The biology of fats in the body

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When you have your cholesterol checked, the doctor typically gives you levels of three fats found in the blood: LDL, HDL and triglycerides. But did you know your body contains thousands of other types of fats, or lipids?

In human plasma alone, researchers have identified some 600 different types relevant to our health. Many lipids are associated with diseases—diabetes, stroke, cancer, arthritis, Alzheimer's disease, to name a few. But our bodies also need a certain amount of fat to function, and we can't make it from scratch.

Researchers funded by the National Institutes of Health are studying lipids to learn more about normal and abnormal biology. Chew on these findings the next time you ponder the fate of the fat in a French fry.

Fat functions

Triglycerides, cholesterol and other essential fatty acids—the scientific term for fats the body can't make on its own—store energy, insulate us and protect our vital organs. They act as messengers, helping proteins do their jobs. They also start chemical reactions involved in growth, immune function, reproduction and other aspects of basic metabolism.

The cycle of making, breaking, storing and mobilizing fats is at the core of how humans and all animals regulate their energy. An imbalance in any step can result in disease, including heart disease and diabetes. For instance, having too many triglycerides in our bloodstream raises our risk

of clogged arteries, which can lead to heart attack and stroke.

Fats help the body stockpile certain nutrients as well. The so-called "fat-soluble" vitamins—A, D, E and K—are stored in the liver and in fatty tissues.

Using a quantitative and systematic approach to study lipids, researchers have classified lipids into eight main categories. Cholesterol belongs to the "sterol" group, and triglycerides are "glycerolipids." Another category, "phospholipids," includes the hundreds of lipids that constitute the cell membrane and allow cells to send and receive signals.

Breaking it down

The main type of fat we consume, triglycerides are especially suited for energy storage because they pack more than twice as much energy as carbohydrates or proteins. Once triglycerides have been broken down during digestion, they are shipped out to cells through the bloodstream. Some of the fat gets used for energy right away. The rest is stored inside cells in blobs called lipid droplets.

When we need extra energy—for instance, when we exercise—our bodies use enzymes called lipases to break down the stored triglycerides. The cell's power plants, mitochondria, can then create more of the body's main energy source: adenosine triphosphate, or ATP.

Recent research also has helped explain the workings of a lipid called an omega-3 fatty acid—the active ingredient in cod liver oil, which has been touted for decades as a treatment for eczema, arthritis and heart disease. Two types of these lipids blocked the activity of a protein called COX, which assists in converting an omega-6 fatty acid into pain-signaling prostaglandin molecules. These molecules are involved in inflammation, which is a common element of many diseases, so omega-3

fatty acids could have tremendous therapeutic potential.

This knowledge is just the tip of the fat-filled iceberg. We've already have learned a lot about lipids, but much more remains to be discovered.

More information: Learn more about the science of health in the Inside Life Science series from NIH's National Institute of General Medical Sciences: publications.nigms.nih.gov/insidelifescience

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