these appendices corresponds to that secreted by the pancreas in man, and is just as important in the process of digestion. The Bicher, found in the Nile, possesses only one appendix, while several of the soles have but two small pyloric ceca. The food-fish has two large ones. Bony fishes as a rule have several or many cecal pouches attached to the commencement of the alimentary canal. The cecum is absent in the carp, eel, lamprey, ray, shark, and many others; however, they are extremely numerous in the electric eel.

It is interesting to know that pyloric ceca have been found in types of still lower subkingdoms.

The common cockroach (*Pesiplaneta orientalis*) has a whorl of eight ceca arranged around the commencement of the chylific stomach, the function of which is probably analogous to that of the liver.

The cellar slug (*Limnea flavus* S. varagatus) has a cecal projection at the pyloric end of the stomach.

The starfish are the lowest class of animals in which a distinct cecum is found. The radial arrangement of the digestive or hepatic ceca may be found in the first ray.

CECUM AND VERMIFORM APPENDIX IN MAN. ANATOMY.

The minute structure of the appendix offers a wide and unbroken field for research. There is very little literature on the histology of the appendix, either normal or pathologic. It is known, however, that the appendix resembles in a general way the other intestines in structure. The little that is known can be comprised in the statement that the fibers are arranged spirally, and that adenoid tissue is found in its structure. A fold of peritoneum forming a mesentery is often found, the blood supplied by a branch of the superior mesenteric artery which varies in size. The nerve supply to the superior mesenteric artery extends from the small intestine and large bowel and from the appendix to the splenic flexure.

APPENDIX VERMIFORMIS.

This is attached to the lower and back part of the cecum. It is a long, narrow, worm-like tube. It varies from one to sixteen inches in length, and its normal diameter also varies greatly. Usually it points upward and inward behind the cecum. It has been found absent but five times in 10,000 autopsies. This is probably due to it being covered by peritoneum, for when so concealed its presence can not be detected by sight or the sense of touch. Its length, diameter, position and caliber of its lumen greatly vary. An infant at the time of birth may have an appendix as large in every particular as a giant. The valve of Gerlach is proportionately larger in infancy than in old age, the after-stenosis is probably due to prolonged irritation.

THE CECUM.

In man the cecum is $2\frac{1}{4}$ inches in length and 3 inches wide. It is the most dilated part of the tube, measuring $2\frac{1}{2}$ inches in the vertical and transverse diameters. It varies in position, but usually rests upon the psoas muscle, placed so that the apex projects beyond the inner border of that muscle in the male. In the female the apex lies internal to the psoas muscle as the pelvis is broader, thus causing that muscle to deviate more to the right than in the male.

The apex may be internal or external to Poupart's ligament, upon the pelvis brim, or within the pelvis and covered entirely by the peritoneum, a condition not infrequently found.

In the new-born child the cecum is quite undeveloped and the difference in size between the large and small intestine is nearly imperceptible. This is true in health during youth. In the middle age only does the cecum become much more extended than the small intestine.

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ZOOLOGY IN THE MEDICAL SCHOOL CURRICULUM.

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Let it be admitted from the start that this paper is written from the standpoint of a zoologist, hence that it is not entirely free from the charge of being a biased statement; let it also be admitted that the medical school curriculum is already full to overflowing; further, that it is not the function of a medical faculty to give to a man a general education, but rather to teach him to diagnose diseases and prescribe treatment.

In order to avoid misunderstanding, the writer makes these admissions at the outset; yet he nevertheless contends that zoology should have its place in the medical curriculum, just as much as should chemistry and botany. It is not contended that elementary or general zoology should be taught, any more than it would be contended by a chemist or by a botanist that elementary or general chemistry or botany has an inherent right to representation. All fair-minded men will, however, admit that a medical curriculum which failed to recognize certain specialties of chemistry and botany, for instance toxicology and bacteriology, would indeed appear strange and would not be entirely free from criticism.

To the writer, as a zoologist, it seems no less strange that few medical schools in this country recognize medical zoology as one of the subjects to be taught. Nor does this fact appear to be explained by any requirements of a general or special knowledge of zoology before beginning to study medicine. On comparing the medical schools of America with those of Europe, it may be noticed that the transatlantic faculties, almost as a rule, either require zoology of a student before he begins medicine, or require it during his course, or offer it to him as an elective. Of American medical faculties—not including the veterinary schools—there are only three, so far as my personal knowledge goes, which recognize medical zoology in the curriculum.

I do not refer in this paper to histology and embryology, which all medical schools teach more or less, nor even to teratology and evolution; but reference is made to the practical and intimate relation which zoology bears to disease and to public hygiene. And it is submitted that since medical schools prepare students to practice medicine, medical zoology should be included in this preparation, with just as equal right as medical chemistry or medical botany. It is submitted

that just as we give special lectures on the chemicals (poisons—biochemistry and toxicology) and plants (bacteria—bacteriology) which cause disease, so if our instruction is not to be one-sided, we should also give courses on the animals which produce pathologic conditions.

Such a course should be placed in the third or fourth year of medical studies. Experience has, in fact, taught that it is not altogether satisfactory to give these lectures to the second and still less to the first year men. The course should be composed of both lectures and laboratory work. Text-book work is not entirely satisfactory, because the works on medical zoology thus far published are either treatises which are more suited as works of reference than they are as text-books, or are too brief and "too zoological" to be of much practical use. Moreover, with all the new work in this line, the subject advances from day to day, so that at present text-books published prior to 1900 are already more or less out of date. The instructor should not spend his time discussing the newest theories of cytology and heredity, but should bring forward practical zoologic information of which the physician can make practical use. The amount of such data will depend primarily on the amount of time allotted to him and on his own experience in the zoologic groups in question. The ideal plan is that followed by the Paris School of Medicine, where there is a regular chair of medical natural history, now occupied by Raphael Blanchard, who takes up such biological subjects as in his judgment are useful to the students. He can, for instance, give a course on parasitic diseases one term for the entire class, a ~~more~~ special one on teratology another term, while during a third he may take up some other special field, of interest perhaps only to a few students, hence only a few will attend.

Such an arrangement is scarcely feasible at present in the majority of American medical schools. Some instruction is, however, feasible, and as a basis for this I would present the following as a general outline: Two to six lectures may be given as an introduction, according to the time allotted. In these may first be discussed the different degrees of parasitism, and the relation of parasitism to climate, seasons, age, sex, race, personal habits, etc.; the different ways in which parasites affect their hosts; the general and public hygienic measures; the classification of parasites. At this point an hour should be given to a discussion of the classificatory names and the rules which govern them—rules of nomenclature. The object of presenting this rather special subject to medical students is to show them the methods of nomenclature followed in a science where we deal with hundreds of thousands of technical names, basing their use on a certain system; by so doing we can give to some of the future bacteriologists the experience of a century and a half of nomenclatural work in zoology, so that they may some day succeed in rescuing the nomenclature of bacteriology from the frightfully chaotic state into which it is falling, or has already fallen.

From this subject the lecturer can pass to the lowest animals, and discuss *Amiba coli*, described as the cause of amibic dysentery; after reviewing the various other amibæ reported for man—for instance, *Amiba intestinalis*, *A. urogenitalis*, *A. buccalis*, etc., he can take up the three parasites of malaria—*Plasmodium malariae*, *P. vivax*, *P. præcox*—and discuss the disease from a zoologic standpoint, its transmission by *Anopheles*, but not by *Culex*, etc. Next, reference would naturally be

made to Texas fever, caused by another sporozoon—*Piroplasma bigeminum*—for which a tick known as *Boophilus bovis* is the intermediate host. The national economic importance of and quarantine against the disease can be referred to; also the economic importance of diseases of fish produced by the *Myxosporidia*, and of silkworms, produced by *Microsporidia*; the *Sarcosporidia*, as well as Gilchrist's *Coccidioides*, and the parasitic theory of cancer should, of course, be mentioned.

Passing up in the animal kingdom, the various ciliate and flagellate parasites of man—none of them of much medical importance—can be touched on; then the medicinal sponges should be exhibited, while they and the coelenterata can be described in the various medical relations—as accessory instruments, as instruments for murder, as cause of urticaria, as producing shock, as treatment used in various countries.

Next naturally follow the trematode worms, which are parasitic in man—*Monostomulum lentis*, *Agamodistomum ophthalmobium*, *Fasciola hepatica*, *Fasciolopsis Buskii*, *Paragonimus Westermanii*, *Dicrocoelium lanceatum*, *Opisthorchis felinus*, *O. sinensis*, *Heterophyes heterophyes*, *Schistosoma hæmatobium*, *Amphistoma hominis*. Most of these parasites have been unimportant for the American medical profession, up to the present time, but now that *Paragonimus* is established in this country, it becomes of no little importance as a cause of parasitic hemoptysis and Jacksonian epilepsy. Furthermore, our troops being in Asia, now make *Opisthorchis* and *Fasciolopsis* important genera for us.

The tapeworms come next: *Tænia solium*, *T. saginata*, *T. confusa*, *T. africana*, *Dipylidium caninum*, *Hymenolepis murina*, *H. diminuta*, *Davainea madagascariensis*, *Dibothriocephalus latus*, *D. cordatus*, *Diplogonoporus grandis*, *Ligula Mansonii*, and the troubles they produce: also hydatid disease and pseudotuberculosis caused by larval tapeworms.

It seems remarkable to me that most physicians do not appear to go beyond the fact that a patient has a tapeworm. What particular species is present does not interest him. This lack of detail is a natural result of not presenting to the students the difference in medical importance represented by the various species.

Following the tapeworms, the round worms of man may be discussed: *Ascaris lumbricoides*, *Oxyuris vermicularis*, *Strongylus longevaginatus*, *Uncinaria duodenalis* and its relation to anemia, *Diocetophyme renale*, *Trichuris trichiura*, *Trichinella spiralis*—as cause of trichinosis—*Filaria* and elephantiasis, *Strongyloides* in diarrhea, *Gordius*, *Mermis*, and *Gigantorhynchus*.

After the worms come the parasitic arachnoidea: *Sarcoptes*, the cause of itch; the national economic importance of *Psoroptes*; *Demodex*; the ticks; and *Linguatula* and *Porocephalus*. Here are also discussed the poisonous spiders, scorpions, etc. Then the insects, both as pests and as transmitters of disease; finally the poisonous snakes.

I do not insist that every physician should keep the above scientific names in mind, but I do submit that with so many American troops in the East, every physician who pretends to know that tuberculosis is produced by the *Bacillus tuberculosis* should also know that parasitic hemoptysis—so common in Asia, and already introduced into this country—is caused by *Paragonimus*; I will not insist on his being able to recall all the various liver-flukes by their eggs or names, but it is not unreasonable to maintain that he should know that quite a common liver disease in Asia is caused by

Opisthorchis sinensis, while the Russian troops—with whom our troops have been associated—are subject to *O. felinus* (*O. tenuicollis*); hence some of the liver troubles of which our returning troops are likely to complain can be diagnosed only by recognizing the eggs of these worms in a microscopic examination of the feces. I do not argue that our medical students should be able to distinguish the millions of insects in the world, or that they should make a collection of beetles instead of bones, but in view of the demonstration that certain species of mosquitoes, belonging to the genus *Anopheles*, transmit malaria, other mosquitoes belonging to the genus *Culex* transmit filarial elephantiasis, and *Culex fasciatus* is now alleged to transmit yellow fever, it does not appear extreme to advance the view that physicians should know something about the breeding habits of these insects. It is not the intention to try to introduce abstract zoologic work into medical colleges, but when we consider how often patients are treated for worms when they have none, and how often they have some which for a long time escape diagnosis it seems justifiable to suggest that if medical students were taught how to distinguish the eggs of various orders by a microscopic examination of the feces, the liability to error in diagnosis would be diminished.

The time will probably never come when our professors of practice will think it best not to discuss malaria, dysentery, trichinosis, and other diseases associated with animal parasites, and we should in fact be opposed to having the clinical side of these maladies turned over entirely to zoologists. Still, the subject of practice is so broad that no one man—not even an Osler—can hope to keep up to date in the entire literature bearing on all its phases. By common consent the chair of practice surrenders the phytoparasites to a botanist or a bacteriologist, and my contention is that if our medical schools are to keep abreast of the times in practice, pathology, and hygiene, the subject of animal parasitism should be treated in a special course, by a special man, preferably by a professional zoologist, if the services of one who has worked in the groups in question can be obtained, otherwise by a physician who has had a general zoologic and special helminthologic training.

Such a course as outlined above should be allotted between twenty and thirty lectures and at least three laboratory exercises, although under pressure the field may be covered—though with less satisfaction to the instructor—in about eighteen lectures.

ANTIPNEUMOCOCCIC SERUM TREATMENT OF PNEUMONIA, WITH REPORT OF CASES.*

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DISCOVERY.

In 1888 Netter rendered mice and rabbits immune to pneumonia by injecting them with a fluid prepared from the dried spleen of infected animals. Later he used an old pneumococcus pleuritic exudate, and still later the sputum of a pneumonia patient after the crisis.

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Foa was able to produce, in animals, an immunity lasting several months, by injecting a serum made by a precipitation of a bouillon culture of the pneumococcus with ammonium sulphate and repeated filtration. His method was to inject the filtrate intravenously into rabbits for three or four days. Later he made an extract of the muscles and viscera of a rabbit, dead of pneumonia; precipitated it in the same way, used it in the same manner, and was able to produce the same immunity; though a similar extract from a healthy rabbit produced no effect.

Klemperer Brothers experimented with a pneumococcus pleuritic exudate which was demonstrated, by cultural methods, to contain no living organisms. They injected two rabbits with 20 c.c. each, and fourteen days later they inoculated both these animals with a virulent culture of the pneumococcus. Both survived, though the control animal died. They also succeeded in rendering dogs immune. Later they demonstrated the curative properties of the serum of animals rendered immune to pneumococcus infection.

Pane and De Renzi inoculated animals with the pneumococcus, and from them obtained a powerful antipneumonic serum. They submitted their results to the Medical and Surgical Academy of Naples, and this body, after repeated tests, declared the serum to be of great value. The harmless character of the serum was also established by the injection into men of 200 c.c. in twenty-four hours, without the experience of any inconvenience. The Klemperers advanced the theory that during the course of pneumonia there is developed in the blood a poisonous albumin called pneumotoxin, and that the system elaborates an antipneumotoxin, this latter substance causing the crisis. They were able to demonstrate the presence of the antipneumotoxin in the blood of pneumonia patients after the crisis; and they also succeeded in curing the disease in animals by the use of antipneumotoxin.

NATURE.

Vaughan considers that the action of the serum is antimicrobial and not antitoxic. McFarland says the nature of the serum is uncertain; it may be antitoxic or antimicrobial, probably antimicrobial. Lambert considers that it may be bacteriolytic in its action.

A. H. Smith says whether the antitoxin is the product of the pneumococci or is simply the result of changes going on in the leucocytes, preparatory to their disintegration, is not yet determined. Smith also cites an observation of Pinna that the pus obtained by injecting turpentine into the cellular tissue of a man, the pus being proved absolutely sterile, had the power, when injected into rabbits, of rendering them immune to inoculations with pus containing pneumococci, though the unprotected animals inoculated in the same manner died of pneumococcus septicemia within thirty-six hours. Smith adds: "It would appear from this that the pus itself, apart from any microbial action, possesses antitoxic properties."

Tizzoni claims that the serum is not only protective against the pneumococcus, but that it protects against reaction to small fatal doses of the tetanus bacillus, while on the other hand the tetanus serum renders the animal less susceptible to pneumococcus infection, and McFarland cites an instance where it protected against the streptococcus.

It may safely be concluded that antipneumotoxin is not a bactericide. The pneumococcus is not killed by contact with it. Instead, the organism multiplies, de-