in the fitness of the meat for table; for only after the appearance of lactic acid [and the setting in of the rigor does the meat become edible, tender and more easily digestible. Further, when the muscle is rigid and acid in reaction, it will be sufficient to boil it at a moderate temperature, from 140° to 158° Fah. to convert the connective tissue into jelly. On the contrary, meat taken immediately after slaughtering and before the beginning of the rigor is tasteless, and so tough that it can hardly be masticated.\*

Thus, the sooner death-rigidity sets in, the greater will be the space of time during which the meat will be free from taint and fit for use. This fact, a very noteworthy one, and for reasons we shall explain later on, is fraught with most important consequences for provincial butchers. Thus, all these circumstances that favour an earlier commencement and a longer duration of the rigidity of the meat are of essential importance for the public health.

The rigor of the muscle can be produced and influenced—

- (a.) By heat ("heat-rigor").
- (b.) By soaking the meat in distilled water ("water-rigor").
- (c.) By the appearance of acidity in the muscle, either caused by some acid that is being formed there or by the combination of salts with acids: lactates, phosphates, &c.

The process of inducing rigor in the meat by warming it or dipping it into distilled water, cannot be otherwise than ruinous for the quality of the meat, as these agents, heat or water, are both of them very deleterious, for they promote a very early decomposition. On the other hand, the formation of lactic acid is not only not injurious to the meat but even protects it from putrefaction quite apart from its above-mentioned property of rendering it more tender and tasty.

After having remained in the rigid state for a certain time the muscle (or the dead body) enters into another condition, called "the solution of the rigor." Meanwhile putrefaction makes its first appearance, and the muscle, though still acid in reaction, becomes soft again.

\* *Vide Handbuch des Fleischbeschau für Thierärzte und Richter*, von Prof. R. Ostertag, Stuttgart, 1892.



The point of time at which death-rigidity begins to disappear varies greatly in different animals,\* and is dependent upon many conditions, as temperature, moisture, ventilation, &c., and also upon the method of slaughter, as we shall later prove.

From what I have said it is clear that from the point of view of hygiene and economy the preference ought to be given to that method of slaughter in which rigidity sets in earliest and passes off and gives way to putrefaction last.†

This consideration prompted me to experiment with a view to ascertaining the exact time of the beginning of death-rigidity in animals slaughtered by direct bleeding—*i.e.*, according to the rules of *shecheta*—to determine the same moment in cases where stunning preceded the bleeding, and to compare the results obtained in both instances; further, to state exactly the time when the rigidity passes off and is followed by putrefaction in the various methods of killing. A scientific investigation into these questions seemed to me to be an urgent necessity seeing that the opinions of laymen widely differ on this point. Whilst many wholesale butchers and even butcher-guilds declare that the meat of animals slaughtered without previous stunning keeps under equal conditions much longer—as much as two days even in summer—others, and amongst them the members of Societies for the Prevention of Cruelty to Animals, contend that in the Jewish method the meat decomposes sooner. Such a discrepancy of statements finds its only explanation in the fact that no scientific experiments had until then been undertaken for comparison and elucidation of these points.

With regard to the first question, the onset of death-rigidity in the various methods of slaughter, no difficulty of any kind was encountered in its solution, as a galvanic apparatus for induced currents was the only thing required for the examination. It is a known fact that during life and for some time after death a muscle contracts if stimulated by an electric current,‡ and in a physiological sense the muscles may be regarded as dead only after they

\* In man the rigor lasts one to six days.

† I have found in the course of my experiments that the solution of rigidity and the beginning of putrefaction are not always identical.

‡ The same effect can be produced also by other stimuli, as friction with the finger and even by a current of cold air. That is the reason why sometimes, when the parts of the divided carcass are hung up, there are yet to be seen contractions of entire groups of muscles, strongly resembling spontaneous movements.



have ceased to answer with contractions to a galvanic stimulus—*i.e.*, after the function of the nerves has ceased. The moment in which this happens is also the exact time of onset of the death-rigidity.

Technical difficulties, but mainly the consideration that the electric current has a deleterious effect upon the taste of meat and even its fitness for food, caused me to refrain from experimenting on slaughtered oxen and to make use of other material. I considered myself justified in doing so, because it really matters nothing whether the experiments are carried out on the dead bodies of oxen or on those of dogs or rabbits, since no one denies that the muscles of man, cattle, dogs or rabbits undergo precisely the same changes on the passage through them of electric currents.

I may be permitted to again repeat here that I abstain from quoting many more experiments of the same nature that I have carried out unaided. I shall only record here those investigations undertaken and carried out in the presence of other specialists. The experiments were carried out in the laboratory of the Veterinary High School of Berlin. On December 15th, 1893, three rabbits were taken, and one of them slaughtered by dividing the arteries of the neck with a knife that is used by the *shochet* or slayer for killing large fowl; the second rabbit was stunned and then slaughtered in the usual way, the third also stunned and then bled by dividing the arteries of the neck. After this all three rabbits were placed on a table, the same group of muscles in each of them laid open, and with the electrodes of the induced current tested for contractility. The results of this experiment are stated in the following table:



TABLE II.—*The Onset of Rigor Mortis.*

Number.	Weight, Colour, and Sex of Animal.	Time of Killing.	Method of Killing.	Time at which Electric Current was Applied.	Result of Stimulation.	Onset of Rigor.	Time between Killing and Onset of Rigor.
1st. Rabbit.	2000 grm. grey buck.	12.05 p.m.*	Division of blood-vessels of neck (Jewish method).	1.05 p.m.	Contraction only with 0.†	1.15 p.m.	1 hour 10 min.
				1.15 p.m.	No contraction.		
2nd. Rabbit.	1850 grm. grey buck.	12.40 p.m.	Slaughtered with previous stunning (method used in Berlin).	1.20 p.m.	Contraction with 6.	3.15 p.m.	2 hours 35 min.
				2.50 p.m.	Contraction with 3.		
				3.00 p.m.	Contraction with 0.		
				3.15 p.m.	No contraction.		
				1.25 p.m.	Contraction with 6.		
3rd.	1950 grm. grey doe.	12.20 p.m.	Combined method (stunning and then Jewish cut).	1.32 p.m.	Contraction with 7.	2.15 p.m.	1 hour 55 min.
				1.55 p.m.	Contraction with 4.		
				2.05 p.m.	Contraction with 0.		
				2.15 p.m.	No contraction.		

\* Twenty-six seconds after the cut the physiologists who witnessed the experiment were able to state that the animal had lost all its eye-reflexes, the visual reflexes as well as the tactile.

† The strength of the current is indicated on the apparatus by numbers, the current being strongest at 0, less so at 1, and decreasing as the numbers go on.

*Note.*—As all of us were busy witnessing the slaughtering and the weighing of the rabbits one after another, before and after the bleeding (for the purpose of ascertaining the true amount of bleeding in the different methods), we could not commence the galvanic examination of the muscles before 1.05 p.m.

The widely-spread notion that the rigor begins at the head of the animal has



It is rather difficult to state with certainty whether the epileptiform convulsions or the variable quantity of blood remaining in the muscles, or both these factors united, are responsible for the earlier or later appearance of the *rigor mortis*. I myself think that among many other reasons it is the epileptiform convulsions, often observed with the Jewish method of slaughter, that help to accelerate the onset of rigidity. For a similar reason game that had been hunted to death gets rigid in a few minutes. Even in fish the rigor sets in earlier and is the more severe the stronger and more active the muscles have been before death.\* But I shall have to return to a more full consideration of the reasons why the rigor begins earlier in one method than in another further on in this publication.

The preceding table also shows how great is the difference in the time of onset of the rigor—*i.e.*, the time when the muscle dies, even in the case of such small animals as rabbits, whose weight of about 2000 grm. amounts approximately only to  $\frac{1}{300}$ th part of that of an ox, and the total amount of blood in whose body amounts to only  $\frac{1}{18}$ th part of the body-weight, whilst in oxen it amounts to  $\frac{1}{3}$ th. Thus, these experiments have served to fully confirm the experience of practical butchers, *that the meat (muscles) of animals, and even small animals, which are slaughtered without previous stunning, becomes rigid sooner than that of stunned animals.*

Mr. Hoffmann, a wholesale butcher in Berlin, who probably has never studied the physiology of muscle, but who is able to form a clear estimate of things, justly remarks in a letter addressed to the author: "The meat of cut cattle—*i.e.*, cut according to the rules of *shecheta*—is just as firm in *two* hours as the meat of those slaughtered with a previous blow on the head becomes in *ten* hours. The latter, as a matter of fact, never attains the firmness and compactness of the *shecheta* meat."

Coming now to the examination of the time at which the rigor ceases, no apparatus whatever is needed for this purpose; the renewed flexibility of the joints affords every one a means of ascertaining it. The time of the relaxation depends upon the temperature of not been confirmed in my researches. On the contrary, I have obtained contractions of the jaw muscles (the masseters) at a time when all other muscles, besides the intercostals, had lost all power of reaction. In three cases the latter muscles retained longest their contractility.

\* Eward, cited by Ostertag, *loc. cit.*, p. 105.



the surrounding medium: the higher the temperature, the earlier the rigidity of the meat ceases. But under equal conditions I have always found that in the Jewish method the rigor passes off last.

This fact has also frequently been acknowledged by meat tradesmen who, knowing nothing about the scientific aspect of the phenomena, express the thing simply enough by saying "the piece gets soft quickly." And the controlling experiment on the three rabbits has given the same result.

To return to the experiment itself: the three rabbits, after the rigor had set in, were taken, unskinned as they were, to an underground room of the Chemical Department in the Institute of Professor Du Bois-Reymond, where they were placed on a table and kept at a temperature of 3° to 7° C. (37° to 44° Fahr.)

TABLE III.—*The Relaxation of the Rigor Mortis.*

Length of Time after Killing.	Parts of Carcase relaxed.		
	No. 1. Jewish Method.	No. 2. Slaughtering (Berlin fashion) with previous Stunning.	No. 3. Combined Method (Stunning and Jewish cut).
3 days.	No relaxation.	Relaxation in the fore-legs and head.	Fore-legs.
4 days.	Begins at joints of fore-legs.	Same.	Fore-legs and head.
8 days.	Fore-legs.	Same.	Same.
9 days.	Same.	Same.	Same.
11 days.	Head begins to relax.	Head, both fore-legs, and left hind-leg.	Head, both fore-legs, and right hind-leg.
13 days.	Head relaxed; begins in hind-legs.	All parts relaxed.	
16 days.	Head, both fore-legs and right hind-leg.		
17 days.	Same.		
18 days.	All parts relaxed.		

NOTE.—All three rabbits were lying the whole time on a table near the window,



The results of the experiments thus clearly disprove the contention made against *shecheta*, that with it the *rigor mortis* disappears earlier. Evidently quite the contrary is the case.

As to the reasons of the relaxation of the rigidity in meat it is difficult to say whether the re-resolution of the myosin alone, or any other causes besides, are answerable for that process. According to Kuchen, the clot of muscle-plasma is readily soluble in solutions of potassium nitrate of all strengths; this would possibly account for the earlier remission of the rigor in the meat of stunned animals, as the accumulation of alkaline salts (ammonia) is greater in that sort of meat.

If it were possible to regard the remission of the *rigor* and the putrefaction as one and the same process, as indeed is done by many scientists,\* the above given results of our observations would be in themselves a sufficient proof that the meat of animals killed in the Jewish fashion withstands putrefaction longer than that of stunned animals. But I would not rest satisfied with a solution of the question based only on such evidence as in my opinion the remission of *rigor* and the putrefaction are two distinct chemical processes, which under certain conditions, it is true, may coincide in time, but are quite able to appear independently. From the above table we have seen that in all three animals decomposition had been equally established in certain parts for a long time, but that the disappearance of the rigor did not reach its end in all three alike. Therefore I could not regard this way as a safe one for establishing the period of time during which the flesh of animals, slaughtered by the different methods, remains untainted,

with the skin entire, except at the spot where the cut for bleeding had been made and at the fore-legs, where, immediately after the slaughter, the galvanic test was applied. On the eleventh day, at the above-mentioned spots, which were free of skin, the meat was found to be alkaline, and in a state of decomposition in rabbits 1 and 2. On the thirteenth day the parts freed from skin had in all three rabbits a strong smell and an alkaline reaction. But on spots, which were not skinned (*e.g.*, on the back), the muscles, particularly in rabbit No. 1, were found to look fresh and showed an acid reaction (in Nos. 1 and 3). Thus it seems that the meat of animals, in whatever way they have been slaughtered, resists decomposition much longer if they remain in their skin, than if they are skinned and exposed to the influence of the air, notwithstanding that in the first case the entrails, which are so liable to putrefaction, remain within the body.

\* The expression "remission of rigor and putrefaction" is very frequently used as conveying *one* idea in numerous text-books of physiology and meat inspection.



but decided to have recourse to the more reliable if more circumstantial method of finding by chemical analysis when decomposition first sets in.

The chief products of putrefaction generally are ammonia\* and carbonic acid, to which, under conditions favourable for the development of bacteria, sulphuretted hydrogen, indol, and other bodies must be added. Now I argued that if I could find out and compare the development and accumulation of one of the above-named bodies in samples of meat of different sources, it would be the best way of determining the first appearance and the degree of putrefaction in the respective sorts of meat. But as experiments of such a kind in relation to our question had never been undertaken, I first of all wished to find out by experiment whether the quantity of ammonia could be regarded as a true indication of the degree of decomposition of meat. These preliminary experiments were carried out in the chemical department of the physiological institute of Prof. Du Bois-Reymond. As material for these preliminary investigations I used fresh-looking meat of uncertain killing, bought at a butcher's, and determined daily the quantities of ammonia therein. At the very outset of my investigations I found that only small portions of meat could be used for analysis, as in larger pieces (50 to 100 grams) the accumulation of ammonia even at the commencement of putrefaction is so enormous that it is difficult to carry out the work properly. I took, therefore, for my experiments but small pieces of meat, weighing no more than 5 grams, minced them well, put them into flasks which each contained 50 cubic centimetres of distilled water, and placed the flasks in an incubator, whence they were taken and analysed every day.

In order not to fatigue the reader, who, though without knowledge of chemistry, would like to satisfy his interest in the matter, I shall give here a short explanation of the method employed in this investigation.

For the quantitative estimation of ammonia contained in the meat I made use of the well-known chemical method of titration, which consists in replacing the ammonia contained in the salts of ammonia by the base (sodium) contained in caustic soda. The

\* Ammonia is a gaseous body arising wherever organic matter is in a state of decomposition. The odour is that of sal-ammoniac.



metal sodium, which is contained in caustic soda, has a greater affinity to the acids which are contained in the ammonia-compounds than ammonia itself; therefore a double decomposition—*i.e.*, a decomposition of both bodies—takes place, and the sodium derived from the one compound combines with the acid derived from the other compound to form a new body, whilst the ammonia is set free. If, for instance, sal-ammoniac (ammonium chlorate) is acted upon by caustic soda (sodium hydroxide), the result will be common salt (sodium chlorate), free ammonia, and water, because sodium and chloric acid have a great affinity for each other—*i.e.*, tend to combine. That is the case not with chloric acid alone, but with any acid that forms a compound with ammonia. Thus, when the meat contains any compound of ammonia (ammonium salts), and we pour on it some solution of caustic soda, we shall cause certain chemical reactions, as a result of which the gaseous body ammonia will be formed. The proceeding in this experiment is the following: The minced meat, with water and a 10 per cent. solution of caustic soda in excess, is put into a flask, which by means of two glass tubes is connected on the one side with a retort in which water is boiling, and on the other side with a cooling apparatus. The steam from the boiling water, in passing through the flask with meat, takes with it mechanically the ammonia gas that is freed from the meat, and becomes condensed into water in the cooling apparatus. That ammonia being a soluble gas, it readily dissolves in that condensed fluid. Now, if this alkaline fluid is taken, and the solution of an acid of a known strength\* is added to it until its alkaline reaction changes into a neutral one,† we can easily estimate from the quantity of the acid required the amount of ammonia which the water has contained, and thus we obtain the exact quantity of ammonium compounds of the meat under examination.

The results were the following (for quantities of 5 grams):

\* For neutralisation I used oxalic acid, which is handy for weighing, observing, and is sold in a very pure state.

† As an indicator I used rosolic acid, which gives the liquid a red colour as long as it contains the slightest amount of a free alkali.



- |    |   |              |
|----|---|--------------|
| 1. | Meat fresh from the shop . . . . .  | 4.2 c. cm.*  |
| 2. | „ after 48 hours standing in the incubating oven (the meat was now tainted) . . . . . | 14.3 c. cm.† |
| 3. | „ after 72 hours standing in the incubating oven (highly offensive odour) . . . . .   | 22.2 c. cm.  |
| 4. | „ after 76 hours standing in the incubating oven . . . . .                            | 22.5 c. cm.  |

After having found by this preliminary examination, and a similar one on the flesh of dogs, that the accumulation of ammonia increases in meat with the growth of putrefaction, and that at a certain point the quantity of ammonia increases as much during one day as during the two preceding days taken together, I was prepared to proceed to the comparative analysis of meat obtained from animals slaughtered in different ways.

It is unnecessary to give here the tables of all my analytical experiments, as their results differ but slightly from each other. I shall confine myself to two series of experiments, in which in the one case the two sorts of meat were kept in the open air on the window-ledge of the laboratory itself, whilst in the second the samples were kept in the incubator.

### THE THIRD AND FOURTH SERIES OF CHEMICAL EXAMINATIONS OF MEAT FOR AMMONIA.

Two oxen were slaughtered in my presence on November 28, 1893, at 3.30 P.M., both of them having grey-coloured hides and being nearly of the same body-weight. One was slaughtered according to the rules of *shecheta*, without any subsequent stab in the neck or after-cutting. The other was stunned, and received three blows before falling down and three further blows before becoming completely unconscious. After the carcasses had been cut up, pieces of meat were taken from the loins of both

\* The figures 4.2, &c., indicate the number of cubic centimetres of a decinormal solution of oxalic acid required for neutralising the ammonia.

† At the second analysis, undertaken after twenty-four hours standing, the flask broke, and no result was obtainable.



animals, a seal being attached to the *shecheta* meat, as a precaution against confusing them, and both were conveyed under equal conditions to the laboratory. The first examination was made two hours and a half after the killing. Six samples were taken of each sort of meat, each sample weighing 5 grams. Each of the twelve samples was put into a special glass flask with 100 c. cm. of distilled water, and properly labelled, and placed in the incubator, which was regulated for 36° to 38° C. (97° to 100° Fahr.). The samples were then analysed daily.

TABLE IV.

*Third Series.**Fourth Series.*

Length of time from killing.	Meat kept at a temperature of 3° to 6° C. (37° to 43° Fahr.).		Meat kept in the incubator at 36° to 38° C. (97° to 100° Fahr.).	
	<i>Shecheta.</i>	Stunning.	<i>Shecheta.</i>	Stunning.
2½ hours.	2·3*	1·5†	—	—
1 day.	6·1	5·8	9·4	12·5
2 days.	6·9	9·9	12·7	Flask burst.
3 "	9·1	12·4	14·6	23·0
4 "	10·6	13·2	14·8	21·2
5 "	12·2	13·7	17·7	30·4
6 "	— ‡	—	19·9	35·7

I must not fail to mention here that in many experiments, particularly with meat kept at a low temperature, it happened, that after a certain amount of ammonia had already developed in the meat, a sudden falling off in the quantity of that gas was noticed, amounting sometimes to as much as 30 per cent. of the previous day's quantity. The next day, however, a rapid increase of this gas was observable, a phenomenon which I encountered but very seldom in the analysis of meat from the incubator (see Table IV.). I cannot enter here into a theoretical discussion of

\* The numbers here, as in the preceding table, indicate cubic centimetres of decinormal solution of oxalic acid used for neutralisation of ammonia.

† I nearly always observed that immediately after the slaughter the meat of stunned animals contained a few points less of ammonia, but soon the quantity rose in a rapid manner.

‡ On the sixth day the quantities of ammonia in the samples from the incubator were so large, and their estimation took so long, that in view of the closing of the laboratory I had to forego testing the other samples.



this phenomenon, which would lead me into the region of the functions of the various bacteria, a study that is not everybody's province. With regard to the question in hand—*i.e.*, the longer or shorter keeping of meat from two different sources—only the relative increase of ammonia under equal conditions is of any importance.

From these two series of experiments it is thus evident that the increase of ammonia, and with it the progress of putrefaction, both in low and high temperatures, is much less rapid in the meat of animals slaughtered in the Jewish manner, than in the meat of those slaughtered after having been stunned.

Further we learn from these experiments that, even if meat is *preserved at a low temperature*, the quantity of ammonia in the meat of stunned animals after the lapse of three days is almost as large as the quantity developed in the *shecheta* meat during five days (corresponding to 12.4 cub. cm., and 12.8 cub. cm. of decinormal oxalic acid). The difference in the quality of the two sorts of meat is more striking still when the samples are kept in a condition favourable for the development of micro-organism—*i.e.*, in the incubating oven—at blood-heat. Whilst 5 grams of *shecheta* meat, after three days standing, required for the neutralisation of its ammonia 14.6 cub. cm. of decinormal oxalic acid, 12.5 cub. cm. were wanted after twenty-four hours for the same quantity of the other sort of meat.

We observe a still greater difference in the further stages of decomposition (17.7 and 30.4, or 19.9 and 35.7).

Let these experiments be as convincing as they may, the objection might still be made, that as the meat was taken from two animals, the difference resulting on analysis might perhaps be due to a difference between the animals themselves. In order to remove any doubt in that direction, I carried out the following experiment on the flesh of a dog:

We already know that, with regard to the preservation of meat, the difference between the Jewish method and stunning is essentially that in the latter method, in consequence of the blows on the head, and the resulting of paralysis of the vasomotor nerves, the outflow of blood is much smaller than in the Jewish method. Now, if we sever the nerves running to one leg of a dog, and with them of course those nerve fibres which regulate the blood-



quantity in the vessels, we cause a paralysis of the leg as well as of its bloodvessels, and if the dog after a while is killed by severing the bloodvessels of the neck (in the Jewish manner), we shall find the leg that has been operated upon in the condition usually caused by stunning, whilst the other parts are in the condition consequent on the employ of the Jewish method, and we are thus enabled to make a comparative analysis of meat of two kinds in one and the same animal. The results of this experiment are also of great importance for the decision of the question whether the better preservation of the *shecheta* meat is due to the small quantity of blood it contains, to the epileptiform convulsions, or to both of these factors.

This experiment was made on December 13, 1893, at 11.15 A.M., in the laboratory of the Veterinary College in Berlin: A black dog of 13½ kilograms weight was deeply anaesthetised by ether, its right sciatic nerve (*n. ischiadicus*) was laid open and cut through, and the wound sewn up. An hour later the dog recovered from the effects of the anaesthetic, and in an hour and a half it was well enough to take food. In walking he dragged the right hind leg behind him, which was a sure proof that the nerve was divided.

At 1.15 P.M. the dog was killed by severing the arteries of its neck with a very sharp and broad knife (Jewish method). Two hours later, when death rigidity was established (the dog operated upon became rigid somewhat later than the others), both hind legs were severed at the knee-joints and carried to the chemical laboratory, where the quantities of ammonia were analysed daily. The interesting fact resulted, *that in the leg operated upon the development of ammonia was greater than in the other one.*

THUS THE RESULTS OF THE CHEMICAL ANALYSIS SERVE TO FULLY CONFIRM THE EXPERIENCE OF THE BUTCHERS, THAT MEAT OBTAINED BY THE JEWISH METHOD OF SLAUGHTER CAN EVEN IN SUMMER BE PRESERVED TWO DAYS LONGER.

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After having proved that under equal conditions in meat of animals slaughtered without previous stunning, the development of ammonia is less than in that of animals killed with previous stunning, it remains only to answer the question, what are the



relations of the development of ammonia to the process of putrefaction?

Before entering on this question a few preliminary remarks on the general causes of putrefaction might find place here.

The process of putrefaction, like that of fermentation, is exclusively the result of the action of certain putrefactive micro-organisms in the presence of moisture and atmospheric air (oxygen). During the decomposition of organic substances (and naturally, therefore, also of meat) various poisonous bodies are formed that have the properties of alkaloids, and are called ptomains (*Selmi*). These bodies are therefore the products of the vital activity of the above-mentioned micro-organisms, which grow in animal matter, in albuminous substances (*e.g.*, the blood), and different other media. The micro-organisms grow more readily in tissues and nutritive liquids of an alkaline reaction, whereas in acid media their growth is greatly impeded. (That is the reason why, in conserving meat, mainly acids and the supersalts of acids, as vinegar, &c., are used.) The ammonia found in the meat is thus an excretory product of these bacteria—*i.e.*, a product of putrefaction. Thus it may be assumed *à priori* that the meat, which for some reason or the other affords the most unfavourable conditions for the growth of the putrefactive bacteria, will remain longest untainted. But the favourable or unfavourable nature of these conditions is dependent on the method of slaughter, and a careful study of the question reveals the fact, that THE JEWISH METHOD ALONE COMBINES ALL CONDITIONS CALCULATED TO IMPEDE THE GROWTH OF MICRO-ORGANISMS, AND TO HOLD IN CHECK FOR SOME TIME THE DEVELOPMENT OF PUTREFACTION.

These conditions may be classified under the following heads :

1. The quantity of blood remaining in the body.
2. Removal of oxygen with the rapidly outflowing blood.
3. Epileptiform convulsions.
4. The removal of water from the muscles.

### 1. The Quantity of Blood remaining in the Body.

The blood being a fluid of alkaline reaction, and with a great proneness to decomposition, it must, according to what has been said above, be an excellent nutrient medium for bacteria. There-



fore the more there remains of it in the slaughtered animal, the more rapidly the micro-organisms grow in the latter, and the sooner putrefaction ensues. With these facts for a guide, we see that a method of slaughter which would leave no blood whatever in the body would be hygienically an ideal one; but it is unfortunately quite impossible for such a method to be found. Now, to bring out clearly that the rate of progress of putrefaction is really dependent amongst other things upon the quantity of blood left in the body, we must show by experiment how widely that quantity differs in the various methods of slaughter.

It is sufficient to once witness the practical application of the Jewish and other methods to recognise how splendidly the theory is confirmed by the practice. If two oxen of the same race, and approximately of the same size and weight, are killed, the one in the Jewish manner, the other in some other way, it is easy to get at a right estimation of the bleeding by carefully gathering the blood of each ox and comparing the quantities thus obtained. But it is more convenient to do the same with smaller animals, as all the blood can easily be caught in some handy vessel.

Not long ago I remarked in the slaughter-house of Zurich a very interesting fact, serving to show how great is the quantity of blood left in the carcasses of animals stunned before the slaughtering. About half an hour after the killing, when the blood is still more or less liquid and the carcase is hung up, one saw, when the hind quarter was being cut off, and the hip-joint and the big vessels there (the femoral arteries and veins) divided, that a great amount of blood was still left in those vessels, and was streaming to the ground in large quantities—a thing that never happens in the Jewish method of slaughter.

Further proof of the insufficiency of the bleeding in the case of stunning may be seen in the fact, that in this method of slaughter the bloodvessels on the inner and smooth walls of the cavities of the body are seen to be widely dilated, and that even the small branches of them, which are usually not to be seen at all, become visible, because they are filled with blood. This is never the case in the Jewish method. Another proof is the fact that during the process of bleeding itself, the slaughterman has to tread about a long time on the belly of the animal before he is able to press out any quantity of blood worth mentioning.



The best way of estimating the different quantities of blood removed from and remaining in the bodies of the animals slaughtered by different methods, would undoubtedly be to weigh the animal before and after the act of slaughter. But in trying to apply this mode of examination to big cattle I encountered difficulties of such a nature, that I had to desist from the attempt. Apart from other and purely technical obstacles—as, for instance, the difficulty of finding two animals of the same race and weight—there may arise many errors in the estimate from the fact that sometimes fæces and urine are passed by the animal whilst it is being slaughtered, and this point cannot be overlooked in making the calculation. But if, instead of big cattle, small-sized animals—*e.g.*, dogs or rabbits of the same litter—are taken and slaughtered by different methods, one will at once see *that in the stunning method the bleeding is much less abundant than in the Jewish one.* This is true, not only of stunning properly so-called, but to a still greater extent in the case of the stab in the neck.

To bring this important fact out clearly in an experimental way, I was compelled to sacrifice a few innocent dogs and rabbits.\* One of these experiments, carried out in the presence of physiologists and medical men in the Veterinary College of Berlin, may be recorded here.

Two buck rabbits of the same litter, weighing, one 2000 grams, and the other 1850, were slaughtered—one according to the rules of *shecheta*, the other after previous stunning in the mode customary in Berlin—and each was weighed a second time after the bleeding had taken place.

From physiology it is known that the quantity of blood in a rabbit varies, according to its race, &c., from one twenty-second to one eleventh part, and on the average is equal to  $\frac{1}{18}$ th of its entire body-weight. The bigger rabbit, therefore (2000 grams), must have had about 111 grams, and the smaller (1850 grams) about 103 grams of blood. But the results were not at all in

\* Being myself a member of a Society for the Prevention of Cruelty to Animals, I must apologise to my fellow-members for this sacrifice in the interest of science. Those “protectors of animals” who regard the method of stunning as an entirely painless one, will certainly find my deed criminal only in the case of the animals killed in the Jewish fashion. However, I see my excuse in the fact that these “sacrifices” may possibly be the means of sparing needless pain to thousands of animals.



harmony with these numbers: the rabbit slaughtered in the Jewish manner lost 80 grams, the other, that had been stunned, lost only 30 grams of blood! That means, that in the body of the first there were left after slaughter only 31 grams of blood, in that of the second 73 grams. In order to bring out clearly the direct influence of the stunning on the escape of blood, a third rabbit was taken, and first stunned, then slaughtered, but not in the usual (Berlin) manner, but in the Jewish one—*i.e.*, by simultaneous severance of both carotids. This third rabbit weighed 1950 grams (to which would correspond 108 grams of blood), and lost 50 grams of blood.

A better view of these results will be presented by giving them in tabular form :

TABLE V.

Method of Slaughter.	Weight of the Rabbit in grams.	Weight of entire Blood quantity of Rabbit.	Blood lost during Slaughter.	Blood remaining in the Meat.	Proportion of Blood lost.	Proportion of Blood remaining in the Meat.
Shecheta	2000 grams	111 grams	80 grams	31 grams	72 %	28 %
Slaughter with previous stunning	1850 grams	103 grams	30 grams	73 grams	29 %	71 %
Stunning and Shecheta	1950 grams	108 grams	50 grams	58 grams	46 %	54 %

The table shows that the animal which was stunned lost 30 grams of blood, and retained 73 grams, amounting to 71 per cent. of the whole bulk, whilst in the carcase of the second rabbit, that was nearly of the same weight, but was killed by direct severance of the arteries of the neck, there were retained only 31 grams, or 28 per cent. of the whole quantity of blood it contained.

Another experiment, carried out in Leipzig on September 13, 1893, gave results still less favourable for the stunning. Two rabbits were taken from one and the same litter, weighing 2680 and 2610 grams—consequently of almost the same size. Here again the first was slaughtered in the Jewish fashion, the second



with previous stunning. The first rabbit lost 90 grams of blood, the stunned animal only 20 grams.\*

These experiments afford a full explanation of the fact that meat obtained by the Jewish method of slaughter yields a smaller amount of ammonia and remains sound for a much longer period than that of animals killed in any way requiring stunning.

The same principle we find also applied in the matter of preserving fish. The German fishermen, for the purpose of preserving the fish longer and improving its quality, use the so-called method of Heinicke, which consists in the removal of the gills and the big bloodvessels that are connected with the gills. Fish that is prepared in this way is whiter and more tasty than that of other methods of preparation, and remains sound for double the period of time. The same expedient is used by the fishermen of Friesland for preserving herrings. Herrings prepared in this manner, packed in bundles, and sent by post for long distances, arrive at their destination in a very fresh state, even after having been subjected for four days to a temperature of 13° to 15° (55° to 59° Fah.†)

Apart from this, another important point must not be lost sight of: that in herbivorous animals the alkalinity of the blood is much diminished by the epileptiform convulsions which accompany the last moments of the animal slaughtered in the Jewish manner. To the reasons of this phenomena I shall have to return later on when examining the influence of the convulsions on the preservation of meat.

An excellent example of the extent to which the blood hinders the preservation of meat untainted is afforded by the following facts.

In some places in England, as was mentioned above (p. 26) for the benefit of people of a certain *goût*, the so-called "patented method of slaughter," without any bleeding whatever, is used. *The meat of animals killed in this way is fit for use only during the first few hours after killing.*

It is likewise a fact within the knowledge of every one, that the liver decomposes very rapidly, because of the large quantity of blood it contains.

\* In the second case, true, some blood had escaped into the cavity of the chest, but only to the extent of a few grams.

† *Revue Scientifique*, vol. xlvii., No. 1, 1891.



The director of the Central Abattoir of Berlin, Dr. Hertwig, with reference to this fact says\*: "This (the Jewish) method, however, has also been taken up by *Christian slaughterers*, because the *escape of the blood is more complete, and the meat, besides keeping better, acquires a more tender appearance.*

Here the objection may be advanced: "If the blood is so detrimental, why is it that in modern medicine feeble persons in some cases are advised to drink it?" (This objection was indeed made during the discussion that followed my lecture, delivered before the Medical Society of St. Petersburg.†) But we ought not to forget that in those cases is meant the fresh and warm blood that is just escaping from the bloodvessels of the animal, which of course is far from being the same as blood that has remained in the dead organism, were it only for a short time. It has already been pointed out that the blood as soon as it leaves the vessels after death undergoes certain changes and clots. Certainly the blood, even whilst in the living organism, contains certain chemical bodies not fit for use as food, but they are continually removed from the body by the excretory organs (kidneys, sweat glands, &c.) in the shape of urine, sweat, &c.; whilst as soon as death has taken place the same chemical bodies are transformed into poisonous substances called ptomains, that increase in quantity from day to day. After a certain time they may have accumulated to such an extent that the quantity of meat usually eaten at a meal would be sufficient to cause grave injury to health.

From what I have said just now it is evident that, from the standpoint of hygiene or public health, preference must be given to that method of slaughter that will yield a stable meat—*i.e.*, a sort of meat that withstands decomposition longest, and can therefore be used as food without any danger to health. *These qualities we only find in the meat of animals slaughtered by the Jewish method.*

After this it is easy to explain why Christian slaughterers too, wishing to obtain a meat that has a nice appearance and good

\* See *The Institutions of Public Health, &c., in the City of Berlin* (Festschrift zur 59ten Naturforscher-Versammlung, Berlin, 1886, chap. xxvii.); *Inspection of Meat* by Chief Veterinary Surgeon Dr. Hertwig, p. 301.

† See author's paper, *On the Anatomical and Physiological Principles involved in the Different Methods of Slaughter.*



keeping qualities, kill their cattle by a direct cut through the bloodvessels of the neck, although they never use for that purpose such a sharp knife as the *shochet* (the Jewish slayer) does.

There are certainly a number of people who have a fondness for meat of a *high* flavour (as also for *high* cheese); but such disgusting, nay, dangerous, *goût* is confined to a few gourmands, whilst the great majority of people could not bring themselves to touch such meat.

Not less ill-founded is the objection that meat, be it obtained by no matter what method of slaughter, will keep well for weeks if it be only placed in a refrigerator. First, refrigerators, or even simple ice-cellars, are not to be found everywhere. In Germany, for instance, only a few large abattoirs, as those of Leipzig and Frankfurt-on-the-Main, are supplied with a refrigerator. In Switzerland I have seen only one—in Geneva; whilst in Russia they do not even exist. Not even Berlin has a refrigerator, and the meat is carried straightway from the slaughter-house to the butcher's shop or to the market, where it is sold. Is it then reasonable to expect that in large and small towns and hamlets refrigerators would be built for the purpose of preventing the putrefaction of meat? Finally, even supposing refrigerators to exist, though in reality they do not, still, the quantity of the blood retained would not lose its significance with regard to the quality of the meat, since the alkaline reaction of the blood makes it an excellent nutritive medium for micro-organisms.

Under the present economical and social conditions of our life it is impossible to contest that the mode of slaughter which guarantees the best taste and the longest keeping of the meat, must, out of pure consideration for the interests and well-being of the people, be unconditionally preferred to all others, and even though it be at the price of wounding the "ethical feelings" and the exaggerated sentimentalities of certain very sensitive and hyper-moral souls.

Doubtless our moral feeling demands that we should treat the animal for the shambles as gently as possible, but we must not lose sight of the interests of our health, and we must, moreover, remember *that the animal is created for mankind*. If you choose to give humanity its full scope and widest application, you must go a step further, and altogether abolish the slaughtering of animals for



food, as indeed has been done by the Japanese.\* That would at least be consistent. However, once the slaughtering of animals for the satisfaction of our greedy and exigent stomach is considered to be permissible and necessary, we can give our approval only to that mode of slaughter which will yield the kind of meat least dangerous for our health.

## 2. Oxygen removed with the rapidly outflowing Blood.

We shall have to dwell on this point at somewhat greater length, because this apparently quite insignificant fact furnishes some very valuable reasons why the meat obtained by the Jewish method of slaughter keeps better than any other.

In the laboratory of Professor Hoppe-Seyler there have been made researches by Araki, which showed that where there is a lack of oxygen, and particularly where the want of it is so great as to cause death, lactic acid and sugar are formed in the muscle. As is known, Araki arranged his experiments in such a manner that the animals were put in a box, and the latter made air-tight by a coating of oil-paint, and thus the quantity of oxygen in the blood of the animal diminished. In every case after such an experiment he found lactic acid in the urine of the animals, sometimes as much as  $\frac{1}{12}$ th per cent. When the want of oxygen had caused the death of an animal he found lactic acid and sugar also in its blood, whilst in the normal condition it contains but mere traces of these substances. Their quantity was always in direct proportion to the want of oxygen, no matter whether the latter was caused in the above described way, or by poisoning the animal with strychnine and thus causing convulsions, or in some other way. Therefore there remains not the slightest doubt that the appearance of lactic acid in these cases is due to its sudden increase in, and partial excretion from, the organs and muscles of the animal, caused by want of oxygen.

Now, on comparison of the Jewish method with the other methods in vogue, we find that in the case of stunning, of Bruneau's mask,

\* In Japan, according to the statement of the German Professor Janson in Tokio, the use of meat was prohibited by the tenets of Buddhism in the seventh century A.D. For nearly twelve centuries no animals were slaughtered for food, so that they sometimes reached the age of fifty years. Only since the appearance of Europeans and Americans in Japan have animals again been sacrificed to this purpose. (See *Zeitschrift für Fleisch- und Milchhygiene*, third year, p. 226.)



of the shooting mask, &c., the blood, which is the chief carrier of oxygen, not only does not escape from the body in a sufficient quantity, but what there is of bleeding takes place so slowly that the men are sometimes compelled to tread upon the abdomen of the slaughtered animal in order to forcibly *press out* a certain amount of blood; whilst in the Jewish method, the vasomotor centres remaining intact during the cutting itself as well as during the whole period of the death struggle, and the heart continuing its pumping action with unabated energy, the blood, immediately on the division of the arteries, begins to spurt out like a fountain jet, and the greatest quantity of it escapes in the relatively shortest time. Therefore it is clear that in the Jewish method of slaughter an amount of lactic acid must be developed in the muscles incomparably larger than in any other method. This view of the development of lactic acid in the organism, in case of severe loss of blood, is also confirmed in a recent paper on the "Metabolism in Cases of Want of Oxygen," by Hoppe-Seyler, which was dedicated to Rudolf Virchow on the occasion of his seventy-first birthday.

In this essay\* we read:

"Since in cases of exhausting losses of blood, as well as in the case when too small a quantity of red blood-corpuscles is contained in the blood, the symptoms of want of oxygen are usually very marked, it was to be expected that in every case of severe anæmia the want of oxygen in the tissues would lead to the excretion of the above-mentioned bodies (lactic acid, sugar, &c.), with the urine. In a case of very grave anæmia in a girl of thirteen, which ended fatally, I found in the urine of the last days large quantities of lactic acid and some amount of glucose (estimated by fermentation and polarisation tests) and very small quantities of albumen. It cannot be doubted that in cases of loss of blood, leading to unconsciousness, the same symptoms will be observed."

The results of his investigations Professor Hoppe-Seyler sums up in the following sentence:†

"The formation of lactic acid in the organs, and at any rate in the muscles, of higher animals, as a result of the absence of oxygen

\* *Contributions to the Knowledge of Metabolism in the Absence of Oxygen*, by Hoppe-Seyler (*Festschrift zu Rudolf Virchow's 71ten Geburtstag*).

† See *Festschrift*, p. 16.



and the excretion of this acid in urine, must be regarded as an established fact."

A reference to the increased formation of lactic acid in the absence of oxygen may also be found in a paper by Professor Fraenkel.\*

On a superficial examination of this fact, the objection may be advanced, that since the absence of oxygen causes the development of lactic acid, the same principle must necessarily hold good also in other methods of slaughter, where respiration is impeded and the supply of oxygen diminished. But there is a very great difference between *this want of oxygen* and that occurring in the Jewish method. In the case of stunning, the sensation of suffocation is even stronger than in the Jewish method, but not so much in consequence of the absence of oxygen, as because of the concussion of the nervous centres of respiration, which calls forth asthmatic attacks. In the above-mentioned essay, p. 9, Professor Hoppe-Seyler says on the metabolism in the absence of oxygen:

"In strong asthmatic attacks lactic acid can only be found in the urine when there is a real want of oxygen, but not if the sensation of suffocation is only the result of some nervous disorder."

From all these discussions it clearly results THAT THE JEWISH METHOD, ENTAILING AS IT DOES A VERY RAPID AND GREAT LOSS OF BLOOD, MUST NECESSARILY PROMOTE A RAPID DEVELOPMENT OF LACTIC ACID.

To the question of the influence of lactic acid on the keeping quality and other properties of the meat, I shall have to return after the discussion of the other characteristics of the Jewish method of slaughter.

### 3. The Epileptiform Convulsions

that unfailingly accompany the rapid escape of blood in the Jewish method ARE LIKEWISE OF EXTREME IMPORTANCE ON THE FURTHER CHEMICAL PROCESSES IN THE MEAT—

a. By advancing the formation of lactic acid in the meat;

\* *Ueber den Einfluss der verminderten Sauerstoffzufuhr zu den Geweben auf den Eiweisszerfall im Thierkörper*, by Dr. A. Fraenkel, *Virchow's Archiv*, vol. lxvii. fasc. 3, p. 275.



- b. By diminishing the alkalinity of the blood that has been retained in the meat ;
- c. By promoting the escape of blood from the small blood-vessels ; and
- d. By accelerating the onset of *rigor*.

All these circumstances tend to hinder to a certain degree the decomposition of the meat, and may be considered as so many reasons why the meat obtained by the Jewish method is distinguished *from all other methods by better keeping qualities*.

a. **The Influence of the Convulsions on the Formation of Lactic Acid.**

To Professor Du Bois-Reymond belongs the merit of having for the first time discovered the formation of an acid in the active muscle. This distinguished physiologist, as far back as 1859,\* proved by experiments on animals that, whilst in the state of rest the muscle is neutral or alkaline in its reaction, it turns acid after contraction.†

Du Bois-Reymond divided one of the sciatic nerves in a rabbit, and then provoked violent convulsions of all the muscles by poisoning the rabbit with strychnine. After the death of the animal he found that in the leg, which had remained inactive because of its nerves having been divided, the muscles were alkaline in reaction ; whilst the muscles of the other leg, that had been convulsed, were acid.

During the thirty-five years that have elapsed since the first discovery of that fact, a great many experiments for the purpose of its verification have been undertaken and published. Now, although some authors (Monati, Batestini, Moleschott, Heffter) have pointed out that normally lactic acid may be detected also in the resting muscle, still this in no wise disproves the fact that the quantity of lactic acid is immensely increased in the active muscle.

\* *Ueber angebliche saure Reaction des Muskelfleisches* : Paper read by Du Bois-Reymond at the meeting of the Royal Academy of Science on March 31, 1859. Also in E. Du Bois-Reymond, *Gesammelte Abhandlungen zur allgemeinen Muskel- und Nerven-Physik*, Leipzig, 1867, vol. ii. p. 3.

† But it must be mentioned here that Berzelius already in 1841 had stated that the more active the muscle is, the more lactic acid is developed in it. See C. G. Lehmann, *Lehrbuch der physiologischen Chemie*, 1850, vol. i. p. 103.



In the question with which we are now concerned—*i.e.*, the influence of lactic acid on the keeping qualities of meat—it is quite immaterial whether the muscle in the state of rest contains a trifling amount of lactic acid or not. It is likewise of no moment whether the lactic acid, as Faker,\* Salkowsky,† and others hold, is a “product of the living protoplasm,” or whether some are right in contending that it arises in the course of the further chemical processes during death-rigidity. It is sufficient for us to state in a general way that

INCREASED ACTION OF THE MUSCLE PRODUCES LACTIC ACID,

no matter whether that takes place during life, or is effected by chemical changes accompanying the *rigor*.

The reason of this phenomenon must be sought for in the increased demand for oxygen which appears every time a strain is put upon the muscles, and which, as a matter of course, must be intensified by the violent convulsions resulting from the rapid escape of blood in the Jewish method. It is a well-known fact, that in the muscles of hunted game a large amount of lactic acid is found (Lehmann). Further, it is proved beyond a doubt by the following experiment of Grützner, that the deficiency of oxygen caused by the loss of blood, and still further increased by the convulsions. If the nerves supplying *one* leg are cut through, and the spinal cord is stimulated in the corresponding part, the muscles of the other leg will be thrown into contractions, whilst those of the first are resting. If, now extracts with pyrogallic acid are prepared from muscles of both legs and filtered, that from the resting muscle will be of a brownish colour, whilst that from the active one is clear as water, or straw-coloured. Likewise, Ludwig, Sczelkaer, and Schmidt have proved that the active muscle is using up much more oxygen than the resting.

From the investigations of Araki‡ we learn that increased activity of the muscle causes the formation of lactic acid in the urine. In the urine of animals poisoned with strychnine he detected lactic acid, which had not been present before the experi-

\* *Centralblatt für d. med. Wissensch.* 1888, p. 417.

† *Virchow's Archiv*, vol. lviii.: *Ueber die Möglichkeit der Alkalienentziehung beim lebenden Thier*, by Dr. E. Salkowsky.

‡ *Zeitschr. für physiol. Chemie*, von Hoppe-Seyler, 1891, vol. xv.



ment. With a similar fact we meet in medicine. The urine of people suffering from epilepsy, after the fit, contains a large quantity of lactic acid, whilst there is nothing of it in the portions taken before the fit.

If we now consider that in the Jewish method the convulsions, which set in at the very beginning of the unconsciousness, as an effect of *the instantaneous and copious loss of blood*, are entirely of the nature of epileptic convulsions, on the strength of which, in fact, they are called "*epileptiform convulsions*," it will be evident that they will

#### RESULT IN THE SAME FORMATION OF LACTIC ACID

as the epileptic convulsions. The importance of lactic acid for the taste and the keeping qualities of the meat will be considered further on.

#### b. The Convulsions Diminish the Alkalinity of the Blood.

From the investigations of Salkowsky,\* Minkowsy, and those of Zuntz and Geppert, who verified the results of the first two, we know that the alkalinity of the blood may be diminished more than half by convulsions of the extensor muscles. Zuntz and Geppert,† on examining the blood of rabbits before and after the convulsions, found that, whereas before the beginning of the contractions 100 grams blood could be neutralised only by 238 milligrams of carbonate of soda ( $\text{Na}_2\text{CO}_3$ ), the quantity required after the convulsions had passed off was but 106 milligrams for the same amount of blood. In cases of prolonged spasms of the muscles, caused by tetanisation, the decrease in the alkalinity was so great that blood poisoning by acidity followed, which caused the death of the animal. Peiper‡ came to the same conclusion by a different way. On examining the blood of two persons before and after a march of two hours and a half, he found that he could neutralise a certain quantity of blood taken after the march with a smaller amount of acid than was required for the neutralisation of the same amount of blood before the marching exercise. Very recently,

\* *Zeitschr. für physiol. Chemie*, von Hoppe-Seyler, 1891, vol. xv.

† *Virchow's Archiv f. path. Anat.*, vol. cxvi. p. 337, 1889.

‡ *Pflüger's Archiv*, vol. xlii. pp. 13, 23.



Cohnstein\* has proved by a whole series of researches that in herbivorous animals the alkalinity of the blood is enormously diminished by muscular activity. But it is a noteworthy fact that these astounding results are not found when the blood of carnivorous animals—*e.g.*, a dog—is examined. But if a dog is fed for a few days exclusively on vegetables (rice), then the results obtained are identical with those in herbivorous animals.

From all these facts it follows that, if *the usual muscular actions are sufficient to diminish the alkalinity of the blood*, this effect will necessarily be much heightened after the violent epileptic convulsions that accompany the bleeding in the Jewish method of slaughter. But a diminution in the alkalinity is of paramount importance in the matter of the preservation of meat.

*c. Convulsions and the Escape of Blood from the smallest Bloodvessels.*

To fully appreciate this point it is necessary to form a clear idea of the mechanism of contraction of a single muscular fibre.

The muscular fibres, as has been mentioned already (page 57), are placed in a parallel order to each other, and consists of a sheath and a contractile part. If a whole bundle of these fibres is divided transversely, they appear in section as small circles, closely packed, between which the smallest bloodvessels, the so-called capillaries, are to be seen lying. During the contraction the several fibres not only become each of them shorter, but also thinner, so that their diameter is much increased. Naturally the interspaces are also enlarged in accordance with the well-known fact that the spaces between large circles are greater than between small circles. Now Ludwig and Sadler have proved that the muscles during contraction become richer in blood because of that enlargement of the interspaces. But each contraction being followed by a relaxation the blood is alternately drawn by suction-action into the muscle during the contraction, and again mechanically removed by the subsequent relaxation.

*d. The Epileptiform Convulsions and the Rapid Onset of Rigor.*

It being a well-known fact that the contractions of the muscles

\* *Ueber die Aenderung der Blutalkalescenz bei Muskel-Arbeit*, Virchow's Archiv, vol. cxxx. 1892.



quicken the onset of the death rigidity, and render the meat more tender, it is evident that the meat will become fit for use the sooner, the stronger the contractions of the muscles have been before the death of the animal. When the illustrious naturalist Schwann in 1859 read the essay of Du Bois-Reymond on the formation of acid in the muscles in cases where convulsions had taken place before death, he directed to him a letter, which, being a proof of how practical experience often confirms scientific discoveries, was published in the *Archiv für Physiologie* of Reichert and Du Bois-Reymond.\* From this letter I quote here a passage which is also of some interest from its bearing on the present question :

“It was at the house of a friend of mine in a neighbouring country-seat. For the opening of the hunting season a dinner was given, to which numerous guests were invited. But the day having been fixed rather too late, the answers of the invited gentlemen could not be to hand in time for making the necessary arrangements for the meal, therefore the host thought—Well, in case we run short the poultry-yard can help us out, there are fowls enough ; whereupon I remarked that fresh-killed animals cannot be cooked immediately, because they are not tender enough. My friend replied, ‘ There is a way of remedying this fault and of making the meat tender, but it is too cruel for me to use. It is done thus: One forcibly pours a spoonful of vinegar down the throat of the live hen and brings it into a closed room where there is nothing breakable, and particularly no glass panes in the window, and chases it about until it is entirely exhausted. If the hen is immediately afterwards slaughtered, its flesh is very tender.’ You will see, therefore, that the cooks have anticipated your discovery and are aware that acid gives tenderness to meat, and that this acid is formed by severe efforts of the muscles in the living animal. At any rate it is interesting to see how scientific research explains methods to which people have arrived by the simple experience of everyday life. I hope that this communication will be of some interest to you as a confirmation of your valuable experiments on the reaction of muscles.”

\* Reichert's u. Du Bois-Reymond's *Archiv*, 1859, p. 846.



#### 4. Removal of Water from the Muscles in the Jewish Method of Slaughter.

As a consequence of the very rapid loss of blood which takes place when both arteries of the neck are cut, the pressure inside the bloodvessels falls so quickly that within a few seconds after the division of the bloodvessels it becomes, inside the blood system, lower than in the surrounding tissues. As a result of this water transudes from the tissues into the vessels, and thus the quantity of water contained in meat from rapidly bled animals must necessarily be much less than in other meat.

This supposition, founded on theory, finds full confirmation in practice. In his declaration, Mr. C. Hoffmann, a well-known wholesale butcher in Berlin, says, "The meat of cut animals (*i.e.*, killed in the Jewish fashion) is, after *two* hours, as firm as that of stunned animals only after ten hours."

In discussing the reasons of the better keeping qualities of meat attained by the way of *shecheta*, I must call attention to one other factor which has a great influence on the early commencement of putrefaction in the other methods of killing and is entirely absent in the Jewish method.

It has already been mentioned above, in the course of the description of the stunning method, that the butchers in order to obtain a bleeding in any way sufficient, do not cut the neck of the stunned animal in the way adopted in the Jewish method, but try to get in their knife as deep as possible in order to open arteries more voluminous than are the carotids.\* By proceeding thus, however, the inner surface of the opened chest cavity becomes bespattered with blood, whilst in the Jewish method it remains perfectly clean. Therefore, in cases where previous stunning is had recourse to, the butcher is compelled to use water for washing out the chest cavity. Now, quite apart from the consideration that neither the cloth used for washing, nor the water in the slaughter-houses, as far as my experience goes, in any way sin by over-cleanliness, we know very well that water, whatever be its qualities, is very detrimental to the keeping quality of meat. In

\* Some butchers assert that if the *shecheta cut* is applied after stunning the bleeding is still less satisfactory. And perhaps this is indeed the reason why that cut is never used in slaughtering with previous stunning.



the *shecheta*, on the contrary, the washing out of the chest-cavity is not wanted at all, since it is not opened during the bleeding and remains perfectly clean. Further, there must be taken into account the peculiar property meat possesses, so long as it is warm and rigor has not yet taken place, of being able to absorb a considerable quantity of water.\* That it has this property all who have a special knowledge in these matters are well aware.†

Only recently I have noticed another factor, which sometimes tends to hasten the decomposition of the meat of previously stunned animals. In some cases, though indeed rarely, there is an extravasation of blood into the muscles of the pelvis or the femur, probably in consequence of the bursting of the big bloodvessels of the groin (femoral artery or vein). I am not able to point out the reason of this phenomenon with any degree of certainty. It is perhaps possible that the bursting takes place at the moment the blow is struck on the head, the bloodvessels, particularly in old oxen, being very brittle.‡ It is a fact of common knowledge that even fractures of bones take place, not at the very spot where the blow is struck, but in some opposite part; a blow on the top of the head, *e.g.*, often producing a fracture of the base of the skull, although the bones are thicker there, a phenomenon known in surgery as fracture by *contre-coup*. Quite as often it happens that a violent box on the ear causes bleeding, not from the ear struck, but from the opposite one. Perhaps in the case of the ox the vasomotor paralysis caused by the blow on the head is followed by a sudden dilatation of the vessels, causing some of them to burst.

Besides, veterinary surgeons are well aware of the fact that the stunning, unlike the comparatively mild casting of the animals in the Jewish method, causes such a violent fall that fractures of the pelvic bones and rupture of the ligaments uniting the sacrum with the iliac bones, occur not unfrequently. The rupture of the bloodvessels may perhaps occur from the same cause.

Whatever be the cause, however, the fact is there and must be

\* Sausages prepared from meat before it has undergone rigidity contain only 30 per cent. of meat and 70 per cent. of water, a fact which easily explains their cheapness.

† See *Handbuch der Fleischschau für Thierärzte und Richter*, by Prof. Robert Ostertag, 1892, p. 105.

‡ The probability of this is, in truth, not great from a theoretical point of view.



taken into account, for the accumulation of blood within the tissues, which remains unnoticed at first by the butcher, leads to the decomposition, if not of the whole part of the carcase, to at least of that spot in which it is situated. On inquiring of butchers whether they had noticed that in the carcasses of animals killed with previous stunning under equal conditions one part sometimes decomposes sooner than the other, I received the reply that this fact has long been known, and there is even a technical expression for it in Germany, where they say *the meat sticks*.

After having treated these points severally let us now consider what scientific and practical value can be attached, as regards the keeping quality and the taste of meat, to these four essential advantages of the Jewish method: the rapidity and the copiousness of the bleeding, the increase of acidity in the muscles by the violent convulsions, the decrease in the alkalinity of the blood, and, lastly, the diminished quantity of water in the meat, advantages that are to be found in the *shecheta*, either exclusively, or at least in a much higher degree than in the other methods of slaughter.

Keeping in mind that the blood forms *an excellent nutrient medium for the lowest forms of vegetable life, that germs that have accidentally found their way into it multiply with an extraordinary rapidity*, that these micro-organisms cannot grow in acid tissue as well as they do in alkaline, and further remembering that in the Jewish method not only is less blood retained in the meat, but also the alkalinity of the retained blood lessened by more than half by the violent convulsions, and finally that the same convulsions, as well as the rapid bleeding, considerably advance and promote the formation of lactic acid: considering these facts, it will be evident that no doubt whatever can be entertained as to the fact, that the growth of the micro-organisms will proceed (all other conditions being equal) much more slowly in the meat of animals killed in the manner of the *shecheta* than in the meat of those killed by some other method, and that accordingly DECOMPOSITION AND PUTREFACTION MUST NECESSARILY BEGIN IN THAT MEAT MUCH LATER THAN IN ANY OTHER SORT OF MEAT.

In maintaining that the better keeping quality of the *shecheta meat* is due to the four reasons enumerated above, of which the increase in the formation of lactic acid is probably the most essential, we must nevertheless not forget that the preservation of the



meat is not a direct effect of the lactic acid itself, but the outcome of a series of chemical changes that take place in the meat when a larger percentage of lactic acid is present. In the tissues of the body—*i.e.*, in the meat—there is contained the neutral potassium phosphate (hydrogen dipotassium phosphate,  $\text{HK}_2\text{PO}_4$ ). By the action of the free lactic acid, appearing on slaughtering, it is transformed into the superphosphate salt (dihydrogen potassium phosphate,  $\text{H}_2\text{KPO}_4$  \*) which gives the muscle its acid reaction and impedes the putrefaction.

All the advantages of the Jewish mode of slaughter that I have been able to demonstrate by the preceding chemical and physiological researches, and by the study of the symptoms of the slaughtering process itself, I can sum up in a scientific manner in the following statements:—

1. *The commencement of the decomposition of meat depends upon the quantity of blood retained.* Closely connected with the rapid bleeding is a decrease in the quantity of water in the meat.

2. At the moment of contraction a chemical decomposition takes place in the muscle. In consequence of the convulsions, the glycogen in the presence of oxygen is changed into sugar, which in its turn undergoes farther changes of oxydation and is decomposed. But if little oxygen or none at all is present (as is the case in the Jewish method in consequence of the rapid escape of blood), the sugar is transformed into lactic acid.

3. The lactic acid thus formed in the muscle deprives the  $\text{K}_2\text{HPO}_4$  (neutral potassium phosphate) of one atom of potassium, with which it enters into combination, and  $\text{KH}_2\text{PO}_4$  (dihydrogen potassium phosphate) is formed, which has an anti-putrefactive effect. But if much blood is still present in the meat, the superphosphate combines with the alkaline carbonates contained in the blood, and forms again potassium or sodium subphosphates (with an alkaline reaction).

4. The blood-escape in the “*shecheta-cut*” being rapid and copious, only a very small portion of oxygen remains available for chemical action. The advantage of rapid bleeding consists, therefore, irrespective of the rapid unconsciousness it produces, in the prevention of the oxydation of lactic acid, and in the diminished

\*  $\text{C}_3\text{H}_6\text{O}_3$  (lactic acid) +  $\text{K}_2\text{HPO}_4$  (neutral potassium phosphate) =  $\text{C}_3\text{H}_5\text{KO}_3$  (potassium lactate) +  $\text{KH}_2\text{PO}_4$  (potassium superphosphate).



neutralisation of the potassium superphosphate. The amount of oxygen which is still left in the blood after the heart has ceased its action, and which is but in a very loose chemical combination, is soon used up by the organs which are in contact with the blood, so that at the commencement of the *rigor* there is no more of it present.

5. Corresponding to the acid reaction of potassium superphosphate contained in the meat, the latter is also acid in reaction, and is rendered more tasty.

6. A living muscle that is able to contract, if tested during rest, is, as a rule, of a neutral or alkaline reaction.

7. Chemical decomposition as the result of contractions takes place not only in the muscle, but as far as we know in all animal cells.

8. The contractions of the muscles are accompanied by a change in the protoplasm.

9. The epileptiform convulsions in the *shecheta* cause therefore the early onset of death-rigidity.

Before concluding the discussion of the chemical examination of meat, I must add here a few remarks on the reaction of meat. To many readers these details may seem perhaps to be quite superfluous, but I am compelled to enter upon them because the diversity and even contradiction of the views and opinions as to the reaction, and consequently as to the quality of the meat obtained by the different methods of slaughter, are probably due to the fact, that in these examinations tests of a different nature have been used, and particularly the litmus paper, which in the examination of meat often gives entirely uncertain results. The litmus paper is undoubtedly a good test for many liquids, but as far as the reaction of meat is concerned, its indications are seemingly contradictory. During two months I was engaged in testing samples of meat that were kept for definite periods and under different conditions, and also in testing watery extracts of the same, with and without the addition of chloroform,\* and I obtained results to such an extent contradictory that litmus paper as a means of testing meat may justly be regarded as worthless. Sometimes, for instance, I obtained with one and the same sample of meat the acid reaction

\* The addition of chloroform delays the onset of putrefaction.



as well as the alkaline—the so-called amphoteric reaction—the red litmus paper turning blue and the blue paper red.\*

The reason of this is very simple ; the colouring matter of litmus possesses the property of showing a double reaction in the presence of phosphates. And since in meat there are both kinds of salts present, neutral phosphates as well as the superphosphates, the red litmus paper is rendered blue and the blue paper red. As far back as 1859 Professor Du Bois-Reymond, writing on the acid reaction of the muscles, called attention to this phenomenon. In his essay we read on page 11 :

“ It was my friend Heintz, who, at the beginning of my investigations on the reaction of muscles, first called my attention to the probability that neither the blue colouring matter turns red nor the red one blue, but both of them equally turn pink, a supposition which was proved by experiment to be true.”

The same scientist, however, shows a way of overcoming the difficulties presented by this fact. On a thin and varnished board of lime-tree wood a number of red and blue test-papers are fastened by means of drawing-pins in such a manner that they overlap each other like the tiles of a roof. The surface of the piece to be tested must be pressed against the border of two strips, so that one half of it comes in contact with the red, the other with the blue test-paper. One has then not only the advantage of observing simultaneously two effects with one and the same test, but the judgment as to the nature and degree of the decoloration of a blue strip, for instance, is also aided by comparison with the effect produced on the neighbouring red strip.

As to the different reactions of the red and the blue litmus, the reasons of it are very simple : the red litmus has a greater affinity for alkalies, and therefore the paper containing this colouring body will turn blue as long as a trace of alkalies remains in the meat. On the contrary, the blue litmus has a greater affinity for acid, and will show the least trace of it by becoming red, even if it be not acids proper, but superacid salts. The same double reaction will be present in the testing of watery extracts of meat,

\* The same amphoteric reaction is found in the normal urine of man, under normal conditions of life, which is again due to the presence of phosphates. In the meat, however, there are, besides, many albuminous bodies that are able to cause the amphoteric reaction.



as in them also there are contained various bodies of different reaction. The same kind of contradictory results have been obtained also by other investigators (Heffter, Rhœmann). Heffter,\* therefore, justly remarks that for testing the reaction of muscles it is much safer to use phenolphthaleine, which decolorates readily, is very sensitive, and is especially suitable for the examination of weak acids.

The use of different testing methods, and especially of litmus paper, which gives results neither reliable nor easily discernible by every one, may be accountable for the fact that many scientists approve of the statement of Du Bois-Reymond, that active muscle is acid in reaction, and many others do not. That the formation of lactic acid is promoted in the muscle by epileptiform convulsions—*i.e.*, that the statement of Professor Du Bois-Reymond with regard to the reaction is true—is also confirmed by the investigations of Hoppe-Seyler and Araki, which have proved beyond doubt the formation of lactic acid from glucose in cases of want of oxygen. We need only bear in mind that epileptiform convulsions cause a greater want of oxygen through extreme acceleration of the respiration. Finally, clinical practice also proves, as has been already mentioned, that epileptiform contractions of the muscles cause the appearance of lactic acid in the urine; after fits this acid is found in the urine of epileptics in large quantities, whilst before them no trace of it can be detected.

It may be added that the microscopical examination of meat likewise serves to confirm that the structure of the muscle-fibres in animals killed with previous stunning, undergoes alteration or rather decomposition earlier than in the *shecheta-meat*. In this place, addressing myself as I do principally to laymen, I must refrain from entering into further details, and from illustrating what I say by drawings of microscopical preparations. I will only say this, that under the microscope most muscles of the body when seen in a fresh state appear to be transversely striped; but when the muscle begins to decompose, this microscopical feature is the first to disappear, and the stripes are no more to be recognised. If pieces of meat from animals killed in different ways are kept

\* *Die Reaction des quergestreiften Muskels*, by A. Heffter; *Archiv f. experimentelle Pathologie and Pharmacologie*, Panum and Smiedeberg, vol. xxxi. fasc. 4, 5, p. 225.



under equal conditions, and subjected to microscopical examination at certain periods of time, we find that at a time, when in the meat of stunned animals the stripes of the muscle-fibres have already entirely disappeared, they are still distinctly to be perceived in the meat of animals slaughtered in the Jewish fashion. This difference amounts to two, or even to three days.

From the results of the chemical, physiological and microscopical examination, we are forced to the conclusion THAT AS FAR AS THE KEEPING QUALITIES OF THE MEAT, OR, IN OTHER WORDS, AS FAR AS HYGIENE IS CONCERNED, THE JEWISH SLAUGHTERING METHOD DESERVES TO BE PREFERRED TO ALL OTHERS. Nay, it can be maintained almost with certainty, THAT ANOTHER METHOD OF SLAUGHTER WILL PROBABLY NEVER BE FOUND THAT WILL EMBODY IN ITSELF ALL THOSE ADVANTAGES WHICH ARE GUARANTEED TO THE JEWISH METHOD BY THE VERY LAWS, ANATOMICAL AND PHYSIOLOGICAL, WHICH GOVERN THE CIRCULATION OF THE BLOOD.

Notwithstanding all these facts, the well-known opponent of the Jewish method, Herr Hans Beringer, maintained, in his report to the Congress of the Societies for the Protection of Animals, held at Dresden, that the meat of animals killed in the Jewish manner undergoes decomposition sooner than any other meat. In the said report of this "animal protector" we read the following words :

"The slaughtering method, known as *shecheta*, in which the cattle are tied and cast down and often violently struggle before as well as after the cut through the neck, seems, with respect to the above-mentioned point and the processes that take place after the killing, to be not so recommendable as many have hitherto thought it. I wished to convince myself by personal observation what difference there is in the keeping of the meat of animals slaughtered by the different methods: *shecheta*, throat-transfixing, and felling. For that purpose, at different seasons of the year—*i.e.*, at different temperatures—I had several calves slaughtered, four for each trial. One was slaughtered in the Jewish way, a second transfixed without previous stunning, and the others were stunned before the transfixion, one of them by a knock with the axe, the other with Kleinschmidt's mallet. A piece was taken from the back of each of the four calves, and the pieces kept in the same room—*i.e.*, at the same temperature. The meat of the



animal killed by the Jewish method was always the first to become tainted, then came that of the transfixd calf, and the meat of the stunned animal was always the last. The test by tasting gave the same results. The soups from the different samples of meat became unfit for use in just the same order of sequence. Thus the opinion, which is still held by many butchers, that the meat of non-stunned animals is more emptied of blood and keeps longer, is totally false ; just the opposite is the case."\*

This declaration, which was made before the delegates of all the Societies for the Protection of Animals, was, however, in point of fact, based only on his personal taste—and there is, we know, no accounting for tastes—and on his own personal acuteness of smell, and is not at all confirmed by scientific research or practical experience. Such an opinion can only be the outcome of an utter ignorance of the elementary laws of physiology and physiological chemistry.

\* *Referat über die Reform des Schlachtwesens, erstattet beim X., internationalen Thierschutzcongress in Dresden*, by H. Beringer, Berlin. (Reprint from the Reports of the Congress.)



## C.—SLAUGHTERING FROM THE POINT OF VIEW OF ECONOMY.

THERE is no doubt that, on a superficial examination of the question, slaughtering with previous stunning, whatever the kind of stunning, would seem to be the most profitable method for the butcher, because—

(1) This method requires less time and less slaughtermen.

(2) The quantity of blood remaining in the meat increases the weight of the latter, so that the butcher receives for the quite worthless blood the same price as he does for the meat.

(3) The blood, if required to be collected for the manufacture of albumen, can be caught up in a more convenient way, as in the stunning method it escapes slowly, whilst in the Jewish method it spurts out like a fountain-jet, so that the butcher, as was said above, is often compelled to compress the cut arteries with his fingers in order to somewhat impede the flow of the blood.

(4) In the Jewish method, in consequence of the cut being made in the neck, a few pounds of meat always go with the head, when the latter is cut off, whilst in any other method of slaughter the butcher may cut off the head as high as he wishes—*e.g.*, between the skull and the first joint of the spinal column—with the result that a few pounds of meat are so much gain to him, the head selling for the same price notwithstanding.

But all these advantages are only apparent, and experienced wholesale butchers are no sticklers for these slight gains, but prefer to obtain a better and more stable sort of meat by using the Jewish method. This is best seen from the fact that the Americans, whose practical turn of mind is well known, for the most part have their cattle slaughtered in the Jewish fashion (in some States even exclusively employed); and, further, we find that in most factories of meat conserves, where certainly the economic side of the question is not neglected, the same method is in use.



### The Purchaser of Meat from Stunned Animals is certainly the Loser.

Not only has he to pay the price of meat for worthless blood, but he gets into the bargain a considerable quantity of water, which the warm meat takes up when it is washed (see page 87), and for which he has also to pay the same price. By this kind of transaction the big hospitals of large towns and the commissariat departments of armies, who contract for large supplies of meat, are those who are most victimised. A Government that has to victual an army of half a million men would be cheated by its contractors to the extent of half a million marks per year (£25,000).\*

\* This results from the following calculation: The mammals, to which of course belongs the ox, have a quantity of blood, amounting to  $\frac{1}{8}$ th of their body-weight. An ox of 1000 lb. weight has 78 lb. of blood, which makes 38 grams to every 500 grams (nearly a pound) of its weight, but a greater quantity still to one pound of meat. From Table V. we have learned that in the Jewish method there remains in the body 28 per cent. of the blood—about 10 grams to every pound of meat; in the stunning method, 71 per cent., about 27 grams to the pound, which makes 17 grams more to the pound than in the *shecheta*. The quantity of meat consumed by an army of half a million men during a day is 250,000 lb., if half a pound is taken as the daily portion for one man. If now the above surplus of blood contained in the meat be but 10 grams instead of 17, the commissariat pays daily at the same rate for 5000 lb. of blood as for meat. In a year this quantity amounts to 1,850,000 lb. If the price of meat be reckoned at no more than 50 Pfen. (6d.) per lb., it results in a yearly loss of 912,500 Marks, apart from the fact that the men have not received their full portion of meat.



## RECAPITULATION.

All I have said hitherto can be summed up in the following statements :—

(1) FROM THE POINT OF VIEW OF THE PROTECTION OF ANIMALS THERE IS NO MORE HUMANE METHOD OF SLAUGHTER THAN THE "SHECHETA," for

(a) This method causes in the quickest and safest way loss of consciousness and insensibility.

(b) The cut with the extremely sharp and smooth-edged knife is entirely painless, and encounters very few sensitive nerves in the neck.

The tying and casting of the cattle previous to the act of slaughter, can on the one hand be easily performed with the aid of the numerous existing apparatus, without causing the slightest pain, and on the other hand, has the great advantage of guaranteeing the safety of the people employed in the slaughter-house.

(2) FROM THE POINT OF VIEW OF HYGIENE THERE IS NO MORE RATIONAL METHOD THAN THE JEWISH ONE, for

(a) The copious and much more rapid escape of blood, and the epileptiform convulsions appearing towards the end of the bleeding, cause in the body of the slaughtered animal the development of lactic acid, which, combining with potassium phosphate, transforms the latter into potassium tartrate and dihydrogen potassium phosphate. Dihydrogen potassium phosphate impedes the development of micro-organisms and the formation of the products of putrefaction (ptomains and other poisonous substances), and considerably improves the taste of the meat.



(b) The epileptiform convulsions render the blood that is still left in the meat less alkaline, and diminish therefore its properties as a nutrient medium for bacteria.

(c) The epileptiform convulsions render the meat more tender and give it a better appearance.

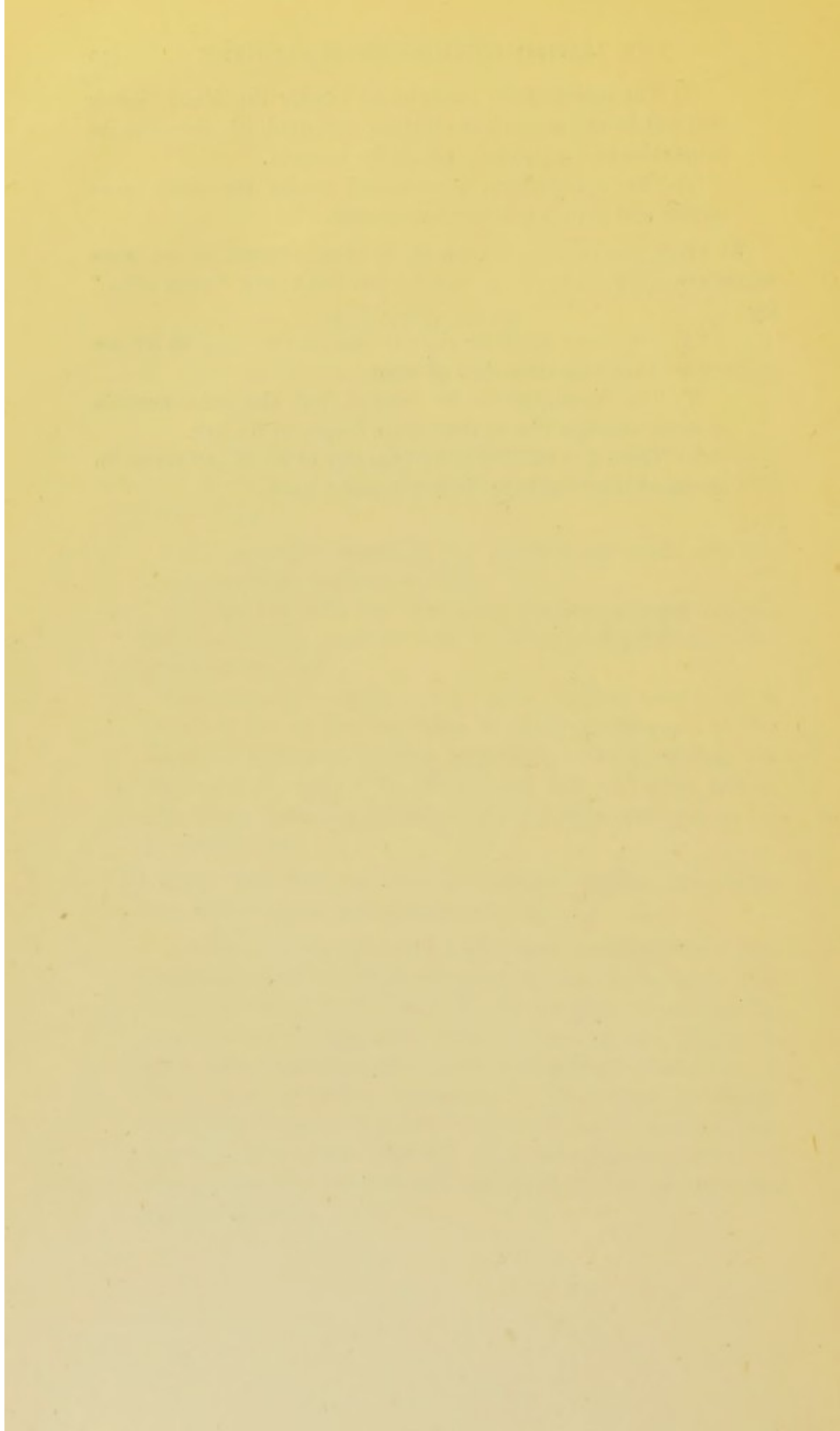
(3) FROM THE POINT OF VIEW OF ECONOMY THERE IS NO MORE RECOMMENDABLE METHOD OF SLAUGHTER THAN THE "SHECHETA," for

(a) The early onset of rigidity makes the meat fit for use sooner than any other sort of meat.

(b) The decomposition is delayed, and the meat even in summer remains two to three days longer fit for use.

(c) There is a much smaller quantity of blood and water in the meat, and the buyer is not imposed upon.

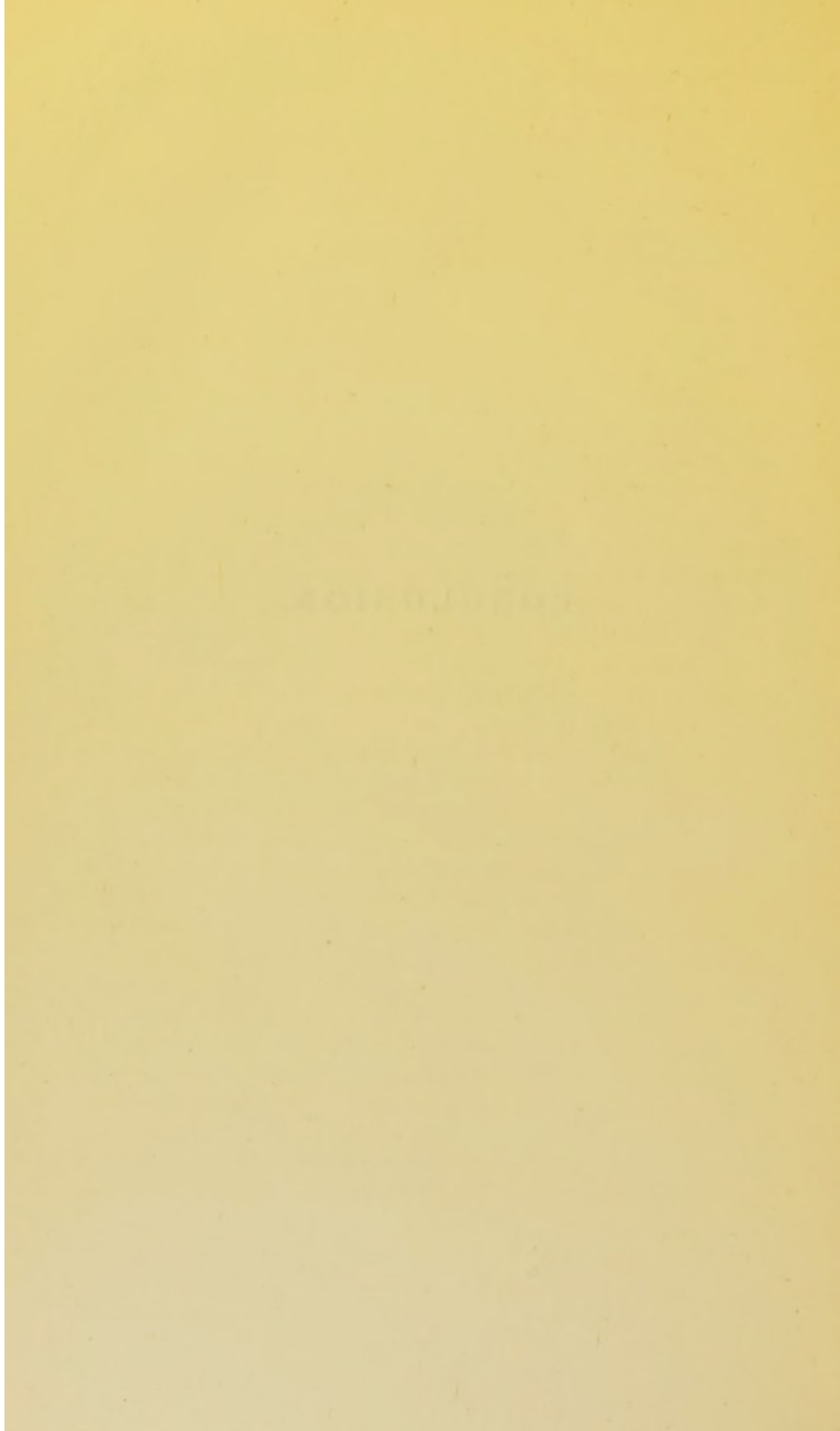






## CONCLUSION







## CONCLUSION.

IN bringing before the public the results of my physiological and analytical investigations and personal observations in slaughter-houses, I may once more emphatically state that it has always been my sincere endeavour in the study of the present question to deal with it and judge it in a totally impartial spirit. To avoid any shade of personal bias, I have in each doubtful case repeated the experiments in the presence of a second expert. With no less zeal than any other member of a Society for the Protection of Animals did I take up the study of the matter, and I likewise thought at first that there must exist serious faults in the Jewish Method of Slaughter to justify its being designated an act of cruelty. And it was natural indeed that I should suppose so. "If so many Societies for the Protection of Animals," said I to myself, "condemn this method as barbarous and so strenuously insist upon its suppression, they must surely have powerful reasons to urge in justification of their demand." Only after I had carefully read and gone into all that was written against the Jewish Method of Slaughter during forty-four years, and after I had at last learned to know the different and at times not quite legitimate means which the agitators against the Jewish method do not disdain to employ, did I acquire the conviction that the majority of these gentlemen are not in the least concerned with finding which of the slaughtering methods is fraught with least pain to the animal, but are influenced by quite other motives. It cannot be doubted that many of them were at first led to take part in the agitation against the Jewish method from their conviction that it was really a cruel one, but passion has clouded their judgment, or they could not now so unscrupulously ignore notorious facts.

On reading the publications issued by Animal Protection Societies during 1850-60, the years in which this question first



rose into notice (originally in the Waadt canton in Switzerland, and subsequently in Aargau, Endingen, and Lengnau), we may recognise the enormous difference in the character of the attacks made on the Jewish method then and now. When, during the first ten years, the agitation against the method was taken up by this or that Animal Protection Society, it was really based on the supposition that slaughter by this method was attended with torture to the animal, and the matter was immediately set at rest when a declaration was forthcoming from an authoritative source that the Jewish method was absolutely no more cruel than any other. But during the last ten years, which have witnessed so great a spread of Antisemitism in Germany, those attacks have been of quite a different character. Unfortunately the inventors of new and, judged at first sight, excellent methods have most effectively played into these gentlemen's hands, and the fact that these vaunted methods were so soon proved to be worthless and had to be rejected did not matter to them in the least. The history of this question shows that the agitation against the Jewish method flashed up like lightning the very instant that any new apparatus for slaughtering loomed on the horizon, without the least trouble having been taken to test its effectiveness. It is only necessary to read the printed reports of one and the same society to see how now one and now another slaughtering method is selected as the best at one meeting, condemned at the next as an infliction of torture, and again at the third recommended as the most humane method for depriving an animal of life.

The following facts will furnish abundant proof of the extent to which these societies grope in the dark on the question of the best slaughtering method. On the 22nd of January, 1886, the Geneva Society for the Protection of Animals drew up a regulation (*Règlement pour le mode d'abattage Israélite*) providing that, as an improvement upon the Jewish method from a humane point of view, the animal to be slaughtered should also receive the neck-stab immediately after its throat had been cut. I have already shown, in my papers read before the Medical Society of St. Petersburg, the true light in which this "improvement" must be viewed. By sawing through the heads of several oxen killed by this stab, I showed that it is not possible with the ordinary stab to pierce the *medulla oblongata*, and that terrible pain is inflicted on the animal



by the dagger piercing the most sensitive nerves. This stab, which paralyses the motor centres, is nothing more than a convenient method of getting the animal down, the application of which after the throat-cutting is without conceivable object since the animal then lies on the ground and is bleeding to death. Passing over the deterioration in quality of the meat caused by the stab through paralysis of the nerves controlling the blood-flow, and consequent insufficient bleeding, the fearful pain may have the effect of restoring to the animal the consciousness of which it had been deprived through anaemia of the brain. It is well known to every doctor that a person suffering from an illness, in which loss of consciousness occurs, such, for instance, as brain fever, may be temporarily restored to consciousness by irritation of any very sensitive nerves—*i.e.*, by causing him an intense pain. Notwithstanding this, the method of stabbing is calmly practised in Geneva and other places, a “finishing touch” to the Jewish method, and has even been imported here into Russia, where it has found its way into the slaughter-houses of St. Petersburg, Moscow, and other towns. But the result of my investigations into the matter, supported by the testimony of the other members of the Commission, will doubtless be its abandonment as cruel and unnecessary at no very distant date.

So that this absurd regulation, the fruit of the ill-advised haste of a misguided Society for the Protection of Animals, has only served to inflict further and absolutely needless pain on the animal slaughtered!

No less absurd is the demand made for humanitarian reasons by many other of these societies that the animal should be struck on the head with a poleaxe after the bloodvessels of the neck have been cut through. Even if the blow be struck at the soonest possible moment, the space of time which elapses between the cutting and the blow must for purely technical reasons be so long that the animal will already have lost consciousness through the brain being emptied of blood. Thus, from the humane point of view, this “finishing touch” would be anything but an improvement, while hygienically it would most certainly be a change for the worse, since the paralysis of the vasomotor nerves which follows the blow would largely diminish the outflow of blood.

As we have already said (see p. 31), the Paris Society for the



Protection of Animals in 1894 awarded M. Bruneau the first prize for his mask, which, however, has not only been rejected in foreign slaughter-houses as useless, but is not even applied in the slaughter-houses of Paris itself, on account, probably, of its ineffectiveness. We ask, with all respect for the exertions of these societies in other directions, is it possible or permissible, in the face of these and other attempts on their part to solve the question of the best slaughtering method, to leave the decision in the matter to them, and to make their demands and contentions without more ado the ground for practical measures and modifications? The solution of a question of such paramount importance to the community should be entrusted only to the governmental authorities possessing full facilities to obtain from competent judges a thorough insight into the true state of affairs. The fact that the stab in the back of the neck, condemned by many German Societies as barbarous, was regarded by the Russian Societies for the Protection of Animals as the ideal method until recently (until the above-mentioned Commission had given in its Report), the fact also that in some places in Germany, as, for instance, in Leipzig, warm commendation is given to the Bruneau mask, which, after being tested in Berlin, was pronounced cruel and replaced by the poleaxe—these facts alone are sufficient to prove that these Societies are not the tribunal whose decision on the present question can be regarded as final. When the researches of competent judges, men of scientific attainments and practical experience, have resulted in showing one method to be the best, then it will be the province of these Societies to direct their vigilance to the suppression of those methods which science has declared to be cruel and barbarous.

I cannot indeed hope that certain members, who unfortunately too often possess a preponderating influence in these Societies, will allow any consideration for the facts I have stated to modify their conduct. If these gentlemen were indeed actuated by a desire to find a good and as far as possible painless method of slaughter, their mode of procedure would be very different from what it actually is. Far from imitating the example of the Russian Central Animal Protection Society, and honestly striving by experiment and investigation to get to the facts of the case, and shape their conduct accordingly, the chief business of these



gentlemen is to introduce as much confusion and obscurity as possible into the question by the misrepresentations which they cause to be circulated in thousands of leaflets. The following is an example of the underhand proceedings of those persons who, in the name of the preservation of "Public Morals," preach a campaign against slaughter by the Jewish method.

In Nos. 35 and 37 of the leaflets issued in the name of the Berlin Society for the Protection of Animals were detailed what purported to be the investigations made by the distinguished physiologists, Professor Du Bois-Reymond, of Berlin, and Professor Brouardel, of Paris. On reading these leaflets, I was totally at a loss to understand how these men of distinguished position in the scientific world could make statements in direct contradiction to the most elementary principles of physiology, medicine, and hygiene. As I myself had thoroughly dealt with the question and arrived at quite opposite results, I immediately communicated by letter with Professor Du Bois-Reymond, requesting him to kindly inform me how he had arrived at the conclusions published in his name by the Berlin Society. In reply I received the following letter, written by the illustrious *savant* in person.

"BERLIN, November 2, 1893.

"To Dr. J. DEMBO, of St. Petersburg.

"DEAR DOCTOR,—In No. 35 of the organ of the Berlin Society for the Protection of Animals, which you have been kind enough to send me, the following words occur, printed in bold type: 'The profound scientific researches of the eminent physiologist, Professor Du Bois-Reymond, have thoroughly established the extremely important fact that the fear and suffering endured by an animal killed in the Jewish manner before and during the slaughtering has such a deteriorating effect on its flesh as to make it unfit for human consumption. This flesh is further liable to more rapid decomposition, and its bad qualities are especially seen when it is salted.' And in No. 37: 'The researches of the physiologist Du Bois-Reymond have definitely proved that a dangerous deterioration is caused in the quality of the blood of an animal which has been terrified and tortured during slaughter. This strikingly confirms the supposition that in the case of animals which are not stunned before the slaughtering, the blood is wrought to such a



feverish condition by pain and fear that the meat becomes unwholesome.'

"In accordance with your request, I hereby declare, empowering you to use this declaration as you may think proper, *that the above statements, in so far as they concern me, have not the slightest foundation in truth. I have never undertaken such researches as are above ascribed to me, and I further regard them as absurd, and their so-called result as false.*—Faithfully yours,

"E. DU BOIS-REYMOND."

Professor Brouardel, in Paris, to whom, as I have said, the Society's organ also referred, wrote as follows to Dr. Klein, who had at my request communicated with him:

"FACULTÉ DE MÉDECINE, PARIS, November 7, 1893.

"DEAR COLLEAGUE,—I have never expressed an opinion on the slaughtering question or on the advantages or disadvantages of any method of slaughter. You may therefore give the *démenti* to all statements on this head.—Yours,

"BROUARDEL."

Is it possible, after the exposure of such machinations (and I could if necessary quote many similar cases), for one who has really at heart the prevention of cruelty to animals to retain the slightest belief in the good faith of these gentlemen? If they were indeed earnest in their professions they would do better, instead of wasting their time and trouble, and expending large sums in the production and circulation of these leaflets and the insertion of biassed articles in the newspapers against the Jewish method, to turn their attention to the matter of finding some apparatus for laying an ox gently down, and to direct their energies to the suppression of those barbarous and shocking offences against humanity with which slaughter by other methods is really accompanied. Or perhaps they do not know that in order to catch every drop of a sheep's blood, which fetches a very high price, and at the same time to avoid as much as possible damaging the tender flesh of the neck, the butcher makes a single opening with the dagger in the neck, and then stands calmly by and with a stick prevents the slowly flowing blood from



clotting too rapidly ; that in order to obtain a really white calf's head it is the custom to cut the head slowly from the living animal, beginning at the nape of the neck ; that in many slaughter-houses sheep are kept for hours together stretched out upon a sort of rough table made of long slips of wood, their feet being fastened in the spaces between the slips, to save the butcher the trouble of tying them up ; that in many places, as, for instance, in Leipzig, dozens of calves and sheep are kept standing in the place of slaughter itself, and witness the killing one after another of their companions ! Or are those gentlemen unaware of the fact, communicated to me by Dr. Hertwig, Director of the Berlin slaughter-house, that often pigs into whose skull the bolt of the Kleinschmidt apparatus has already been driven are nevertheless quite unstunned and must be killed by a stab in order that the firmly fixed bolt may be drawn out again ? Do these protection-pledged knights not know that pigs stunned by their much-vaunted Kleinschmidt apparatus often spring quite alive out of the cauldron of boiling water into which they are thrust immediately after the so-called stunning ? Would it not be much more humane, even if economically not so advantageous, to first cut through the blood-vessels of the animal's neck with a long sharp knife ?

Instead of putting an end to these veritable cruelties to animals the so-called Societies for the Protection of Animals direct their attacks against a method so adequate as the Jewish, which fulfils every required condition. There is no scientific question on which unanimity of opinion reigns among experts to a greater extent than on the question of *shecheta*, which all authorities on physiology and veterinary surgery agree in declaring to be the most rational and humane of all the slaughtering methods. When we read the opinions expressed respecting the Jewish method by the eminent physiologists of various countries, it seems exactly as though an understanding had been previously arrived at between them on the different points involved. The supposition that these eminent men, true pillars of science, would make statements at variance with their actual opinions, could not be entertained for a moment by any person in the full possession of his reason. Is it not an enormity in this boasted nineteenth century, with all its parade of respect for science and science workers, that a small set of people, who at bottom have little in common with science in general and



medicine in particular, should publicly charge men of such great authority as Virchow, Du Bois-Reymond, &c., whose names are heard with respect by educated men all over the globe, with being incompetent to decide the slaughtering question—a purely physiological question be it remembered, which could be dealt with by any medical man of proper scientific attainments!

In Saxony and Switzerland the Jewish, the best of all methods, has been, at the instance of sentimental laymen, declared barbarous and illegal. I should like to see the physician who could, without losing all respect for himself, attempt to justify this suppression and maintain that the Jewish method is really a barbarous one.\*

I myself cannot entertain any doubt that when a decision has been pronounced on the slaughtering question, not by single individuals, but by the medical and veterinary societies, it will not be long before the Jewish method *is recognised on all hands as the best, and made obligatory everywhere*. If either the method of stunning or slaughtering by the mask is really the most humane, then why is it not employed by Governments for the execution of criminals, with whom the method will have a much more sure result, the human skull being so much thinner? Yet we see that the guillotine is employed for executions, a method of killing that much resembles the Jewish slaughtering method, but which has the drawback, as was proved above, of not being applicable, at least to large animals. When the Emperor Nero condemned his former teacher Seneca to death, allowing him to choose the form of death, which method of dying did the great philosopher and naturalist choose? Did he choose to be felled with a club? By no means. He bade them sever his arteries, wishing to bleed to death. And it is certain that Seneca was at least as humane towards himself as the animal protectors are towards their *protégés*.

One merit, however, cannot be denied these agitators—the merit of having awakened the public interest for this question when it had once been raised. And if the result of their efforts proves quite different to the one they had in view: when the Jewish

\* Unfortunately the grounds are not known on which the Commission in Saxony rested their judgment that the Jewish method is repugnant to humanity, and I cannot therefore deal with them here. All my efforts to obtain authentic information on this head were quite unsuccessful.



method of slaughter, instead of being rejected and suppressed, shall have incontestably established before the tribunal of science its full, its exclusive, right to existence; when the Government, in response to the behests of science, shall have taken adequate measures for the introduction of the Jewish method everywhere—then will its present zealous opponents yet be able to reconcile themselves to the fact and to reflect with a certain satisfaction that they also, though unintentionally, have contributed something to this most desirable result. Those knights of humanity, however, whose sole object it is to deprive their Jewish fellow-citizens of their morsel of meat, will have to wait for the realisation of their hopes until such time as the circulation and pressure of the blood in an animal have been modified and until the skull of the ox changes so as to resemble man's. As long, however, as the thickness of the skull and the laws of the circulation of the blood in an ox have undergone no modification, the effort to find a method superior to that of rapid outflow of blood will be fruitless. The only hope which the opponents of *shecheta* could still have cherished—that of slaughtering by electricity—has now vanished, since this method, apart from its spoiling the meat, has been proved to be anything but humane by the recent execution experiments.

When, on examining the slaughtering question, it becomes apparent that each new invention, each new apparatus, has been fraught with fresh suffering to the animal for the shambles, then we may think of that saying in Börne's "Aphorisms":

"When Pythagoras discovered his well-known theorem, his countrymen sacrificed a hecatomb (one hundred oxen) to the gods. Since then the oxen tremble whenever a new truth comes to light." In the present case it is the question of anything but the discovery of new truths, but the oxen have only so much the more reason to tremble when the "Animal Protectors" and opponents of the Jewish method "invent" a new method of slaughter.



