Understanding microRNA

Frank Middleton, PhD

BY WILLIAM MUELLER

These tiny keys could unlock treasure trove of medical knowledge

BY JIM HOWE

RESEARCHERS AT UPSTATE are looking at tiny bits of genetic material that could open up new ways of understanding diseases and how the mind and body work.

The material is called microRNA and is present in saliva, blood and other bodily fluids.

"MicroRNA potentially could end up in every biofluid and potentially could affect every fluid … people have envisioned these microRNAs now as a whole new molecular endocrine signaling system," says Upstate research scientist Frank Middleton, PhD, an associate professor of neuroscience and physiology, biochemistry and molecular biology, pediatrics and psychiatry and behavioral sciences.

He was comparing the ways microRNA sends signals throughout the body to the way the endocrine glands send their own signals, by releasing hormones into the bloodstream to reach distant cells.

MicroRNA is made by all of the body's cells, it can enter neighboring or distant cells, and it is critical to brain development, learning and nearly every process that cells carry out, he notes.

Protein production is a key activity in cells, and "MicroRNAs block proteins, and the ones involved are particularly relevant for autism," Middleton says.

He is the principal investigator of an ongoing study that is looking at measuring microRNA in children's saliva as a quick, painless and accurate method to help diagnose autism early, so those children can get into treatment faster.

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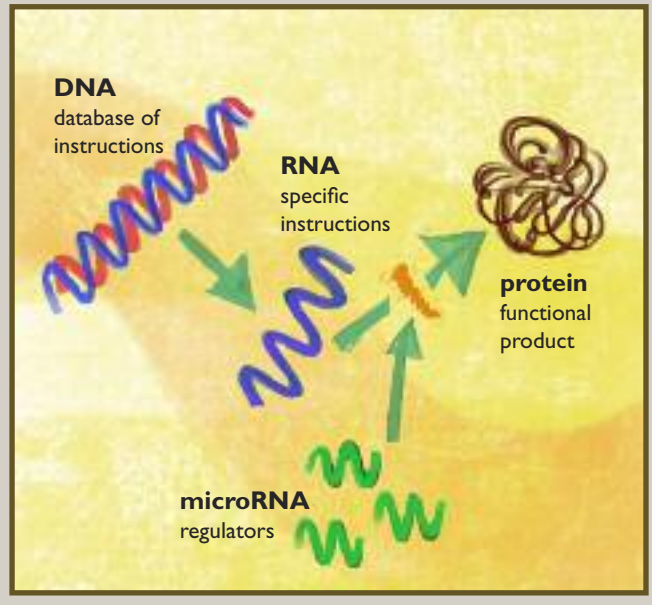
Middleton also collaborated on a study of microRNA in saliva that identifies concussion in children and predicts the length of recovery. He worked on both studies with Steven Hicks, MD, PhD, an Upstate graduate who is now a pediatrician and researcher at Penn State Health in Hershey, Pa., and with Quadrant Biosciences, which is headquartered at Upstate.

MicroRNA could also play a part in regulating the aging process and in how the body processes drugs, Middleton says, and it has been implicated in Parkinson's, Huntington's and Alzheimer's diseases and amyotrophic lateral sclerosis, also known as Lou Gehrig's disease.



DNA, RNA and microRNA

In high school biology class, everyone learns about DNA, which looks like two long, twisted chains. DNA stands for deoxyribonucleic acid — a chemical compound that stores a person's genetic information.

To carry out those genetic instructions, DNA tells RNA what to do — such as instructing a cell to make protein, a key activity.

RNA, or ribonucleic acid, has just one long, twisted chain. Some short segments of RNA are called microRNA.

MicroRNA can block protein production and regulate a cell's activity. Discovered in 1993, microRNA appears to control a large number of human genes and to play an important role in a range of biological processes and diseases.

SOURCES: NATIONAL INSTITUTES OF HEALTH; ESSENTIAL CELL BIOLOGY, 4TH EDITION