worm (*Echinococcus****)*** is characterized by the fact that the tape-worm heads are not directly developed in the wall of the bladder itself, but from “ brood capsules ” which lie in numbers on the inner wall of the bladder.

*Development of the Echinococcus.—*The smallest bladder yet seen was reared by Leuckart in the pig, and consisted of a minute proto­plasmic mass surrounded by a structureless cuticle. This cuticle thickens by deposition of new layers as growth proceeds, and the lamination of the cuticle is one of the characteristic peculiarities of the *Echinococcus,* another being the absence of an excretory system. At certain points in the parenchyma lining the cyst small warts are noticed (fig. 2, D, *a*), which enlarge and become hollow ; then the cavity enlarges in a direction opposite to the point of origin, and at the extremity of this hollow suckers and hooks are formed as in the case of *Cysticercus* described above (*b,* *c*). No sooner has the devel­opment of the first of these reached a certain degree of completeness than others are formed in similar fashion. The first part of the invagination takes place, by which the future head comes to lie within the brood-capsule and the pedicle is no longer hollow but solid (*e*) ; the suckers and hooks are, however, still invaginated, and remain so for a considerable period. Seeing that the interior of the brood-capsule is lined with cuticle, it corresponds to the outside of the parent cyst, and hence is probably the representative of a previous invagination. If this be so then the development of *Echinococcus* would be quite comparable with that of *Cysticercus,* the only difference being that, instead of the head being an inva­gination of the wall of the cyst itself, it is a secondary invagina­tion, the primary being the brood-capsule. This does not, however, exhaust the peculiarities of the *Echinococcus ;* the form just de­scribed, with a simple cyst and brood-capsules, is common in cattle, and hence goes by the name of *Echinococcus veterinorum ;* but cases are frequent, and are the most common in the human subject, in which the cyst contains daughter-vesicles, differing from those just described in being sterile—giving rise to no heads. These daughter-bladders may originate in three different ways :

1. from little granular heaps, which are seen between the different layers of the cuticle, and which are probably derived primarily from the parenchymal layer,—since new layers of cuticle are continually formed internally, these bladders gradually make their way out­wards, until they come to lie externally to the mother-vesicle (*Echinococcus exogena,* Kuhn ; *E. scolecipariens,* Küchenmeister) ;
2. from brood-capsules ; (3) from *Echinococcus-*heads ; these last two modes of development give rise to vesicles, which are within the mother-vesicle, and produce a form which has been variously called *Echinococcus endogena,* Kuhn, *E. altricipariens,* Küchenmeister, and *E. hydatidosus.* A very remarkable form is *Echinococcus multilocularis,* which consists of a number of very small vesicles embedded in a common soft stroma; it is found exclusively in man, and for long was regarded as a form of alveolar cancer. The mode of its development is unknown (for further information, see Virchow, 17). Compound bladders occur in man and the ox, whilst other ruminants, swine, and monkeys usually harbour the simple or exogenous forms. The organs most often affected are liver and lungs. The adult tape-worm (*T. echinococcus*) is found in the intestine of the dog, jackal, and wolf, occurring in consider­able numbers between the villi. Its length (fig. 3, A) is at most 5 mm. and it consists of only three or four segments ; the head has four suckers and a double circlet of hooks.

*Pathological Effects.*

The pathological effects of Cestodes fall naturally into two categories—(1) those due to the adult worm, and (2) those due to the larvæ or bladder worms.

(1) Those of the first group are in general slight, being confined to the abstraction of a certain amount of nutri­ment, and to a more or less acute feeling of irritation, sometimes amounting even to colic-like pains, in the intestine. There have indeed been many authorities who have maintained that they were beneficial ; Jördens went so far as to describe them as the good angels and unfailing helpers of children, and Schimper records that the Abys­sinians consider that they prevent constipation, and only regard them as disadvantageous when they grow too long. Notwithstanding all this, however, there are not a few cases on record in w’hich anæmia and neurotic, or even mental, diseases have been caused by the malnutrition and irritation which they occasion.@@1

(2) The effects of Cestode larvæ may again be divided into two subdivisions. (*a*) That due to the invasion and wandering of a large brood of six-hooked embryos has been most successfully studied in cases in which animals have been fed for experimental purposes with fragments of ripe tape-worms; in such instances a train of symptoms has been observed to w’hich the name “acute cestodic tuberculosis ” has been given. It is characterized by loss of appetite, fatigue, ruffling of the hair, and fever ; on post-mortem examination it has been found that the lymphatic system is in a state of inflammation, while the muscles present the appearance w’hich has already been described. (*b*) The effects of formed bladder-worms may be summed up as dependent upon the pressure of the growing cyst and the consequent absorption of the sur­rounding tissues of the host, so that the importance of the results depends almost entirely upon the organ which is affected. Bladder-worms in the brain are, of course, the most frequently fatal, especially when, as is not unfre­quently the case, they exert pressure upon the ganglia at its base. Küchenmeister has collected a considerable number of occurrences of cystic worms in the brain ; among these sixteen were not accompanied by pathological symptoms during life; in six others these were slight; twenty-four were cases of epilepsy, six of cramp, forty- two of paralysis, and twenty-three of mental disturbances of varying intensity. *Cysticerci* in the brain vary greatly in size and form according to the precise situation which they occupy ; in its ventricles they have been found as large as a pigeon’s egg. In the meshes of the arachnoid the bladder sometimes grows into a remarkably branched structure, w’hich has been called *Cysticercus racemosus* by Zenker (3). Another peculiar form from the same organ has been described by Köberlé (4) ; it is characterized by the great length of its head-process (2 cm.), which is coiled up into a regular spiral of sometimes three turns ; it has received the name *Cysticercus turbinatus,* though its specific distinctness is doubtful. The occurrence of *Cysticerci* in the eye is of special interest, because of the opportunity it affords of observing, by means of the ophthalmoscope, the development of the worm in its natural environment. It seems generally to lie at first below the retina, and is visible as a bluish-white sharply defined body; subse­quently the retina is destroyed by the pressure, and the worm falls forward into the vitreous body; sometimes the head may be seen protruding first through the opening ; in the chambers of the eye the *Cysticercus* is almost always free, that is, without a capsule, and swimming in the fluid, so that its form and motions may be readily and accurately observed. A large number of cases of this affection have been recorded, principally by Von Graefe in Berlin (5), and in some the bladder has been successfully removed by operation.

The special symptoms of the *Echinococcus* vary, like those of other bladder-worms, w’ith its situation and size : when it grows within cavities with more or less firm limits compression of adjoining vessels and glandular passages often results, producing oedema, varicose veins, congestion of various organs, or even dyspnoea, if the parasite occur in the thorax. The liver is its most frequent seat, and next the lung ; but there is scarcely any organ of the body in w’hich it has not been found, even the bones being sometimes affected. Since the expanding cyst grows in the direction of least resistance, it has a tendency to pass

@@@1 The method of treatment for the removal of these tape-worms from the human body consists in the administration, first of purgatives, and thereafter of one or other of the following anthelmintics:—tur­pentine, male fem (*Lastrea Filix∙mas*)*,* pomegranate, or kousso,—of

which the first two are the most reliable. Turpentine may be given in half-ounce doses along with castor oil, or made up into an emulsion with yolk of egg ; while the male fern is usually administered in the form of liquid extract (half a drachm to one drachm). Careful search should be made in the evacuations for the head or scolex, without the expulsion of which there is no certain evidence that the parasite has been removed from the body.