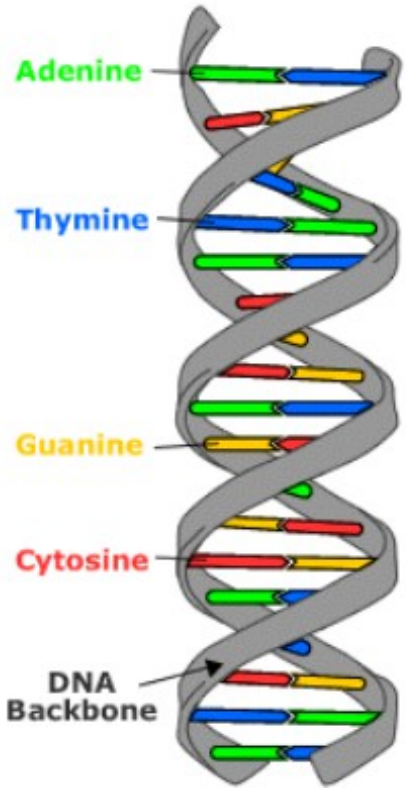
LECTURE NINE; EPIGENETICS



- The central dogma: DNA codes RNA, which codes proteins
- DNA is the molecule of heredity that passes into the next generation
- However, the DNA is not the only vehicle of information transfer between generations
    - Epigenome = involved in regulation of DNA expression, development and tissue generation
    - Modification via the epigenome can also lead to trans-generational transfer
    - Does not involve modification of DNA sequence
- 4 nucleic acids: A T C G

  Anj = Adenine

  Thinks = Thymine

  Cats = Cytosine

  Gross = Guanine
- Chemicals that moderate the genome
    - Attach to DNA and modify its function
    - Do not change the sequence of DNA
    - Change the way DNa is interpreted by the cell
    - Turn off and on different genes in different cells
    - Allows for cell differentiation
- Two main types
    - Methyl groups: attach to the bases of the DNA molecule and turn gene expression on or off
    - Histone modification: DNA molecule is wrapped around histone proteins. These proteins can be modified and determine if DNA regions will be translated or not

- Epigenetics and twins
    - Throughout an individuals lifetime, their DNA does not change (except for some rare mutations in individuals)
    - The epigenome however can change based on environmental influences
    - Cell environment, nutritional environment, disease
    - This allows rapid adjustment to environmental change
- is the epigenome inherited?
    - Mostly the epigenome is reset in the fertilized egg
    - Under some circumstances chemical tags (methylated groups) or histone modifications are passed onto eggs and sperm
    - Transferred into next generation
- Epigenetic effect of famine in humans
    - First generation effect: children whose mothers had been malnourished early in pregnancy → higher rates of obesity and other health issues including mental health
    - Second generation effect: grandchildren of malnourished grandmothers also had greater health issues
    - After six generations, the epigenetic signature is still present
- In summation:
    - Epigenome moderations how the DNA is interpreted in the cell
    - Can change rapidly within an individual relative to the environment
    - Can be transmitted to the next generation

LECTURE TEN; SPECIES AND SPECIATION

Speciation

- Origin of new species (speciation) is the focal point of evolutionary theory
- Appearance of new species is the source of current and past biodiversity

- In addition to explaining genetic changes in populations over time, evolutionary theory must also explain the apprearcne of new species

What is a species?

- many definitioons
- the most relevant to this unit is the **biological species concept (reproduction)**
    - a population or group of population
    - members have the potential to interbreed in nature → to produce viable, fertile offspring
    - are unable to produce viable fertile offspring with members of other populations
- Other definitions
    - Morphological species concept
        - Characterizes a species in terms of its body shape, size, and other structural features
    - Paleontological species concept
        - Focuses on morphologically discrete species known only from the fossil record
    - Ecological species concept
        - Views a species in terms of its ecological niche, where do they occupy
    - Phylogenetic species concept
        - Defines a species as a set of organisms with a unique genetic history
        -
- The biological species concept requires observation of living organisms, information about their reproduction and offspring and therefore may not be suitable as a concept for other situations
- The central point of this concept is the idea that members of different species can not reproduce to form viable offspring → the species are reproductively isolated in order to define species boundaries

- Reproductive boundaries =
- Prezygotic barriers
    - Impede mating between species or hinders the fertilization of eggs if members of a different species attempt to mate
        - Habitat isolation → members of different species occur in different habitats and don't encounter eachother e.g. terrestrial garter snake and water living garter snake
        - Temporal isolation → members of different species are active and mate during different times of year e.g. different species of skunks have different mating seasons
        - Behavioural isolation → complex courtship e.g. birds dancing → elicits the right response in the right species
        - Mechanical isolation → morphological differences prevent successful mating e.g. snails can only mate if both coil is in the same direction
        - Gametic isolation → sperm and eggs are unable to fuse and intiate development of the zygote e.g. sea urchins release eggs and sperm into water, but gametes of different species can not fuse
- Postzygotic barriers
    - Often prevent the hybrid zygote from developing into a viable fertile adult
        - Genes of parents from different species interact in a way that impairs hybrids development e.g. salamander hybrids often can not complete development and if they do, are fragile
        - Hybrids may be sterile because of differences in chromosome number and structure e.g. hybrids of horses and donkeys (mules) are robust but sterile
        - Hybrid breakdown → first generation of hybrids may be viable and fertiole but their offspring are feeble and sterile e.g. second generation of hybrid rice are small and sterile