potential toxicity and teratogenicity, the benzimidazoles are not routinely administered during pregnancy or the first year of life. The drug oxantel has specific anti-Trichuris activity; and in some countries it is available in suspension suitable for pediatric use. 9

Prevention and Control

The infection is most common in tropical areas, where prevalence as high as 80% has been documented. Most infections tend to be light and therefore are asymptomatic. Warm, moist soil in tropical and subtropical regions favors the infection; direct sunlight for 12 hours or exposure to temperatures in excess of 40°C for 1 hour or to temperatures below −80°C destroys the eggs. The eggs are relatively resistant to chemical disinfectants.

Proper disposal of feces is, of course, the primary means of prevention. In areas of the world where untreated human feces are used to fertilize crops, control of this infection is impossible.

References

7. Brown HW: Studies on the rate of development and viability of the eggs of Ascaris lumbricoides and Trichuris trichiura under field conditions. Parasitology 14:1–15, 1927

3. Ascaris lumbricoides (Linnaeus 1758)

Ascaris lumbricoides, which lives in the upper part of the small intestine, is often referred to as the giant intestinal worm because it can grow to a length of more than 30 cm. It has a worldwide distribution and is thought to affect 1 billion people. 1 Although its eggs fare best in warm, moist soil, they are highly resistant to a variety of environmental conditions and can survive even in the subarctic regions. 2 There are no reservoir hosts.

Historical Information

In 1683 Edward Tyson described the anatomy of A. lumbricoides, then known as Lumbricus teres. 3 Linnaeus gave it its current name on the basis of its remarkable similarity to the earthworm Lumbricus terrestris, which he also named. The life cycle was accurately described by Brayton Ransom and Winthrop Foster in 1917. 4
In a remarkable series of experiments with himself and his younger brother as subjects, Shimesu Koino, in 1922, described the clinical spectrum of disease induced by this nematode. Although in this experiment *Ascaris suum*, the ascarid of pigs, failed to complete its life cycle in humans, it is now known that in some cases this infection in man can result in the development of adult worms. In addition, he proved that a pneumonia-like syndrome developed during the early phase of the infection and that it was caused by third-stage larvae migrating through the lungs on their way to the stomach. Koino, who swallowed 2000 *A. lumbricoides* eggs, became seriously ill but fortunately did not suffer permanent disability. His younger brother, given 500 larvae of *A. suum*, did not experience the disease as severely.

Life Cycle

The adult worms (Fig. 3.1) live in the lumen of the upper small intestine, where they consume predigested food. The worms maintain themselves in the lumen of the small intestine by assuming an S-shaped configuration and pressing their cuticular surfaces against the columnar epithelium of the intestine and continually moving against the peristalsis. The worms secrete antitrypsins and as a result compete successfully for proteins the host ingests.

The female *Ascaris* is one of the most prolific producers of offspring in the animal kingdom. On average, each female produces 200,000 eggs per day and may contain at one time up to 27 million eggs in its uterus and oviduct. To synthesize the huge amounts of sterol necessary for massive egg production, the adult *Ascaris* has evolved a means by which to carry out this oxygen-dependent reaction in the low-oxygen environment of the folds of the small intestine by assembling the components of the reaction on a special oxygen-avid hemoglobin. The eggs (Fig. 3.2) the worm lays are fertilized but non-embryonated. They become incorporated into the fecal mass in the large intestine.

Embryonation of the fertilized eggs takes place in the soil. If the eggs are deposited in the soil directly, the embryonation is completed within 2–4 weeks, depending on the ambient temperature and moisture. The eggs need not reach the soil directly; they can survive for several months before beginning embryonation. The infective embryonated egg must be swallowed for the life cycle to be completed. Hatching of the larvae is stimulated in the small intestine by the combined action of bile salts and

*Figure 3.1. Ascaris lumbricoides* adult male (right) (15–31 cm long) and female (left) (20–35 cm long). Note the hook-like tail of the male. × 0.50.