The Physics of Swimming

by LIAM COLLIER

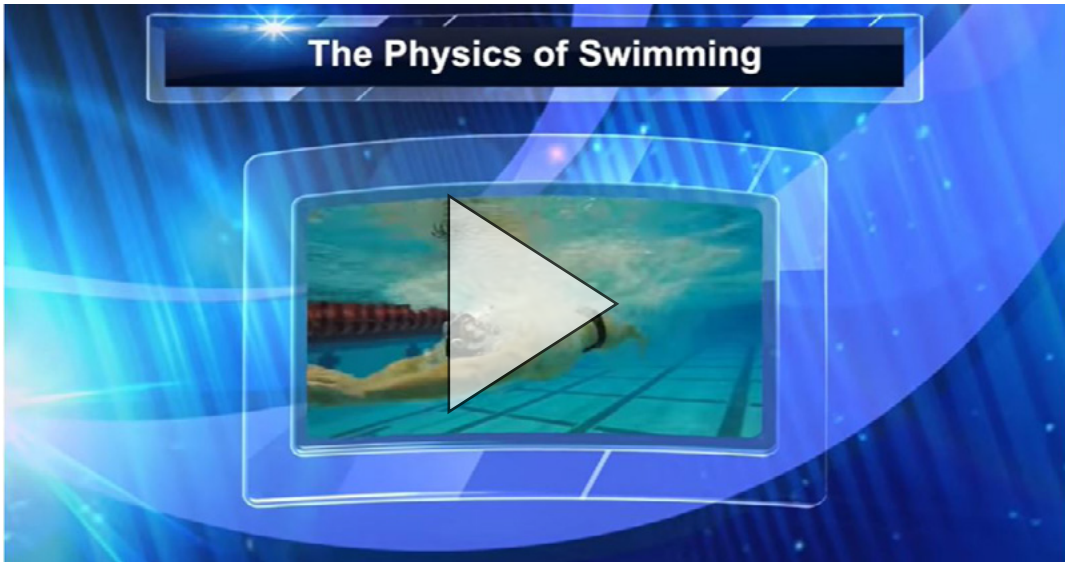
On its most basic level, swimming is a great example of Newtonian Physics, the basic rules and mathematical equations, mostly developed by Sir Isaac Newton in the 1700s, that scientists use to understand how forces act on matter.

Isaac Newton's first law of motion states that "if a body is at rest or moving at a constant speed in a straight line, it will remain at rest or keep moving in a straight line at constant speed unless it is acted upon by a force." Newton's third law of motion goes on to state that "when two bodies interact, they apply forces to one another that are equal in magnitude and opposite in direction." Or, put another way: when Object A pushes Object B, Object B pushes back on Object A. And the forces are the same on A and B.

How does this play out in the water? Before a swimmer begins to make their way across the pool, they are "at rest." Newton's first law tells us that the swimmer will remain at rest - and will not move - unless they are acted on by a force. Newton's third law explains that when the swimmer pushes the water with their arms and feet, the water pushes back in an equal and opposite direction. Because the swimmer is pushing the water backwards, the water pushes them forward and they make their way across the pool.

Of course, if you've ever been swimming, you can probably sense that it's not quite that simple.

Watch the video below to learn about the many other scientific concepts at play in professional swimming. Then, answer the questions underneath to test your knowledge of the physics of



swimming.

1. How does this video define the word **drag**? What are four ways that professional swimmers counteract this force?

2. What is the difference between **linear velocity** and **angular velocity**? What techniques can swimmers use to increase their angular velocity when they are changing direction?

3. Why don't swimmers begin their races in the water? What does this have to do with **density**?