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Personalizing Medicine

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Personalizing medicine

DNA is the essence of biological diversity. But it's responsible for more than just the basics like eye color, hair texture or height. At a less visible level, DNA also varies our bodies' reactions to our environment. It's also the foundation of personalized medicine, a developing medical model that takes our genetic differences into account. This new approach may reshape the future of diagnostics.

But to get there, environmental effects on DNA need to be understood. That's where Douglas Ruden, Ph.D., associate professor and director of epigenomics at WSU's Institute of Environmental Health Sciences, comes in.

As part of his extensive research on lead exposure's genetic effects, Ruden is searching for genetic signatures of lead sensitivity to refine prevention and treatment of lead poisoning, which according to the City of Detroit has affected 58 percent of Detroit Public Schools' students.

Genomes are complex blueprints of our biological identities that comprise the complete sequence of our genes. Genes are stretches of DNA, and DNA is composed of billions of chemical bases named either A, T, G or C. But each person's four-letter sequence is patterned differently, with different arrangements accounting for different traits. If the manifestations of these arrangements are understood, then physicians can use this information to customize prevention and treatment for patients.

"That's sort of the fantasy," said Ruden. "We could be two years away from that or it could be 20 years. But that's the goal."

To help reach that goal, Ruden examined the genomes of both lead-exposed and healthy fruit flies – the same species that led Thomas Hunt Morgan to formulate the theory of heredity nearly a century ago. Ruden measured the flies' genetic traits, "but instead of something quantitative like height, we measured the expression of all 20,000 genes," he said.

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— **Dr. Douglas Ruden, Ph.D.**

What Ruden has found thus far are nearly a dozen genetic pathways that are co-regulated by lead. Each of these genetic pathways is the sum of interactions among genes that produce the lead sensitivity trait. But when lead co-regulates this process, it is partially controlling how and at what rate proteins are being developed, activating some genes and turning others off.

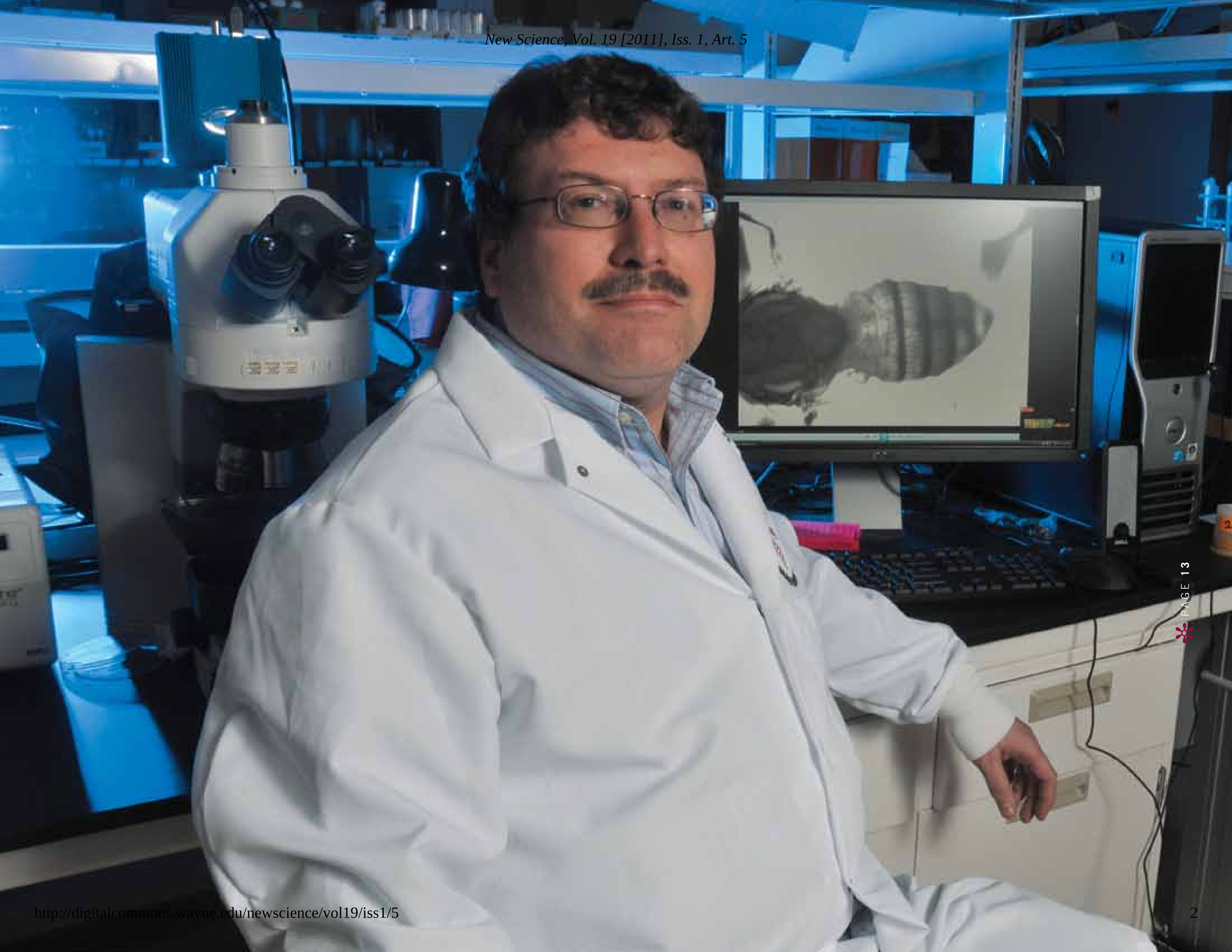
"Once lead binds to these transcriptional regulators [that dictate gene expression], it activates several hundred genes," said Ruden. "And those genes that are activated or suppressed tend to be in neural developmental processes, like synapse formation." In fact, lead poisoning manifests itself primarily in the central nervous system and can cause learning problems, memory loss and poor coordination – in addition to a host of other symptoms throughout the body.

Now, Ruden is targeting the location of these pathways to identify the transcriptional regulators with which lead co-regulates the production of many of the body's molecular elements. And finding those regulators will expand the scientific understanding of genetic and bioenvironmental interactions while bringing the world closer to a day when medical diagnostics is as particular as our DNA.

About Dr. Douglas Ruden:

Dr. Ruden received B.S. degrees in biology and chemistry from the California Institute of Technology and a Ph.D. in biochemistry from Harvard University. He was a postdoctoral fellow at the Max Planck Institute. He joined Wayne State University in 2004.

For more information, visit:
http://www.iehs.wayne.edu/bio.php?id=44317


PAGE 13