Epigenetics of Generational Trauma

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Genetics Basics

- Deoxyribonucleic Acid (DNA)
- Blueprint for life
- Building Blocks four bases with a backbone
- The alphabet of genetics:

  Adenine (A); Cytosine (C); Guanine (G); Thymine (T)
- DNA Strands are joined together by complementary base pairs; A pairs with T and C pairs with G
- They function together in larger units called genes
- A complete set of genes is called a genome

Genetic Basics Continued

- Proteins carry out most of the body's function and make up the bulk of it's structure
- The instructions to build proteins are found in genes
- The building blocks of protein consist of long chains of amino acids (20 in total)
- Different sequences result in different shapes which allow for a variety of function
- Smaller chunks of DNA are called chromosomes
- Humans have 46 (23 pairs)
- Each DNA strand wraps around a histone (another protein)

Cell Division and Transcription

- When a gene is switched on an enzyme (RNA Polymerase) breaks the double helix
- DNA is copied and chromosomes change form and condense
- As the cell divides this change in form keeps DNA organized and untangled
- Free bases are added to messenger RNA where
- U (Uracil) pairs with A and G pairs with C
- mRNA exits the nucleus into the cytoplasm and ribosomes reads the code and produces a chain of amino acids called Transfer RNA which return to the original DNA pulled apart strand thus making the protein which folds into a specific shape

- https://www.youtube.com/watch?v=6j8CV3droDw
- https://www.youtube.com/watch?v=gG7uCskUOrA

FUN FACTS

- *It would take nearly 5,000 strands of DNA laid side by side to equal the width of a human hair.*
- https://learn.genetics.utah.edu/content/basics/builddna
- *The average human protein-coding gene is about 3,000 letters long, but our genes come in a wide range of sizes. The shortest has only 500 letters, and the longest has 2.3 million.*
- https://learn.genetics.utah.edu/content/basics/geneanatomy/

True or False Quiz

- 1) One gene does equal one trait
- 2) Our genes are our destiny despite environmental factors
- 3) There is same gene for hair texture (curly or straight) and the allele varies
- 4) We inherit equal amounts of DNA from both parents
- 5) Mutation is always bad
- 6) All of our cells contain identical DNA

Inheritance

- Sexual reproduction involves passing down genetic information to offspring
- We have two copies of every gene may be the same or different
- The outcome of the two sets influences our inherited traits
- Genotype are genes inherited from our parents (alleles dominant and recessive traits)
- Phenotype is the genotype plus environment can be observable traits and behavior

Mutations

- Also known as Single Nucleotide Polymorphisms (SNP)
- Common spelling mistakes when DNA is copied; normal and some are corrected
- May involve the deletion of a base or an insertion of a base
- May be a spelling error a base doesn't pair correctly
- https://learn.genetics.utah.edu/content/basics/mutation/

FUN FACTS

- More than 99.9% of our DNA sequence is the same
- Proteins make up about 42% of the dry weight of our bodies. The protein collagen—which holds our skin, tendons, muscles, and bones together—makes up about a quarter of the body's total protein.
- The most abundant protein in our blood is albumin
- https://learn.genetics.utah.edu/content/basics/proteins/

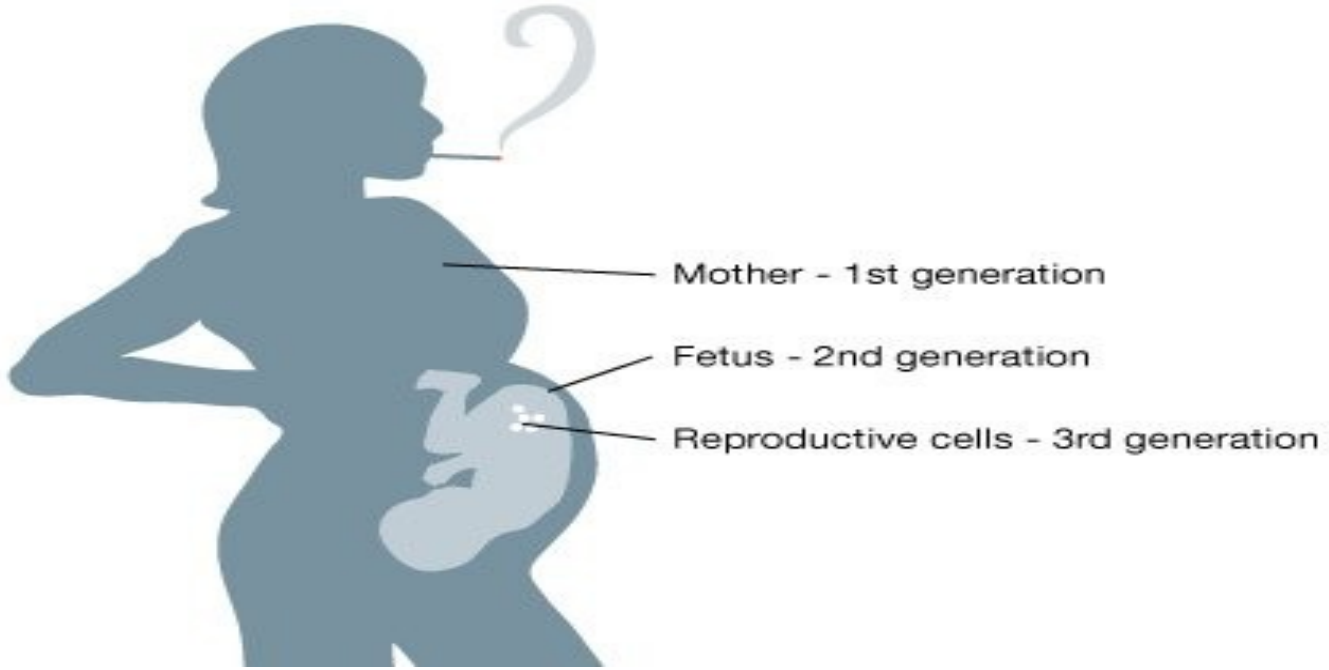
The Basics of Epigenetics

- Do you remember we learned strands of DNA are wrapped around another protein call Histones?
- This DNA and Histones are covered in chemical tags this second layer is called the **epigenome**
- When a gene is inactive the epigenome is wrapped tightly making genetic information inaccessible
- When it is relaxed it actives genes making the genetic information accessible

The Basics of Epigenetics Con't.

- DNA is fixed and the Epigenome is flexible
- Epigenetic tags react to signals from the outside world (i.e. diet, lifestyle, and stress)
- Four types of cell tissue: connective, epithelial, muscle, and nervous
- https://learn.genetics.utah.edu/content/epigenetics/intro
- https://learn.genetics.utah.edu/content/epigenetics/twins

Epigenetics & Inheritance



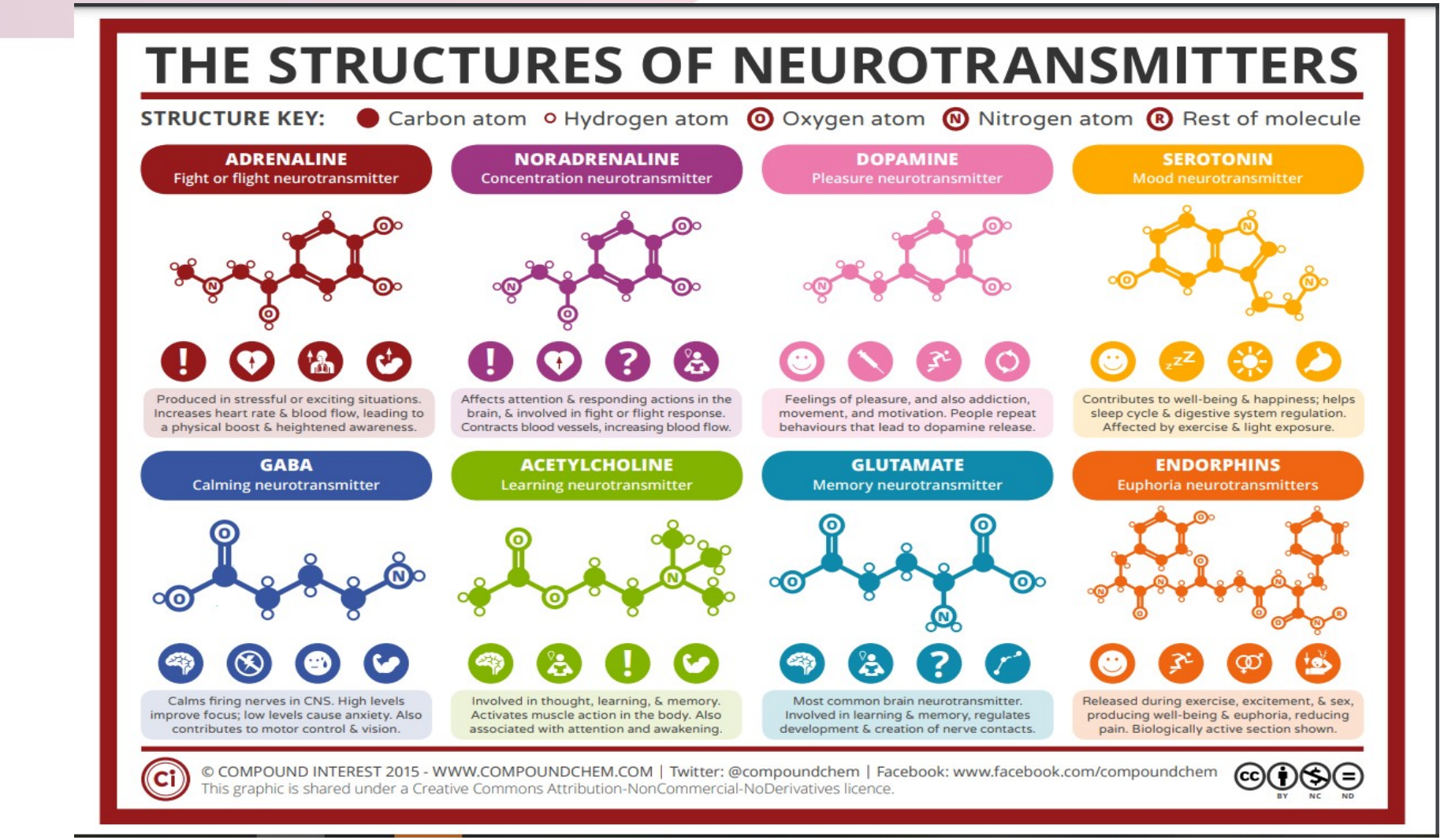
Three generations at once are exposed to the same environmental conditions (diet, toxins, hormones, etc.). In order to provide a convincing case for epigenetic inheritance, an epigenetic change must be observed in the **4th** generation.

https://learn.genetics.utah.edu/content/epigenetics/inheritance

Epigenetics & Cell Signals

- Proteins carry signals to DNA
- Types of signals include **direct contact**, **release factors** picked up by neighboring cells, **hormones** (like radio signals), and **environmental factors** (food and stress triggers)
- Gene regulatory proteins have two functions:
  - To attach to a specific sequence on DNA to turn on or turn off a gene
  - To recruit enzymes that recruit epigenetic tags
  - Both DNA and tags are copied in cellular division
  - Epigenome causes cells to have a **memory** even after tags are removed (***genomic imprinting***)

Mental Health Neurotransmitters



Nutrigenetics

MODULE 2 - BASICS OF GENETICS

Resources

NUTRIGENETIC GXE INTERACTIONS

GENE **ENVIRONMENT**

Generic variability (nucleotide sequence changes) influences how we interact with our environment. This area of **NUTRIGENETICS** concerns the influence of gene variants on our ability to interact with bioactive molecules in the molecular environment surrounding our cells and the consequences of that interaction. As an example a nucleotide change in the CYP1A2 gene can determine an individuals ability to metabolize caffeine, explaining those who get the jitters after two cups of coffee!

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Nutrigenomics

MODULE 2 - BASICS OF GENETICS

Resources

NUTRIGENOMIC INTERACTIONS

ENVIRONMENT **GENE**

In contrast to nutrigenetic interactions where the gene variants acts on the environment, with **Nutrigenomic** interactions the **environment influences gene expression**

Nutrigenomics is concerned with the influence of bioactive molecules interacting with a gene, potentially influencing gene expression. Either **up-regulating** or **down-regulating** (turning it up or down) or **activating** or **silencing** (on or off).

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Nutrigenomics

MODULE 2 - BASICS OF GENETICS

Resources

NUTRIGENOMIC GXE INTERACTIONS

There is no change in the DNA sequence, there is no genetic variant.

The area of **NUTRIGENOMICS** is concerned with the impact of nutrients, specifically, bioactive food components on gene expression.

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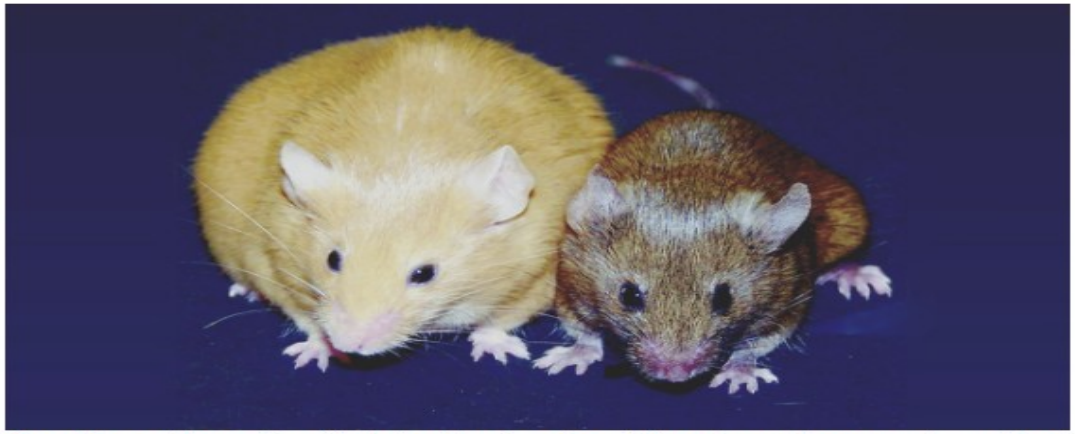
Agouti Mice

NIH.gov | Blog Home

agouti mouse

Creative Minds: Building the RNA Toolbox

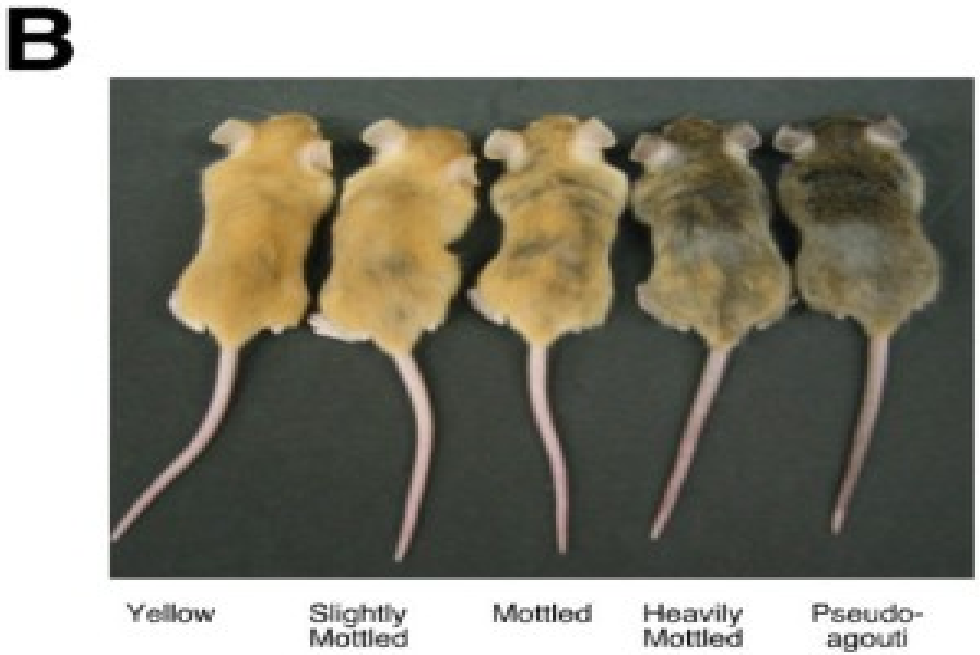
Posted on October 20th, 2016 by Dr. Francis Collins



Caption: Genetically identical mice. The Agouti gene is active in the yellow mouse and inactive in the brown mouse.
Credit: Dana Dolinoy, University of Michigan, Ann Arbor, and Randy Jirtle, Duke University, Durham, NC

https://directorsblog.nih.gov/tag/agouti-mouse/

Agouti Mice



https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2822875/#:~:text=The%20viable%20yellow%20agouti%20(A,on%20the%20fetal%20epigenome%20(Fig.

Using NET & F.A.S.T to Alter Epigenomic Expression

- Neuroemotional Technique is a Mind-Body intervention to process the memory of emotions in the nervous system
- One Research Foundation shows emotions are a neuropeptide a psychological construct
- F.A.S.T., First Aid Stress Tool is not NET, but is an element of NET which can process emotions, including trauma
- Stressed – a documentary film https://www.youtube.com/watch?v=ahU2FP_b9OQ

Thank you for your time and attention ☺

Enjoy your weekend !!