commonly live among the hairs of their hosts, feeding on blood. Some species are carriers of the **epidemic** inducing typhus fever. Fleas usually infest **birds** and mammals, and can feed on humans when they are transferred from pets or livestock. Fleas are known to carry a variety of devastating diseases, including the plague.

Arachnids

Another prominent class of arthropods that contains parasitic species is the arachnids. Though this group is more commonly known for spiders and scorpions, its parasitic members include ticks and **mites**.

Mites are very small arachnids that infest both plants and animals. One common type is chiggers, which live in **grasses** and, as larva, grab onto passing animals and attach themselves to the skin, often leading to irritating rashes or bite wounds. Scabies are another mite that causes mange in some mammals by burrowing into the skin and producing severe scabs, lesions, and loss of hair.

Ticks also live their adult lives among grasses and short shrubs. They are typically larger than mites, and it is the adult female that attaches itself to an animal host for a blood meal. Tick bites themselves can be painful and irritating. More importantly, ticks can carry a number of diseases that affect humans. The most common of these include Rocky Mountain spotted fever, Colorado tick fever, and the latest occurrence of tick-borne infections: **Lyme disease**.

Control of parasites

Most parasitic infections can be treated by use of medical and surgical procedures. The best manner of controlling infection, though, is prevention. Scientists have developed and continue to test a number of drugs that can be taken as a barrier, or prophylaxis, to certain parasites. Other measures of control include improving sanitary conditions of water and food sources, proper cooking techniques, education about personal hygiene, and control of intermediate and vector host organisms.

See also Flatworms; Strepsiptera; Tongue worms.

Resources

Books

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KEY TERMS

Arthropod—A phylum of organisms characterized by exoskeletons and segmented bodies.

Cestodes—A class of worms characterized by flat, segmented bodies, commonly known as tapeworms.

Definitive host—The organism in which a parasite reaches sexual maturity.

Helminths—Term to define various phyla of worm-like animals.

Intermediate host—An organism infected by a parasite while the parasite is in a developmental form, but does not sexually mature.

Nematodes—Characterized by long, cylindrical bodies, commonly known as roundworms.

Protozoa—One-celled organisms.

Trematodes—A class of worms characterized by flat, oval shaped bodies, commonly known as flukes.

Vector—Any agent, living or otherwise, that carries and transmits parasites and diseases.

Periodicals

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Jeffrey R. Corney

Parity

Parity is both an operation and an intrinsic property used to describe particles and their wavefunctions (mathematical representations of one or more particles) in **quantum mechanics** (a branch of **physics** focusing on particles smaller than an atomic nucleus).

The parity operation is a combination of a left-right trade (mirror reflection) with a top-bottom switch. This combination is also called a spatial inversion. How objects behave under a parity operation defines their intrinsic parity. All microscopic particles have an intrinsic parity that helps us tell them apart. An object or group of objects that is the same before and after a parity opera-

tion is called parity **invariant**. A parity invariant object has "even" or "+1" intrinsic parity. If the parity of an object changes due to a parity operation, it has "odd" or "-1" intrinsic parity.

Even though people do not obey reflection **symmetry** (their right and left sides are different), scientists believed that the laws of physics were parity invariant. In 1956 a Chinese-American scientist named Tsung Dao Lee figured out that the idea of parity invariance had not been tested in **relation** to one of the fundamental forces of physics, the weak **force** (responsible for spontaneous decays of some microscopic particles). This prompted Lee and a colleague, Chen Ning Yang, to think of a clever experiment to test the parity invariance of the weak force. Later in 1956 Dr. Chien-Shiung Wu carried out this difficult experiment using a radioactive (spontaneously decaying) element called Cobalt. Wu observed the direction of electrons (smallest naturally-occurring charged particles) coming out of the Cobalt due to its **radioactive decay**. She found that the electrons did not come out the way she expected. Thus this experiment was not parity invariant. Since it tested the weak force, this meant the weak force was not parity invariant either. This result was so important that Yang and Lee won the 1957 Nobel Prize in physics for it. Now we know when we see parity invariance the weak force is the culprit. All other fundamental forces are parity invariant.

Parity is often studied along with charge conjugation. Charge conjugation changes a particle into its opposite, or **antiparticle**, by changing the sign of its **electric charge**. Even though parity is not conserved by itself, it was thought that the combination of parity (P) and charge conjugation was conserved. In 1964, however, physicists J. H. Christenson, J. W. Cronin, V. L. Fitch, and R. Turlay discovered that CP **conservation** is not obeyed by studying the decays of particles called Kaons. Scientists know that the laws of nature must obey conservation of the combination of parity, charge conjugation, and **time** symmetry (T), because of the way they are formulated. This is called CPT symmetry. Because CP symmetry is not conserved, it follows that time symmetry must not hold, so that total combination, CPT, can be conserved.

Lesley Smith

Parkinson disease

Parkinson disease (PD) is a **disease** in which cells in regions of the **brain** involved with muscular coordination and control suffer in impaired ability to synthesize the **neurotransmitter dopamine**.

Parkinson disease or Parkinsonism is named for the English physician James Parkinson. His description of the various manifestations of the disease was published in 1817, in a work entitled "An Essay on the Shaking Palsy." He used the terms" shaking palsy" or "paralysis agitans" to describe a group of related symptoms, which he carefully observed and recorded. It is now known that this neurological disorder is caused by damage to the brain. The main symptoms of the disease are tremor while at rest and abnormal movements of the arms and legs while standing or walking. These are accompanied by a number of other symptoms, including **speech** problems, a stiff, bent-over position, **insomnia**, and constipation.

All related disorders are attributed to a malfunction of the basal ganglia (which contain a rich array of neurotransmitters and receptors controlling muscular movements) and of the substantia nigra (where dopamine is produced). Dopamine is one of the brain chemicals involved in the control of physical movement, and Parkinsonism is characterized by dopamine depletion. Secondary Parkinsonism, in which symptoms are of a passing nature, is due to temporary dopamine depletion, induced most commonly by **antipsychotic drugs**.

Cause

The basal ganglia control movements of the muscles, muscle tone, balance, coordination of groups of muscles that oppose each other, and the change of state necessary for muscles to go from rest to **motion**. Control from this section of the brain also enables some muscles to remain at rest while others are in action. In a healthy state, signals pass from the motor cortex of the brain to the reticular formation and spinal cord and then to the various muscles that are to undergo contraction. At the same **time**, other signals follow a different pathway through the basal ganglia, where the nerve signal is dampened (subdued or toned down) so that the resulting contraction does not become jerky (too sudden or quick). Dopamine, found in the basal ganglia, is the neurotransmitter responsible for the dampening effect of the motor signal. If the dampening effect should become too strong, then another neurotransmitter, **acetylcholine**, counteracts the effects of the dopamine, thus maintaining a balance in the **force** of the signals sent to the muscle.

In Parkinson disease, degeneration of the basal ganglia, along with damage to the dopamine-producing cells of the substantia nigra, hampers the proper functioning of the nerve pathway that controls movements of the muscles. The muscles become excessively tense, a condition that gives rise to tremor and a rigid joint action.