Newton's Third Law of Motion

Isaac Newton was a 17th century English physicist who was the first to describe the three laws of motion and the law of gravity. Newton's Third Law states that if two particles interact, the force exerted by the second particle on the first particle (called the *action force*) is equal in magnitude (size) and opposite in direction to the force exerted by the first particle on the second (called the *reaction force*). Simply put, for every action there is an equal and opposite reaction. The terms *action* and *reaction* refer to forces.

A force is a push or a pull that causes an object to change its speed, direction, or shape. Forces result from interactions. Some forces result from contact interactions. These are interactions where forces touch each other. Examples of contact interactions are termed *normal, frictional, tensional,* and *applied forces*. Other forces are the result of action-at-a-distance interactions. These are interactions where forces do not touch each other. Action-at-a-distance forces are termed *gravitational, electrical,* and *magnetic forces*. According to Newton, whenever objects interact with each other, they exert forces upon each other. When you sit in your chair, your body exerts a downward force on the chair and the chair exerts an upward force on your body. There are two forces resulting from this interaction—a force on the chair and a force on your body. These two forces are called *action* and *reaction forces* and are the subject of Newton's Third Law of Motion.

According to Newton's Third Law of Motion, there is a pair of forces acting on the two interacting objects. There is never a third object in Newton's Third Law action-reaction pairs. The size of the force on the first object equals the size of the force on the second object. The direction of the force on the first object is opposite to the direction of the force on the second object. Forces always come in pairs—equal and opposite actions. These are called action-reaction force pairs.

A variety of action-reaction force pairs are demonstrated in nature. Consider a fish moving through water. A fish uses its pectoral fins to push water backwards. But a push on the water will only serve to accelerate the water. Since forces result from mutual interactions, the water must also be pushing the fish forward, propelling the fish through the water. This is an example of a contact interaction. The size of the force on the water equals the size of the force on the fish. The direction of the force on the water (backward) is opposite the direction of the force on the fish (forward). For every action, there is an equal (in size) and opposite (in direction) reaction force. Action-reaction force pairs make it possible for fish to swim. This action is similar to human swimming actions. A person's arms and legs have contact interactions with the water, which, in turn, propel that person through the water.

