ters, sinapisms, cupping, etc.), and also by morphine, may be attempted. The use of cold to reduce inflammation in spinal-cord disease is an uncertain procedure, concerning the real effects of which we know but little.

In the destructive stage of these conditions, when paralytic and anæsthetic phenomena are present, rest may still be an important factor. The use of mercury, and of potassium iodide, may be of service in this period to promote the absorption of exudations.

In later stages and in chronic cases the use of tonics, of iron, strychnine, arsenic, etc., is called for. Nitrate of silver may be indicated. Electricity is usually to be avoided in the irritative stage of an acute affection; or, if used, as for the relief of pain, it should be in the form of a gradually increased galvanic current, avoiding interruption. For the paralysis, the interrupted galvanic and the faradic currents, to produce muscular contractions, and spinal applications of the uninterrupted galvanic current, are of value, as are also massage and passive movements. For anæsthesia, the faradic brush is often serviceable.

Extreme care and cleanliness are essential in all cases of paraplegia, and the avoidance of pressure and irritation over the buttocks and sacrum, on account of the danger and frequency of bedsores. Attention must be paid to the bladder and rectum. Catheterization, conducted with extreme cleanliness, may be necessary, and also antiseptic irrigation of the bladder. Constipation must be prevented by cathartics, enemas, etc. Compression myelitis from caries, dislocations, fractures, and other traumatisms requires appropriate surgical treatment.

W. R. Birdsall.

PARASITES.—A parasite is an organism which lives, temporarily or permanently, within the body or on the surface of some other living thing upon which it feeds. Evidently, then, not only may there be both phytoparasites and zoöparasites, but also that form which is parasitized upon and is known as the host may be equally either plant or animal. Among forms which find in man at some time or in some region a subject for attack, the phytoparasites include the prominent group of bacteria which have received attention elsewhere, and a few fungi of etiological importance, in dermal affections chiefly, which have also been discussed. Here will be given a brief discussion of the animal parasites of man, with especial reference to their biological and etiological relations.

It is important to notice first the wide range in degree of parasitism exhibited and the manner in which the various grades merge into one another, producing a scale of dependence in which almost every stage is represented. Most independent of all are the temporary parasites, like the mosquito, bedbug, or leech, which stay by the individual host only long enough to secure a single meal, and which present clearly the structure and habits of free living organisms. Some leeches suggest most plainly the close relation between the carnivorous and the parasitic habit since they often devour bodily small aquatic forms, but when favored by opportunity extract the blood of larger animals. More dependent are such forms as the fleas which can change their host and often do so, and yet their structure has been highly modified in the loss of wings which are generally characteristic of insects and by the development of powerful leaping and grasping organs. Somewhat further modified in the direction of parasitism are the lice, which, moreover, lack special means for effecting a change of host, and may be included among the list of stationary parasites—*i.e.*, those that remain with a single host constantly, or at least for considerable periods of time.

All of the forms thus far noted are parasitic upon the exterior of the host, and consequently are denominated Epizoa or ectoparasites. All human ectoparasites belong to the group of Arthropoda, and include both mites (*cf. Arachnida*) and true insects (*cf. Insects*). Among the water-living animals, however, soft-bodied forms, such as flat worms (Trematoda) and unicellular animals (Protozoa) occur as Epizoa. With the gradual assumption of an aërial or terrestrial existence on the part of the host such parasites were necessitated, if they had not already sought more sheltered regions, now at least to abandon the external surface and to colonize internal organs where thin mucous membranes afforded facilities for extracting nourishment similar to those which existed on the thin outer skin of the aquicolous animal. The choanæ, pharynx, gills, lungs, alimentary canal, and even the bladder were thus invaded by forms whose kinship to the ectoparasitic species on these lower animals is too plain to fail of recognition.

The Entozoa or endoparasites of man, however, do not even belong to the same branch of the animal kingdom as the forms ectoparasitic upon him, with the single exception of the rare and aberrant Linguatulids, now usually regarded as highly degenerate arachnids (*q.v.*), though formerly classed with the Cestoda. The human Entozoa include Protozoa, Trematoda, Cestoda, and Nematoda, and many of them are highly modified in adaptation to the parasitic mode of existence, as compared to the related free living forms which, however, are entirely wanting in the second and third groups listed.

The term helminthology has been used as synonymous with animal parasitology, and yet this is a considerable extension of its original meaning. The Helminthes or intestinal worms included the pre-eminently parasitic groups, such as Trematoda, Cestoda, and Nematoda, while the Protozoa, Arthropoda, and even the few parasitic Terbellaria, which are in fact closely related to Trematoda, were omitted. The term became thus one of convenience rather than of scientific accuracy.

It is necessary to emphasize the fact that neither Helminthes nor parasites constitute a group of systematic value. At most the forms are related in a biologic sense and not structurally, for they are comprehended in several distinct branches of the animal kingdom, and a given form is often more closely related to free living species than to other parasitic forms. Even the narrower term Helminthes embraced forms of little similarity to each other and rightly to be distributed with their related free living species into several distinct groups, namely, the Linguatulida to the Arachnida, the Trematoda and Cestoda to the Plathelminthes, and the Nematoda to the Nemathelminthes.

Location.—While the majority of endoparasites inhabit the alimentary canal and its adnexa, there is no organ which is immune to them. The following list of human parasites arranged according to the organ inhabited will serve to indicate the extent of the parasitic habit, and will assist in the identification of a given form. The records given apply only to the human host. Parasites are entered under the normal location of the species, and in the most frequent erratic location only; a few forms of doubtful standing, as human parasites or of uncertain location in this host, are omitted.

Parasite.	Stage.	Type of parasitism.	Normal habitat.	Recorded in U. S. A.
Skin and subdermal tissue.				
Leptodera Niellyi	Larva	Accidental.	Europe	No.
Gnathostoma siamense	Adult.	Occasional.	Siam	No.
Filaria medinensis	Adult.	Normal	Africa	Yes.
Uncinaria duodenale	Larva.	(?)	Cosmopolitan.	Yes.
Eye.				
Filaria loa	Adult.	Normal	Africa	Yes.
Filaria lentis	Adult.	(?)	(?)	No.
Filaria conjunctivæ	Adult.	Occasional.	Europe	No.
Cysticercus cellulosæ	Larva.	Erratic	Europe	No.
Echinococcus polymorphus.	Larva.	Erratic	Europe	Yes.
Brain and membranes.				
Cysticercus racemosus=cellulosæ.	Larva.	Erratic	Europe	Yes.
Cysticercus acanthotrias.	Larva.	Erratic (?).	U. S. A.	Yes.
Echinococcus polymorphus.	Larva.	Erratic	Europe	Yes.

Parasite.	Stage.	Type of parasitism.	Normal habitat.	Recorded in U. S. A.
Brain and membranes.				
Paragonimus Westermanni.	Adult.	Erratic	Asia	*
Connective tissue.				
Fasciola hepatica	Adult.	Erratic	Europe	*
Bothriocephalus Mansoni	Larva.	Occasional.	China	No.
Cysticercus cellulosæ	Larva.	Normal	Europe	Yes.
Cysticercus acanthotrias.	Larva.	Normal	U. S. A.	Yes.
Echinococcus polymorphus.	Larva.	Normal	Europe	Yes.
Filaria loa	Adult.	Normal	Africa	Yes.
Paragonimus Westermanni.	Adult.	Erratic	Asia	*
Muscles.				
Cysticercus cellulosæ	Larva.	Normal	Europe	No.
Cysticercus acanthotrias.	Larva.	Normal	U. S. A.	Yes.
Trichinella spiralis	Larva.	Normal	Cosmopolitan.	Yes.
Heart.				
Filaria Magalhaesi	Adult.	(?)	So. Amer.	No.
Cysticercus cellulosæ	Larva.	Erratic	Europe	No.
Echinococcus polymorphus.	Larva.	Erratic	Europe	Yes.
Blood-vessels.				
Fasciola hepatica	Adult.	Erratic	Europe	*
Schistosoma hæmatobium.	Adult.	Normal	Africa	Yes.
Echinoccus polymorphus.	Larva.	Normal	Europe	Yes.
Filaria immitis (?)	Adult.	Occasional.	Europe	*
Filaria embryos (see key under Nematoda).		Normal		Yes.
Lymph vessels.				
Filaria Bancrofti	Adult.	Normal	Tropics	Yes.
Filaria volvulus	Adult.	Normal	Africa	No.
Filaria lymphatica	Adult.	Occasional.	Europe	No.
Lungs.				
Fasciola angusta	Adult.	Erratic	Africa	No.
Paragonimus Westermanni.	Adult.	Normal	Asia	*
Cysticercus cellulosæ	Larva.	Normal	Europe	No.
Echinococcus polymorphus.	Larva.	Normal	Europe	Yes.
Strongylus apri	Adult.	Occasional.	Europe	No.
Liver.				
Fasciola hepatica	Adult.	Occasional.	Europe	*
Opisthorchis felineus	Adult.	Normal	Russia	No.
Opisthorchis sinensis	Adult.	Normal	Asia	Yes.
Opisthorchis noverca	Adult.	Normal	Asia	No.
Distoma Rathouisi	Adult.	Occasional?	Asia	No.
Dicrocœlium lanceatum.	Adult.	Normal	Europe	*
Cysticercus cellulosæ	Larva.	Normal	Europe	No.
Echinococcus polymorphus.	Larva.	Normal	Europe	Yes.
Paragonimus Westermanni.	Adult.	Erratic	Asia	*
Small intestines.				
Fasciolopsis Buski	Adult.	Normal	Asia	No.
Opisthorchis felineus	Adult.	Erratic	Russia	No.
Opisthorchis sinensis	Adult.	Erratic	Asia	No.
Heterophyes heterophyes	Adult.	Normal	Africa	No.
Dibothriocephalus latus.	Adult.	Normal	Europe	Yes.
Dibothriocephalus cordatus.	Adult.	Occasional.	Greenland.	No.
Diplogonoporus grandis	Adult.	Occasional.	Japan	No.
Dipylidium caninum	Adult.	Occasional.	Europe	Yes.
Hymenolepis nana	Adult.	Normal (?).	Europe	Yes.
Hymenolepis diminuta	Adult.	Occasional.	Europe	Yes.
Hymenolepis lanceolata	Adult.	Occasional.	Europe	No.
Davainea madagascarensis.	Adult.	Occasional (?).	Africa	No.
Tænia solium	Adult.	Normal	Cosmopolitan.	Yes.
Tænia saginata	Adult.	Normal	Cosmopolitan.	Yes.
Tænia africana	Adult.	Normal	Africa	No.
Tænia confusa	Adult.	Normal (?).	U. S. A.	Yes.
Strongyloides stercoralis.	Adult.	Normal	Asia	Yes.
Trichinella spiralis	Adult.	Normal	Cosmopolitan.	Yes.
Strongylus subtilis	Adult.	Normal	Africa	No.
Uncinaria duodenalis	Adult.	Normal	Cosmopolitan.	Yes.
Uncinaria americana	Adult.	Normal	America	Yes.
Physaloptera caucasica	Adult.	(?)	Caucasus	No.
Ascaris lumbricoides	Adult.	Normal	Cosmopolitan.	Yes.
Ascaris canis	Adult.	Occasional.	Europe	*
Ascaris maritima	Adult.	Occasional.	Greenland.	No.
Oxyuris vermicularis	Adult.	Normal	Cosmopolitan.	Yes.
Gigantorhynchus gigas	Adult.	Occasional.	Cosmopolitan.	No.
Gigantorhynchus moniliformis.	Adult.	Occasional.	Cosmopolitan.	No.

* Present in the United States of America in some other host, hence easily possible in man, although no record of its occurrence in the human host was found.

Parasite.	Stage.	Type of parasitism.	Normal habitat.	Recorded in U. S. A.
Large intestine.				
Gastrodiscus hominis	Adult.	Occasional (?).	India	Yes.
Trichocephalus trichiurus	Adult.	Normal	Cosmopolitan.	No.
Oxyuris vermicularis	Female.	Normal	Cosmopolitan.	Yes.
Kidney.				
Echinococcus polymorphus.	Larva.	Normal	Europe	Yes.
Dioctophyme renale	Adult.	Occasional.	Europe	*
Bladder.				
Leptodera pellio	Adult.	Accidental.	Europe	No.
Anguillula aceti	Adult.	Accidental.	U. S. A.	Yes.

SPUTUM—EGGS.

Parasite.	Frequence.	Size in microns.	Plate E.
Fasciola angusta	Recorded once.	143–151 × 82–88.	
Fasciola hepatica, Fasciola magna, etc.	Not observed, but possible.	Given below under Fæces.	
Paragonimus Westermanni.	Frequent	88–103 × 53–68.	Fig. *a*.
Strongylus apri	Few cases	50–100 × 39–72.	

SPUTUM—EMBRYOS.

Filaria, many species possible (see key under *Nematoda*).

URINE—EGGS.

Parasite.	Frequence.	Size in microns.	Plate E.
Fasciola hepatica, Fasciola magna, etc.	Not observed, but possible.	Given below under Fæces.	
Schistosoma hæmatobium	Frequent	135–150 × 55–66.	Fig. *c*.
Filaria Bancrofti	Recorded once.	25–28 × 15 (or 35 ?).	
Dioctophyme renale	Few cases	64–68 × 40–49.	Fig. *b*, *b'*.
Oxyuris vermicularis†	Common	50–54 × 20–27.	Fig. *d*, *d'*, *d''*.

URINE—EMBRYOS.

Filaria, many species possible (see key under *Nematoda*).

The eggs of the other kidney parasites will not hatch as long as kept in urine.

Adult forms, like accidental parasites of the Nematode type, are so small as to be easily taken for embryos (see Anguillula aceti, etc., under *Nematoda*).

FÆCES—EGGS.

Parasite.	Frequence.	Size in microns.	Plate E.
Gastrodiscus hominis	Recorded once.	150 × 72.	
Fasciola hepatica	Several cases	130–172 × 72–80.	Fig. *e*.
Fasciola magna	Not recorded	109–168 × 75–96.	Fig. *aa*.
Fasciola angusta	Recorded once.	143–151 × 82–88.	
Distoma Rathouisi	Recorded once.	150 × 80.	
Fasciolopsis Buski	Several cases	120–126 × 77.	
Opisthorchis felineus	Several cases	26–30 × 11–15.	Fig. *f*.
Opisthorchis noverca	Recorded once.	34 × 21.	Fig. *ff*.
Opisthorchis sinensis	Several cases	27–30 × 15–17.	Fig. *g*.
Dicrocœlium lanceatum.	Several cases	40–45 × 22–30.	Figs. *h*, *h'*.
Heterophyes heterophyes.	Frequent	26–30 × 15–17.	Fig. *i*.
Paragonimus Westermanni.	Frequent	88–103 × 53–68.	Fig. *a*.
Dibothriocephalus latus.	Frequent	68–71 × 45	Figs. *k*, *k'*.
Dibothriocephalus cordatus.	Reported once.	75–80 × 50.	
Diplogonoporus grandis	Few cases	63 × 48–50.	Fig. *l*.
Dipylidium caninum	Few cases	43–50, embryo 32–36.	Fig. *m*.
Hymenolepis nana	Frequent	39, or 43 × 31.	Fig. *n*.
Hymenolepis diminuta	Several cases	70–86, embryo 36 × 28.	Figs. *o*, *o'*.
Hymenolepis lanceolata	Recorded once.	50 × 35.	
Tænia solium	Frequent	30–35, embryo 20	Figs. *p*, *p'*.
Tænia saginata	Common	(Yolk membrane 70) 30–40 × 20–33.	Figs. *q*, *q'*.
Tænia africana	Recorded once.	31–34 round, or 34 × 39.	Fig. *r*.
Tænia confusa	Two cases	30 × 39.	Fig. *s*.
Strongyloides stercoralis.	Frequent	67 × 37.	Fig. *t*.
Trichocephalus trichiurus.	Common	50–54 × 21–23.	Figs. *u*, *u'*.

* Present in the United States of America in some other host, hence easily possible in man, although no record of its occurrence in the human host was found.

† Only in female through infection of vagina from rectum.

FÆCES—EGGS.—*Continued.*

Parasite.	Frequence.	Size in microns.	Plate E.
Strongylus subtilis	Several cases	63–80 × 35–41.	Fig. *v*.
Strongylus apri	Few cases	50–100 × 39–72.	
Uncinaria duodenalis	Frequent	55–65 × 32–45.	Fig. *w*.
Uncinaria americana	Frequent	64–72 × 36–40.	Figs. *x*, *x′*, *x″*, *x‴*.
Physaloptera caucasica	Reported once.	57 × 39.	
Ascaris lumbricoides	Common	50–75 × 40–50, fertilized.	Fig. *y*, *y″*.
		63–98 × 91–77 unfertilized.	Fig. *y′*.
Ascaris canis	Few cases	72–68, spherical.	Fig. *z*.
Oxyuris vermicularis	Common.	50 × 16–20.	Figs. *d*, *d′*, *d″*, *d‴*.
Gigantorhynchus gigas	Few cases.	80–100 long, oval 85 × 40.	Fig. *dd*.
Gigantorhynchus moniliformis.	Few cases.		

FÆCES—EMBRYOS.

Parasite.	Frequence.	Size in microns.	Plate.
Filaria.*			
Strongyloides stercoralis	Common	200–400 long.	
Trichinella spiralis	Rare	90–100 × 6.	

* Many species possible (see key under *Nematoda*).

One may recognize among these parasites those which occur in their normal host but in an unusual location, like the brain cysticerci or a liver fluke in a subcutaneous cyst; there are also many of the species listed which cannot be regarded in any way as characteristic of the human host. Such are the occasional parasites which are species of true parasitic habit and can attain normal development in the human host, but ordinarily do not find conditions favorable for their introduction. As an instance of such species may be mentioned *Fasciola hepatica*, the common liver fluke of the sheep, which in many regions of the world is extraordinarily abundant. That it can thrive in the human system is demonstrated by the score or more of cases of its occurrence there definitely recorded; but its infrequence is equal evidence of a general immunity on the part of man, lacking in these particular cases, or of special features in its life history which make the infection of the human host difficult. That the latter is the probable explanation may be inferred from the fact that the cercaria larva, liberated from the intermediate host, encysts on grass, and hence could reach the human alimentary canal only under unusual circumstances. Similar examples may be taken from other groups of parasitic forms, such as the rare occurrence in man of *Strongylus apri*, one of the commonest parasites of the pig in Europe, or of *Dipylidium caninum*, the cosmopolitan tapeworm of both dog and cat, which has been reported only rarely from man.

Such occasional parasites often occur under abnormal conditions; thus a fish nematode, *Ascaris clavata*, was discovered once in the hollow tooth of a man. Here the position was probably accidental, but in other cases it is the result of the action of the parasite itself. So the "red spiders," or "jigger" mites of the Central States bury themselves in the skin of man, although such a position is so clearly abnormal that in fact it destroys the chance of further development and costs the parasite its life. A small leech, *Limnotis nilotica*, common in the Circummediterranean area, is often drawn into the throat of men and other animals drinking at wayside pools. It usually retains its position, causing serious difficulty, until removed by operative interference; hence it has become an occasional parasite of man rather than, as in the case of most leeches, a temporary parasite; or one may regard it as falling in the next following group of accidental parasites. This example shows most clearly the narrow and somewhat artificial limits which separate these groups of parasites from one another. Of the mites also, which have been reported a few times as obtained living from stomach, bladder, and rectum, it is difficult to say whether they are occasional or accidental parasites of man.

There are also rarely forms which commonly occur free living, but which by chance are introduced into some organ in which conditions are such that they can thrive. They become thus accidental parasites, a group difficult practically to distinguish from the last, the occasional parasites, and yet presenting somewhat different biological conditions. The recent discovery by Stiles and Frankland, as well as others, of the vinegar eel, *Anguillula aceti*, as an apparently successful colonizer of the bladder in a female patient illustrates the type under consideration. There is little doubt that this parasite was introduced through the use of vinegar in vaginal douches and effected a successful colonization, possibly by virtue of the trace of albumin present in the urine which furnished it with nourishment. Equally striking is the case of Scheiber, who discovered *Leptodera pellio* in the urine of a female patient in Hungary. This typical slime-inhabiting nematode gained entrance, no doubt, through the application of mud poultices, which are commonly employed by peasants in that region. It should be noticed that such accidental parasites are necessarily confined to those groups of animals which have free-living forms. Such are Protozoa, Nematoda, and perhaps Insecta in the larval condition, while Cestoda and Trematoda, which live only as parasitic forms in some host, would become rather occasional parasites of man should they stray into the human system in some chance manner and find favorable conditions for existence.

Quite distinct from the types just considered are pseudo-parasites, which rank high in clinical importance. Among them one may recognize several very distinct classes. First, those which are actually free-living animals, introduced by accident, usually in food or drink, into the human alimentary canal, exciting there abnormal conditions which induce their more or less immediate and forcible expulsion. Thus Botkin found in the vomit of a Russian numbers of a small nematode which he wrongly believed to be a human parasite. In fact it lives normally in the onion, and its introduction into the stomach with this food excited the untoward symptoms noted. Similarly Blanchard records a case in which coleopterous larvæ were found in the vomit of a child.

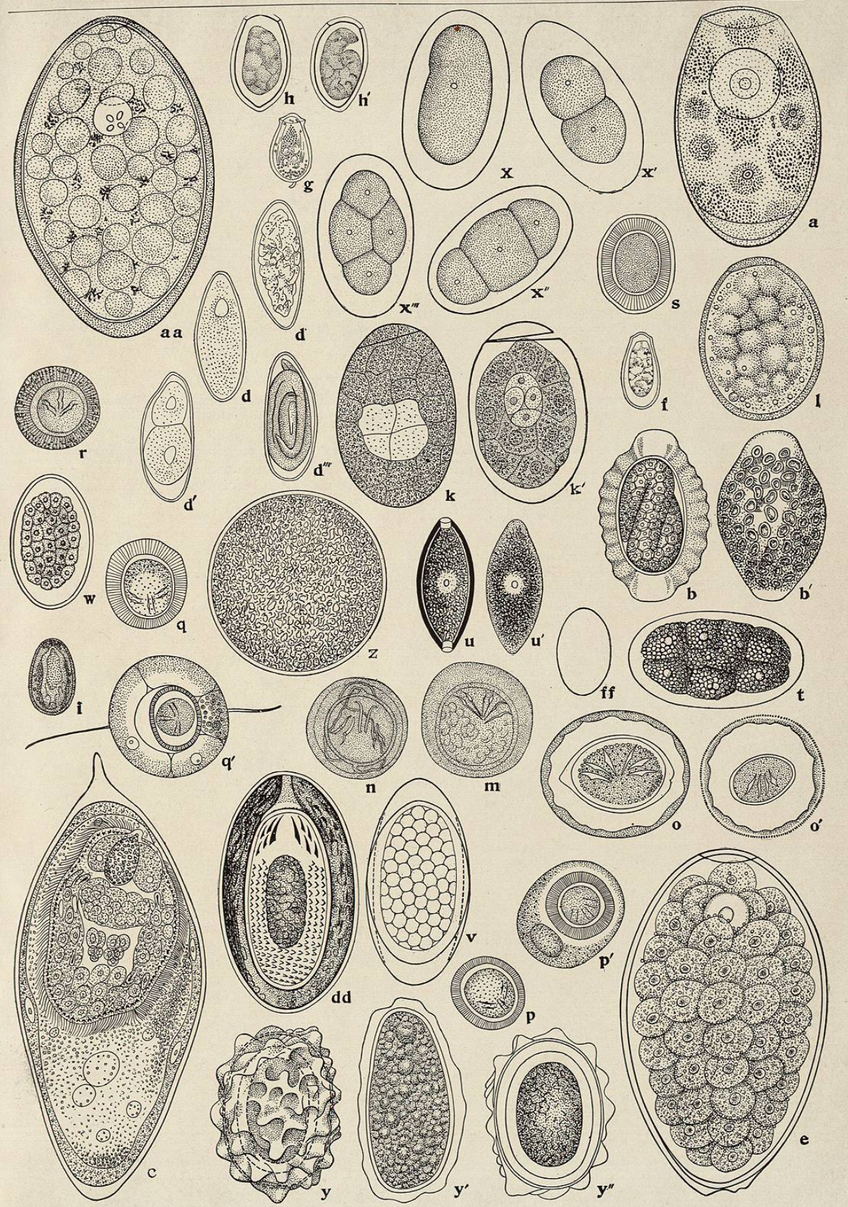
That such may be the result of introducing a true parasite from some other host is indicated by several cases, like that of *Ascaris maritima*, which Leuckart described from a single specimen vomited by a child in Greenland, and which this author noted was very similar to *A. transfuga* of the brown bear. In all probability it was ingested with the viscera of some animal (seal?), though it may have been a species which had strayed into this unusual host, only to make its appearance under the circumstances noted.

Of similar import are the cases of *Gordius*, the hair snake, which have been reported from man. In the adult condition this is normally a free-living species, but about a dozen specimens have been taken from man after a supposed sojourn of from a few hours to fourteen days. Some of these have been vomited and others passed per anum. This form has often been passed off upon the physician as a true parasite, and in one celebrated case at least as the Guinea-worm.

In the same way one may find the explanation for other isolated cases of parasitism, even when the parasite is reported to have been passed from the alimentary canal. Thus Cobbold reported that larvæ of *Blaps mortisaga*, the English churchyard beetle, were found in fecal discharges, and many authors have recorded the presence of dipterous larvæ in the alimentary canal.

The majority of such observers have inclined to regard these larvæ as temporary endoparasites, and to consider that they have accommodated themselves to the conditions present in the human host. The cases seem to show that these larvæ live for some time in the canal, and they often appear to evoke serious or even fatal disturbances; and yet the conclusions are open to grave doubt, for Calandruccio experimented extensively on two families of flies to which many of the supposed accidental parasites

PLATE E.



EGGS OF HUMAN PARASITES
(MAGNIFIED FIVE HUNDRED DIAMETERS)

belong, and found that the ingested larvæ were regularly and promptly evacuated, dead or dying, and in no case did they secure a footing in the canal.

Among the myriapods about forty recorded cases of pseudoparasitism have been brought together and discussed by Blanchard. In the large majority the animal was taken from the nasal fossæ, though in a smaller number it was actually obtained living from the alimentary canal, where it undoubtedly can exist for a brief time in spite of the untoward environment. The ingestion of such forms is purely accidental, the symptoms are those of helminthiasis in general, and their stay at most is very limited. They never show any evidence of adaptation to the new environment.

In some such accidental fashion other forms are sometimes introduced into various organs not connected with the alimentary system. Thus Trouessart reported the occurrence of a species of detricolous Sarcoptids in the human testicle where the mites formed an old colony in a painless cystic tumor.

In contrast with the living animals of the types noted, the second class of pseudoparasites includes a large number of other structures which have been described as parasites. These may be considered conveniently in a few groups, the first of which includes bodies which are parts of the so-called host animal itself. Thus fragments of the arteria hyaloidea have been described as eye worms (*Filaria lentis*, *F. oculi humani*, etc.), the organisms of whooping-cough are nothing more nor less than ciliated tracheal cells torn from the wall and found in the sputum in distorted form, while groups of small axillary and inguinal glands, hydatid moles, and Pacchionian bodies from the arachnoid have been frequently put on record as hydatid cysts.

Parts of substances used as food, both of plant and of animal origin, which have not been destroyed by the action of digestive juices are also among the pseudoparasites of man. The radulæ of the common limpet have been reported several times from stools; the seeds of the mulberry were duly baptized as parasitic worms; and plant vessels and other similar undigested structures of peculiar appearance appear periodically as new helminthes. That a differentiation of such structures is not simple appears from the account given by Stiles of the partially digested banana fibres which closely simulate minute tapeworms. Some years ago Leuckart entrapped a group of research students in helminthology with the pulp vesicles of an orange which were found in a fecal examination.

In all of the cases considered above it should be kept in mind that the animals or these other structures actually came from within the human body. There is, however, another class of objects of which this cannot be said.

In determining the nature of unusual forms reported from man it should always be kept in mind that in the absence of positive personal evidence, suspicion in case of neurasthenia at least favors the deceitful introduction of doubtful bodies. In many cases on record such things as earthworms, chicken entrails, etc., have been forcibly introduced into the rectum or vagina, and have been subsequently reported by the attending physician as undoubted human entozoa of a remarkable character! Here as elsewhere the appearance of unusual structures should at once arouse the suspicion of the physician and call forth a most searching examination of the case in all its factors, that any deceit be disclosed, or that in the event of the discovery of some rare parasite all conditions connected with its appearance be put on record for future use. The large number of parasites in other animals which some unusual combination of circumstances may bring into the human system makes it imperative also that any supposedly new species be submitted to the judgment of a specialist before it is described as such. Only in this way can the discoverer avoid adding to the long list of synonyms, which already burden the literature of this subject, and render it so difficult for the investigator not a specialist in this particular line to find his way aright. Furthermore, it is important to preserve the fullest data in regard to any substances associated with the supposed parasite, as well as the food of the patient, whether usual or unusual, since in this way some hint as to its introduction may be found.

Effect upon the Host.—In the belief of the medical profession two hundred years ago there was no disease, real or imaginary, which was not due to the presence and effect of some kind of parasite. Each ailment had its particular "worm" in its characteristic location. This was a direct result of the endeavor to reduce every malady to some definite cause, and of the joining of the unknown sickness with the parasites of which they knew as little. Under the influence of study and of increasing knowledge regarding the parasites such a theory was seen to be untenable, and the movement in the opposite direction began, a tendency which may be said by this time to have passed its height.

It is true that internal parasites are very widely distributed, and that scarcely any individual is entirely free from them. They are, however, usually present in limited numbers, and are believed to be harmless if infrequent or of small size. This does not seem to be strictly correct, for while it is doubtless true that the effect of a single parasite, or even of a considerable number of minute size, is small and difficult to measure or estimate, it is equally clear that even this is a certain drain on the host. Furthermore, the tax on the host is in proportion not only to the number and size, but also to the habits of the parasites present. Thus there is a great difference whether the parasite is active and growing in the alimentary canal or some other cavity in the body of the host, or passively resting in the midst of the tissue of some organ.

While encysted parasites exercise a continued and sometimes serious pressure on adjacent tissue, yet the draft on the host by free parasites is much the greatest, and manifests itself in three ways. The parasite requires a certain amount of food for its support; this it takes directly from the host, either from that which the latter has digested for its own use, if the parasite be in the alimentary canal, or from material which the host has formed to perform certain work, as in the case of blood parasites, or from the tissue of the host, as in the case of some intestinal worms which feed on the cells composing the wall of the intestine. In any case the host expends at least the extra energy necessary to procure and digest the food taken by the parasite, and this extra labor will be directly in proportion to the amount of food taken, or in general to the size of the parasite and to its fertility.

In the second place the parasite occupies a certain amount of space, and correspondingly reduces the calibre of the tube in which it lives. Unless a considerable number are present this is hardly a practical stoppage for the alimentary canal, although in several recorded cases death has followed occlusion of the canal by a mass of ascarids, and in the case of the blood system a vessel may be closed or a clot formed by the presence of even a very few parasites.

In the third place active parasites will, by their movements, give rise to a certain amount of irritation and inflammation of the membranes over which they move. This is in some ways, perhaps, the most serious trouble which a few parasites can cause, and it is much increased if in the special case the parasite obtains its food at the expense of the tissues of the host, that is, if it tears or consumes the walls of the cavity in which it lives. A secondary, though possible, result of this manner of living is the liability of rupturing some blood-vessel, with consequent serious results, as in the case of certain lung flukes which may chance upon some large blood-vessel and in this way produce even fatal hemorrhage. In the alimentary canal a single ascaris may perforate the wall and induce fatal peritonitis, as has been observed several times in recent years. It is evident, then, that no more than a single active parasite may be dangerous, and that it is always some tax on the domestic economy of its host. Of course, the effect of a microscopic worm in the alimentary canal of an elephant will be so small that it