Principal Background on Epigenetics

Let's Get Healthy! in partnership with Oregon Heath and Science University is working to bring the latest health related research to Oregon schools. As part of this effort, a new module was developed for the Let's Get Healthy! fair to educate students, parents and teachers about a new area of science called epigenetics. Epigenetics studies the environment's influence on how DNA is expressed.

What the students will be doing

To learn about this, your students will attend a health fair where one station will teach through an interactive game the basics of epigenetics. Before or after the fair, classroom teachers may use some lessons OHSU offers to teach more aspects and more detail about the subject. These have been designed by teachers to link to traditional curriculum in classes including science, math, health, art, and social studies. We hope these lessons increase student awareness of epigenetics and understanding of how choices made now and throughout life can impact their own health and that of their future children and grandchildren.

What the teachers will be doing

As part of the Let's Get Healthy! fair, teachers will be asked to conduct a pre and post survey to help us learn student perspectives on epigenetics. Teachers will receive information and specifics about the survey from the Let's Get Healthy! staff. Let us know if you would like a copy.

The epigenetic lessons provided are designed to supplement curriculum and lessons already taught in the disciplines of science, social sciences, language arts, health, technology, math and the arts. Being aware that each discipline is already full of content, lessons were designed by teachers to provide an epigenetic perspective to typical lessons already taught. A curriculum web and standards spreadsheet are available (http://www.letsgethealthy.org/wp-content/uploads/2013/08/Curriculum-Standards.docx) to demonstrate the interdisciplinary relationships of the lessons and how they tie into CCSS, NGSS and Oregon State Standards. Lessons are designed to meet the literacy requirements for CCSS.

Why is epigenetics important

DNA is made up of genes that are the codes for proteins. Genes can be turned "on" or "off", a process called gene regulation. Gene regulation is required for normal development

throughout our lives. Genes that are expressed instruct cells what to become, how our organs form, how we remember material for a math test, how our bodies respond to disease and infection, and much, much more. Epigenetics is the study of how environmental factors impact gene regulation which controls gene expression. Gene regulation influences our health throughout our lifespan and new research is suggesting that epigenetic changes may extend across multiple generations to affect the health of our children, grandchildren, and possibly even great-grandchildren. Epigenetic changes are reversible, so our life choices may reverse or mitigate the effects of early epigenetic marks and prevent them from being transmitted to further generations. This is like playing a card game. Even if you are dealt a bad hand it is possible to play it well. It is also possible to mess up a good hand with the wrong life choices. This is an important concept for adolescents because it suggests that we aren't just a product of our genes, but our environment and the choices that we make, too. We need to "nurture our nature".

How is a person impacted by epigenetics

Epigenetics affects our bodies throughout our lives because gene expression occurs every day throughout our lifespan. The epigenetic effects on our health depend on when (in our development) and where (in our bodies) our genes are turned "on" and "off". We have learned from historical famines and population-wide studies that long-term health effects can be observed following a variety of environmental exposures. Current research suggests that the following environmental factors can affect how our genes are regulated.

Sun (ultraviolet light)
Drinking water pollutants
Auto exhaust
Radiation
Diet (methionine, choline, folate, B12)
Social interaction
Hormones (bisphenol A, DES, estrogen, dioxins)
Pesticides
Metals (Ni, Cr, As, Cd, Hg)
Tobacco Smoke

Future research and unanswered questions

There are bound to be many news stories about epigenetics in the next few years. It is important to consider the credibility of the sources of these stories. Carefully designed studies from respected institutions with a clear statement of the limitations of the investigation backed up through review of other scientists are more credible than extreme claims made through the popular press without details of how the investigation was conducted or reviewed. Especially suspicious are claims made in relation to products which claim to have health benefits through epigenetic effects. Other than general dietary recommendations, it is just too early to be able to manufacture such products. Such things will take a number of years of development and would be tested in carefully controlled studies. Currently, there is solid scientific evidence of epigenetic impacts on vulnerability to hypertension, kidney disease,

obesity, type II diabetes, cholesterol problems, stroke, and osteoporosis. Under investigation are links between epigenetics and vulnerability to autism, depression, and schizophrenia.

Right now, the best advice is to eat a healthy diet, sleep well, avoid stress, and avoid exposure to environmental toxins. All these are familiar bits of advice that your grandmother may have given you, but now we are beginning to understand the deep molecular biology for how they work and we will be able to use that understanding to give more specific epigenetic help.