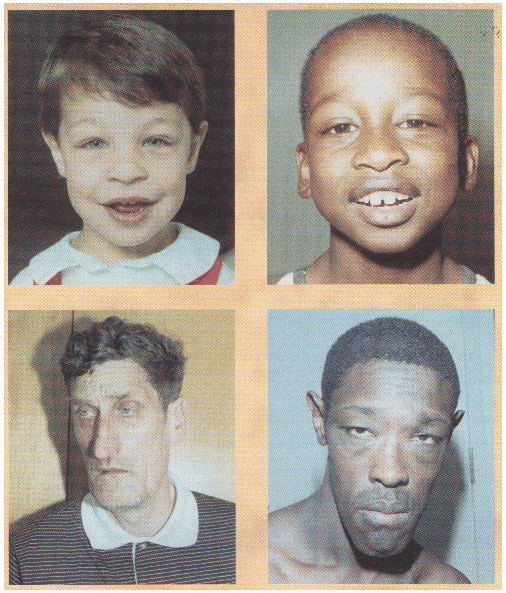
Psych 3102
Introduction to Behavior Genetics

Lecture 7

Further examples of Non-Mendelian Inheritance

Fragile-X syndrome



X-linked dominant with
incomplete penetrance and
variable expressivity

Prevalence:

Phenotype:

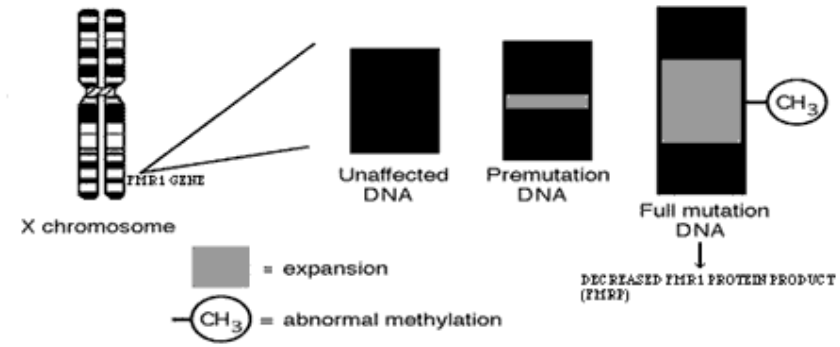
morphological and behavioral
features

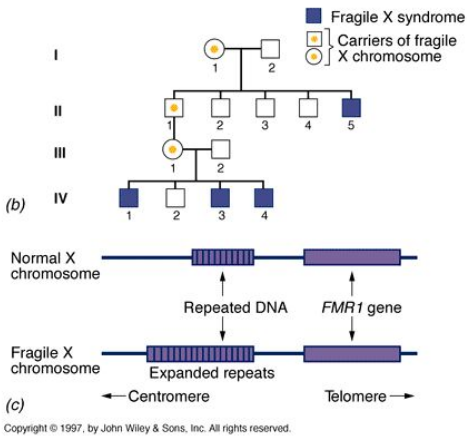
triplet repeat mutation $(CGG)_n$

n=6-52 normal

n=52-230 premutation

n=230-2000 affected





Genetic anticipation

Huntington disease - earlier onset, swifter progression

Fragile-X syndrome – greater severity

- explained by increase in number of repeats as allele is passed on

Alzheimer disease early-onset type

schizophrenia manic depression ??

Premutation

Huntington disease male expands repeat sequence more than female (due to imprinting)

11-34 CAG repeats = normal phenotype

34-36 CAG repeats = premutation, normal phenotype

37-100 CAG repeats = HD phenotype

Fragile-X syndrome female expands repeat sequence more than male (due to imprinting)

Fragile X syndrome X-linked triplet repeat mutation

- accounts for 2% of males in residential special schools
- twice as common in males as females due to incomplete penetrance in females (50% of females with the mutation do not express any symptoms) X inactivation
- causes moderate retardation in males, mild retardation in females variable expressivity
- premutation 52-230 repeats (normal allele has av.30)
- genetic anticipation symptoms increase 230 -> 2000 rpt
- imprinting female has 80% chance of increasing repeats during meiosis
- pleiotropy

  - retardation, physical and behavioral features

  large protruding ears and jaw, long face, enlarged testicles, unusual speech, flapping hands, overactive, impulsive, inattentive

good mouse model – brain neurons affected as in humans

Drosophila model – similar synaptogenesis abnormalities

Genetic imprinting
(genomic, gametic imprinting)

- expression of an allele sometimes depends on whether it was inherited from the male or the female parent
- imprinting is a form of epigenetic inactivation via methylation
- occurs during gamete formation, the maternal or paternal copy of a gene is selectively inactivated so that only one copy of the gene is active during development after fertilization
- both male and female imprints are necessary
- original imprints are erased during germ cell development so new ones can be laid down according to sex of parent

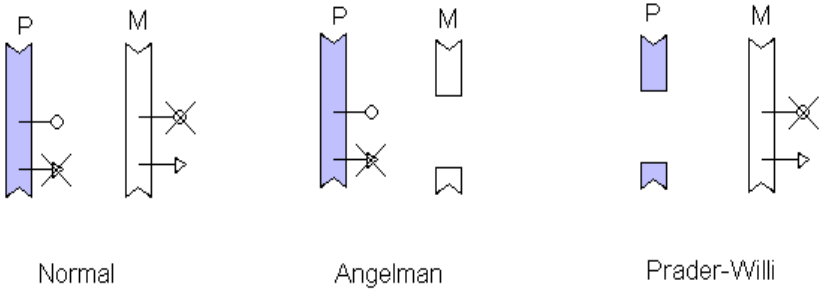
Angelman/Prader-Willi syndromes

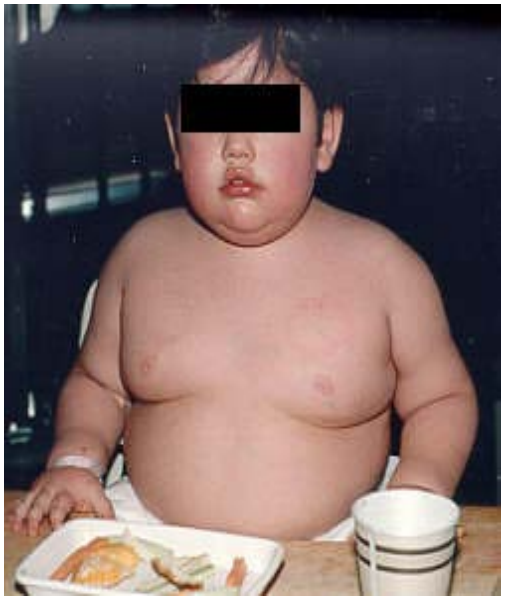
example of genetic imprinting

deletion on chr 15

from Mom

from Dad





Cytoplasmic inheritance (maternal inheritance)

- genes in mitochondria (and chloroplasts) are only passed on from female parent since all cytoplasm for zygote comes from female gamete
- all offspring resemble female parent for traits influenced by mitochondrial genes

  encephalomyopathy

Alzheimer disease

Bipolar disorder

most DNA controlling MT function reside in nucleus – cannot assume problem in MT function is due to mutation on MT DNA