

AN EXPLORER'S GUIDE TO **EPIGENETICS**

IT'S TIME TO TAKE YOUR GENETIC DESTINY INTO YOUR OWN HANDS

BY **DIANNE E. PRICE**

CONTINUED ON NEXT PAGE

■ Say your grandma handed down her special family recipe for mashed potatoes. It included two sticks of butter, a tub of sour cream, a package of cream cheese and a dose of heavy cream. Your grandma died of a heart attack. Seeking to avoid the family fate, you modify the recipe: cauliflower instead of potatoes, ghee instead of butter, cut the sour cream and cream cheese, and substitute almond milk for heavy cream. Similarly, you can alter your genetic recipe in much the same way.

Yes, you still “gotta dance with the one who brung you” (your DNA doesn’t change), but the emerging science of epigenetics is showing us ways we can change the tune.

You just might be stuck with that crooked nose or receding hairline, but no longer are you sentenced to cancer, diabetes, depression and other unwelcome inheritances from your forebears. The science of epigenetics is teaching us how we can better understand and perhaps override specific genetic tendencies.

“Epigenetics’ is a word that most Americans have never heard of, but five years from now everyone will know about it,” says William J. Walsh, Ph.D., president of the Walsh Research Institute in Naperville, Illinois, and a pioneer in nutrition and epigenetics. “I believe it’s the new revolution in mental and physical health.” In fact, Transparency Market Research predicts that this revolution will snowball into a \$5.7 billion global market by 2018.

The completion of the sequencing of the human genome in 2001 turned upside down the belief that many diseases are genetic in nature. Instead, it suggested that they are epigenetic (above genetic) in nature. In fact, our environment can alter our genes.

“We are just at the beginning phases of understanding how such delicate details of the cellular machinery affect the ways our genetic code gets turned on and off — and hence how environmental factors and diet in particular can play a huge role in our health, well-being and longevity,” says Robert Sheeler, M.D., a family-medicine physician at the Mayo Clinic in Rochester, Minnesota.

“DNA is inside every cell in your body. It can coil and uncoil,” explains Walsh. “Genes only have one job: to make protein. You need a different chemical mix in every part of your body for survival. Epigenetics provides the blueprint that specifies the combination of proteins to be manufactured in each tissue.”

And, of course, all of these processes are controlled by the brain

Epigenetics can potentially revolutionize our understanding of the structure and behavior of biological life. Although epigenetics is touching our lives, from A to Z, we are still far from fully benefiting from its application in our daily lives.

Contrary to what most of us think, “Genes

are not fixed, predetermined blueprints passed from generation to generation,” according to Theri Griego Raby, M.D., founder and medical director of the Raby Institute for Integrative Medicine at Northwestern. “Instead, our genome contains at least 4,000,000 ‘switches’ that can be turned on and off by life experiences and environmental influences. Scientists are now linking certain markers, or switches, to conditions such as asthma, diabetes, mental illness and even cancer.”

According to the Genetics in Primary Care Institute, “There is a mistaken belief that epigenetics is like genetics and cannot be changed, but epigenetics is actually modifiable. The likelihood that epigenetics will be used in the treatment of childhood diseases and developmental disorders in the future is greater than that for genetics.”

Scientists and some physicians are waking up to the importance of epigenetics, but it’s enlightened consumers who will change the face of medicine, pushing for answers to how they can override their own genetic processes to attain their best health. Raby calls epigenetics “the true preventative medicine.”

This user’s guide to epigenetics seeks to provide digestible bits that will lead savvy readers to deeper exploration into their own health and well-being — and, perhaps, genomic action.

Note: As with any health or medical advice, individuals should consult with their physician. In the case of genomic interventions, a personalized genomic profile is essential, as each person’s blueprint is unique and requires distinctive supports. In other words, what may be right for one person may be wrong for another.

Altering Alzheimer’s and engaging antioxidant protection.

Science has determined that Alzheimer’s begins decades before a clinical diagnosis is made and can be the result of oxidative stress. Paul Coleman, Ph.D., director and senior scientist at Banner Sun Health Research Institute in Sun City, Arizona, is leading the way in the area of Alzheimer’s epigenetic research and is currently seeking a better understanding of how environmental factors affect who gets Alzheimer’s, and is developing a blood test to detect the disease. Some studies suggest that antioxidants have

no value once Alzheimer’s has been diagnosed. Other studies indicate that, prior to diagnosis, doses of vitamin E, vitamin C and alpha-lipoic acid, or coenzyme Q, could reduce the failures that occur in advanced stages of the disease. The antioxidant benefits of green tea are also well-documented.

Breast and other cancers: With epigenetic research, we are closer to a cure than ever before.

We’ve known for more than a century that cancer is a disease in which an otherwise normal cell’s genes go awry. It has taken decades to understand the many genes and proteins involved in the process. The role of genetics in breast cancer was recently on display when actor Angelina Jolie announced her decision to have a double mastectomy because she was found to carry the harmful mutation to the BRCA1 gene (BRCA1 and BRCA2 are types of tumor-suppressing genes).

Depression and mental health

According to Walsh, “There is considerable evidence that epigenetic errors are responsible for mental breakdowns experienced in schizophrenia, bipolar disorder, the sudden emergence of OCD and the striking symptoms associated with regressive autism. Epigenetic errors can occur when certain foods or toxic chemicals change the methylation pattern in DNA. Traumatic events in early life or adulthood can potentially alter DNA methylation and induce abnormal brain gene expression and, ultimately, depression.”

Eating and food: “Let food be thy medicine, and medicine be thy food.”

According to Walsh, without an accurate metabolic analysis, you can’t really know what foods to eat or avoid. “The best diet for one person may be the worst diet for the next person,” he explains. “For example, a person who tends toward clinical depression may have low serotonin levels. These people would do very well on a high-protein diet. Then there are people with anxiety conditions that have the opposite problem: They have too much methyl in their systems. These people thrive on a vegetarian diet.”

Generational handoffs and homosexuality: A consequence of erased epimarks?

According to a study published in December 2012, how gene expression is regulated by temporary switches, called “epimarks,” appears to be a critical factor contributing to the longstanding puzzle of why homosexuality occurs. The *Quarterly Review of Biology* reported that specific epimarks, which normally do not pass

between generations and are therefore “erased,” can lead to homosexuality when they escape erasure and are transmitted from father to daughter or mother to son.

Individualized medicine and pharmacogenomics

An article in *Nature*, May 2004, reported that the “intersection of genomics and medicine has the potential to yield a new set of molecular diagnostic tools that can be used to individualize and optimize drug therapy.” Differences in DNA sequences that alter the expression or function of proteins that are targeted by drugs can contribute significantly to variation in the responses of individuals. “Imagine your health-care provider knowing in advance what drugs will work for you, what you need to avoid and exact dosages that will work for you,” explains Joe Veltmann, Ph.D., nutritional biochemist and CEO, Institute for Individualized Medicine and the Genesis Center for Integrated Medicine, Santa Fe, New Mexico.

Know yourself. Know your profile. Know your biochemistry.

“Your genes are part of an orchestra,” says Veltmann, “in which each aspect of your life, the level of toxins in your environment, the quality and quantity of food you eat, your emotional well-being, how you respond to stress, amount of inflammation, and your own belief systems can impact your DNA.”

“Do the best you can to avoid environmental insults (such as disease and infection, harmful food supply, natural disasters, water pH, levels of pollutants in soil) and strengthen your protection against them with glutathione, zinc, vitamin E and D,” says Walsh.

Methylation is important to your mental health.

Not all genes are active at all times. DNA methylation is one of several epigenetic mechanisms that cells use to control gene expression and is highly connected to mental health. Each of us is born with normal, under- or over-methylation. A simple blood test can identify an individual’s rate of methylation. As an example, if the antidepressant, “feel-good” brain chemical serotonin is not methylated, it will become inactive, which in turn leads to depression.

Nutrients: Heal your biochemistry to heal your brain.

According to Walsh, recent advances in epigenetics provide a road map for nutrient therapies that have potential for overcoming mental disorders and eventually eliminating the need for psychiatric medications. “The primary raw materials for the synthesis of many neurotrans-

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HOW ONE MAN GAVE NEW INSTRUCTIONS TO HIS DNA AND SAVED HIS OWN LIFE

Barry Spiker, age 58, thought it was just indigestion. He had eaten some spicy leftovers late that afternoon. About an hour later, the burning sensation in his upper chest got increasingly severe. The successful international business consultant e-mailed his family physician, who said it probably wasn’t anything to be concerned about. About 10 p.m., Spiker drove himself to the emergency room. That decision probably saved his life.

After he entered the ER, the staff wasted no time in ordering an EKG. In about 20 minutes, Spiker was in surgery, being prepped to have his blocked mid-right coronary artery cleared. The cardiologist worked on him for more than four hours but said he couldn’t clear the artery because it was simply too small. Releasing him from the hospital, the surgeon remarked, “Well, you will either live or die!”

Six months later, Spiker thought he was having another heart attack. But this time it was different. He called 911, and the EMTs were at his home within minutes. They too thought something was very wrong. Spiker made a return visit to the ER.

After prepping Spiker for surgery, the surgeon remarked, “We have 31 minutes to clear this blockage. If we can’t clear it, it would yet another ‘live or die’ moment for Spiker. Once again, the surgeon couldn’t clear the artery. But on second look, the surgeon said that the artery he had been trying to clear was dead. Since his previous visit to the ER, Spiker had developed a brand new mid-right coronary artery.

“Impossible,” said the surgeon. The surgeon remarked that in 35 years he had never even heard of someone Spiker’s age growing a new artery — complete with all its collaterals. How did this happen?

Shortly after his first stay in the ICU, Spiker began contacting all of his extended family to gain a better understanding of his genetic inheritance. No one in his family had ever had a heart attack. In fact, members of Spiker’s extended family had lived well into their 90s, and even 100s. Spiker traced his heart problems back to a tick bite incurred during a visit to Martha’s Vineyard several years earlier. That was the beginning of Lyme disease, sleep apnea and, eventually, heart problems. But what had caused the heart to regenerate itself?

After his initial scare, Spiker embraced a number of practices that changed the inner workings of his body. He changed his diet, ate only organic food and a lot of cruciferous vegetables (like broccoli). He walked every day and ended a toxic relationship. He meditated. He lost 50 pounds.

What Spiker was doing made sense to him, but it also made sense to his DNA, and, as he later discovered, his own epigenetic performance. Spiker and his doctors believe that this genetic “override” is exactly what caused his body to grow a new, healthy mid-right coronary artery.

Spiker’s real-life experience and passion for the science of epigenetics led him to launch a business, Epigenesis, and website, www.epi-genesis.org. The website is capturing and cataloging epigenetic news and information and making it available to the public. Spiker’s big vision is to end all forms of pervasive developmental disorders, halt the debilitating effects of Alzheimer’s, obliterate cancer and raise funds to fuel epigenetic research and development.

—Dianne E. Price

Epigenetics continued...

mitters are nutrients — amino acids, vitamins, minerals and other natural biochemicals we obtain from food,” writes Walsh in *Nutrient Power*. “Good mental health requires proper neurotransmitter activity at synapses. A comprehensive metabolic analysis would likely reveal several nutrients that are deficient due to genetics.”

Offenders: Dr. Walsh tracks down “repeat offenders.”

“The greatest mischief in the brain is caused by nutrients that are on overload,” explains Walsh. “For example, copper overload is present in most cases of hyperactivity, learning disability, postpartum depression, autism and paranoid schizophrenia.”

According to Walsh, other repeat offenders are vitamin B-6 deficiency, zinc deficiency, methyl/folate imbalances, oxidative stress overload, and amino-acid imbalances.

Personalized medicine

Genomic testing and interpretation is the path to truly personalized medicine. “This means you can save time and money lost with the current system of one-size-does-not-fit-all, trial-and-error method of medical care,” according to Veltmann. “People will be able to avoid the unwanted side effects that often accompany drug therapy and learn exactly what lifestyle choices, diet and nutritional supplements will help them avoid disease and lead to optimal health.”

Quantum physics and epigenetics: A provocative intersection

The publication of Bruce Lipton’s *The Biology of Belief: Unleashing the Power of Consciousness, Matter & Miracles* in 2008 awakened many — scientists and seekers alike — to the reality that just because we don’t see it doesn’t mean it doesn’t exist, especially as it relates to our mental and physical health. With the deconstructing of the atom, scientists learned that it was an immeasurable, invisible energy that created the real power. Just as that elusive energy powers up the atom, it is the epigenetic processes that power (or weaken) our health.

“The old story told us we were victims of our own genes,” says Lipton. “The new story — epigenetics — tells us that we can control the readout of our genes and thus are masters of our own genetic fate.”

Risky business: Just who should consider genomic testing?

Veltmann explains that certain types of people are most likely to benefit from genomic testing. This includes people who are adopted; are challenged by stress, depression, anxiety, hyper-

vigilance or ADHD; work split shifts or have disrupted Circadian rhythms; have heavy metal loads; have inflammatory disorders; have a family history of heart disease, stroke or hypertension; are predisposed to diabetes, obesity or the inability to lose weight; and have oxidative stress related to aging or premature aging.

This also includes women who are contemplating pregnancy, in-vitro fertilization, taking or contemplating taking birth-control pills, hormone-replacement therapy or bio-identical hormones; or who have fibroids, endometriosis or heavy periods.

Other types include men who are concerned about prostate and other cancers; children with ADHD diagnosed with autism; and athletes seeking a competitive edge.

SNPs: Get better acquainted with your “snips.”

Veltmann has been studying single-nucleotide polymorphisms (SNP; pronounced “snips”) for nearly 15 years. 23andMe, a personalized genetic-testing service, calls SNP “typos, errors that happen when cells make mistakes in copying genetic instructions into new cells.” Identifying a person’s “snips” can potentially decrease the risk of chronic disease and eliminate the guesswork about medications, diet, supplements and lifestyle.

T: Tests and treatment: Where can I get tested?

“Get your genome tested and have the results interpreted by a healthcare professional trained in genomics, nutrigenomic interventions, and behavioral and environmental medicine,” says Veltmann. “Have your children tested between ages 5 and 7.”

Resources include Veltmann’s Institute for Individualized Medicine, which applies functional genomics to improve health and wellness and offers a low-cost prostate and breast-cancer-susceptibility genomic test. www.iimsite.com

23andMe Personal Genome Service provides a low-cost “comprehensive genetic scan of about 1,000,000 SNPs, which correspond to the SNP data being studied by the research community. Individuals provide saliva samples, which are analyzed, and the results are returned online.” In addition, 23andMe offers special methods for testing young children. Their test can help you “find out if your child will be at risk for 50 inherited conditions and learn about steps you can take.” www.23andme.com

The Walsh Research Institute was founded by William Walsh to continue his research efforts into a range of mental disorders and to train others around the world in advanced nutritional treatment of these disorders. The site includes links to more information, new findings and experts. www.walshinstitute.org

Myriad Genetics is a “molecular diagnostic company dedicated to making a difference in patients’ lives through the discovery and commercialization of transformative tests to assess a person’s risk of developing disease, guide treatment decisions and assess risk of disease progression and recurrence.” www.myriad.com

United States: Build a nurturing society for better health

Researchers at the University of Alabama showed that rat mothers denied access to materials needed to make a proper nest, grew anxious and spent less time mothering their young. Pups raised by these stressed-out rat moms exhibited increased methylation, a genetic neural-growth factor.

According to an essay in *Science*, this research “could have important implications for our own society. The United States has the highest levels of inequality in the so-called developed world, and one-third of Americans suffer from extreme stress, according to the American Psychological Association. If rodent research on epigenetics translates to humans, the implications could be far-reaching.”

Violence can be aggravated by medications

“We now know that certain forms of violence are programmed from birth,” says Walsh. More than 35 years of research has convinced Walsh that extreme violent behavior is predictable and can be prevented in most cases. He has amassed an extensive database, demonstrating a link between biochemical imbalances and mental-health disorders. These biochemical imbalances have a direct role in the malfunction of neurotransmitters, resulting in garbled signals between the brain and body. Walsh believes that drug-free natural therapies can correct these imbalances, thereby improving mental health.

Womb time is the critical time for the creation of healthy epigenetic processes.

“Epigenetics is a natural procedure. Something we have to have to be alive,” explains Walsh. “Most of it happens in the first month in the womb. If you don’t have environmental insults in the womb, in a normal healthy development of a baby, the epigenetic marks are established. These are chemical tags that are attached to your DNA and regulate these chemicals. Nutrition can turn on gene expression and cause the expression of these proteins.

“The key time to make an impact is before a woman gets pregnant and during the first month — even during the next nine months,” Walsh continues. “This is when these genetic variations get caused — autism and spina bifida and a predisposition for things like mental ill-

ness and heart disease, so nutrition is incredibly important. These bookmarks are there for the rest of your life.”

X chromosome: Environmental insults can lead to disease.

When X-chromosome genes are faulty, specific genetic conditions may result: hemophilia, Duchenne and Becker muscular dystrophy, and fragile X syndrome.

When the egg and the sperm join at the time of conception, they form the first cell of the baby. This cell has 46 chromosomes, made up of 23 pairs, which is all the genetic material needed for a new person to start developing. There are also two chromosomes that have been given the letters X and Y: These are the sex chromosomes.

Young people and “bad” behavior: Is it in their genes?

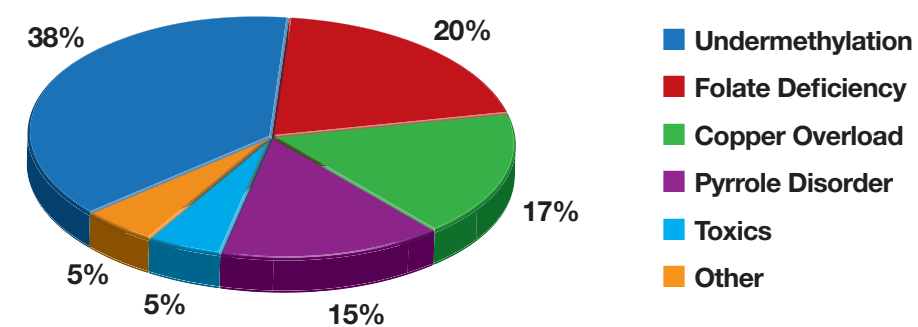
“The reality is that most children with terrible behavior were born with chemical imbalances that predispose them to this conduct. Flawed life circumstances can aggravate this condition, but the underlying cause is usually bad chemistry,” explains Walsh.

Walsh also explains that, unfortunately, sometimes the very medications provided to allay mental health have the opposite result — and end up causing tragedies. After studying some 50 school shootings, Walsh observes, “Most of them [the shooters] did not have a behavior problem until around 15 or 16. Then they got on an SSRI (selective serotonin re-uptake inhibitor) like Prozac or Paxil. Their genetic makeup caused an intolerance to these drugs, resulting in greater disturbance.”

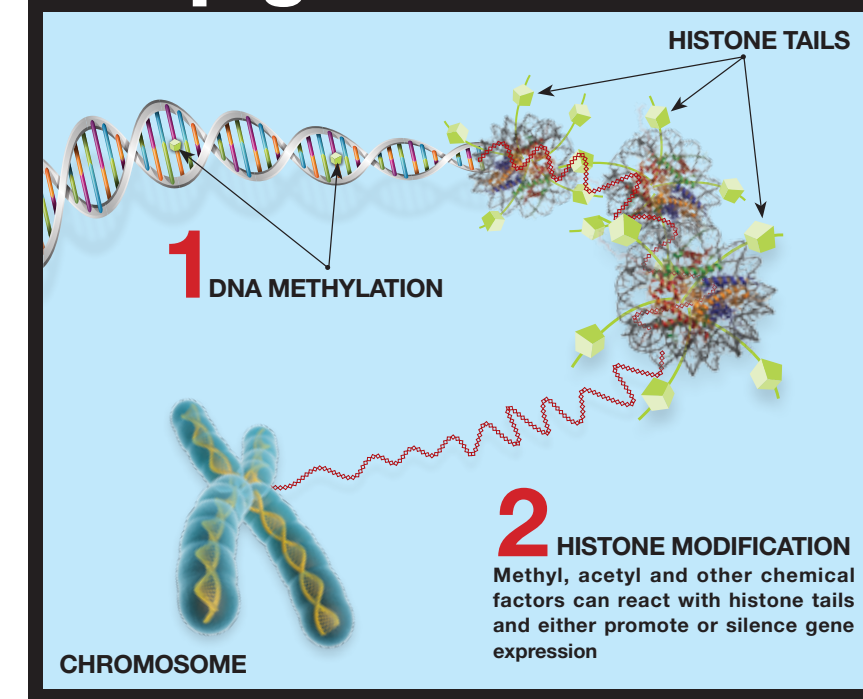
Zinc as a protector against oxidative stress

Zinc is essential for protecting against oxidative stress and helping DNA repair. Some studies have suggested that increasing zinc in the prostate may help prevent prostate cancer. According to researchers at Oregon State University, about 12 percent of the U.S. population, including as much as 40 percent of the elderly, is at risk for zinc deficiency due to inadequate dietary intake and less absorption of this essential nutrient. **B**

Depression Biotypes



The Two Main Components of the Epigenetic Code



AD Plaques and Tangles

