COGS 1: Spring 2019

Section **B**, Week 3

Professor Boyle	*mboyle@ucsd.edu*	Friday, 2-4 pm	CSB 130
Lauren	*lcurley@ucsd.edu*	Tuesday, 10-11am	CSB 225
Lexi D.	*adalenco@ucsd.edu*	Tuesday, 12:30-1:45 pm	Sun God Lounge
Elena	*edreisba@ucsd.edu*	Thursday, 1-2 pm	CSB 114
Adrian	*ajm033@ucsd.edu*	Wednesday, 5-6 pm	CSB 114
Audrey	*aberardi@ucsd.edu*	Tuesday, 4-5 pm	CSB 114
Devansh	*d4agarwa@ucsd.edu*	Monday, 4-5 pm	CSB 114
Lori	*rol044@ucsd.edu*	Monday, 10-11 am	CSB 114
Lexi F.	*adfrankl@ucsd.edu*	Thursday, 4-5 pm	CSB 114

Important Information

- Review Questions
  - Available at the end of every week on Saturday
  - Use these to guide your understanding of lecture and readings
- Extra Credit
  - EC quizzes on readings on TritonEd
    - This week’s quiz is based on Reading for Dr. Rangel
    - Opens Wed 4pm and closes Thu 10am before lecture
- Section Slides
  - Posted after the end of the last section on Friday

Last Week’s Topics

- **Lecture 3 | Dr. Coulson: Lateralization of Function**
- **Lecture 4 | Dr. Ellis: From Genetics to Data Science**

Lecture 3

Lateralization of Function

Dr. Coulson

Lecture 3 | Review Questions (1 of 5)

Vote!!

1. What does “lateralization” of function mean?
   a. Can you think of different examples from lecture and the reading?
2. What are the main function of the four lobes of the brain?
   a. Are any of these function lateralized?
3. What are the language centers of the brain?
   a. Where are they?
4. From the lecture and your reading--identify the :

   Corpus callosum, Broca’s area, Wernicke’s area, the four lobes

Lecture 3 | Review Questions (2 of 5)

Vote!!

5. What does the Wada test establish? What is it used for? How does it work?

6. What are the differences between Broca's aphasia and Wernicke's aphasia?
   a. In lesion areas?
   b. In impairment of language production and/or comprehension?
   c. What about conduction aphasia?

7. What is the simplified Wernicke-Geschwind model of different aphasia?
   a. Are there ways in which the model is simplistic

Lecture 3 | Review Questions (3 of 5)

Vote!!

8. What are the major sulci that divide the different lobes?
9. Where are the primary motor & primary somatosensory cortices located in the brain?
10. What is the homunculus?
11. How do the right and left hemispheres differ and how do they communicate?
12. What is the relationship between hand and hemisphere dominance?
13. What are Brodmann's areas (you don’t need to know the different ones, just know the basics of what they are.)

Lecture 4

Reading (Coulson) | Review Questions (4 of 5)

Vote!!

14. What is meant by the "average brain is skewed"?
15. What are some anatomical differences between the hemispheres?
16. What are some functional differences between the hemispheres?
17. Identify important regions of the brain that are vulnerable to damage when undergoing brain surgery.
    a. Why would someone being undergoing this procedure in the first place?
    b. How are these regions mapped out?
18. Provide examples of when brain function was altered but enabled localization of function.

Lecture 4

Reading (Coulson) | Review Questions (5 of 5)

Vote!!

19. Be able to describe anomia and aphasia.
20. What is the purpose of electrically stimulating Neil's cortex while he names off the objects on each slide?
21. What was significant about the planum temporale?
    a. Where is it located?
    b. How does it differ across both hemispheres?

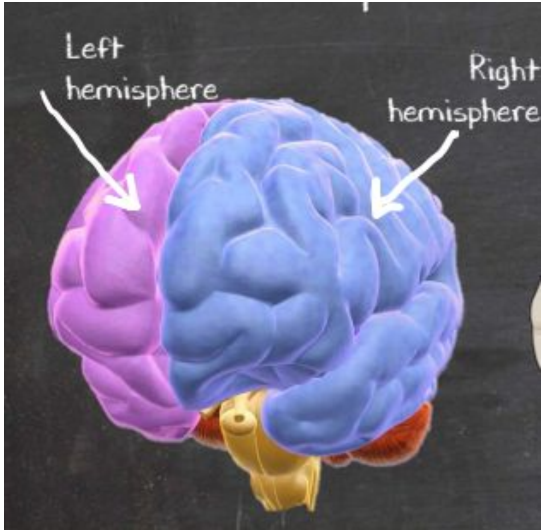
Lecture 4

1. What does lateralization of function mean? Examples?

Definition: The tendency of a hemisphere to be more dominant in/integral to the performance of a certain process

For example:

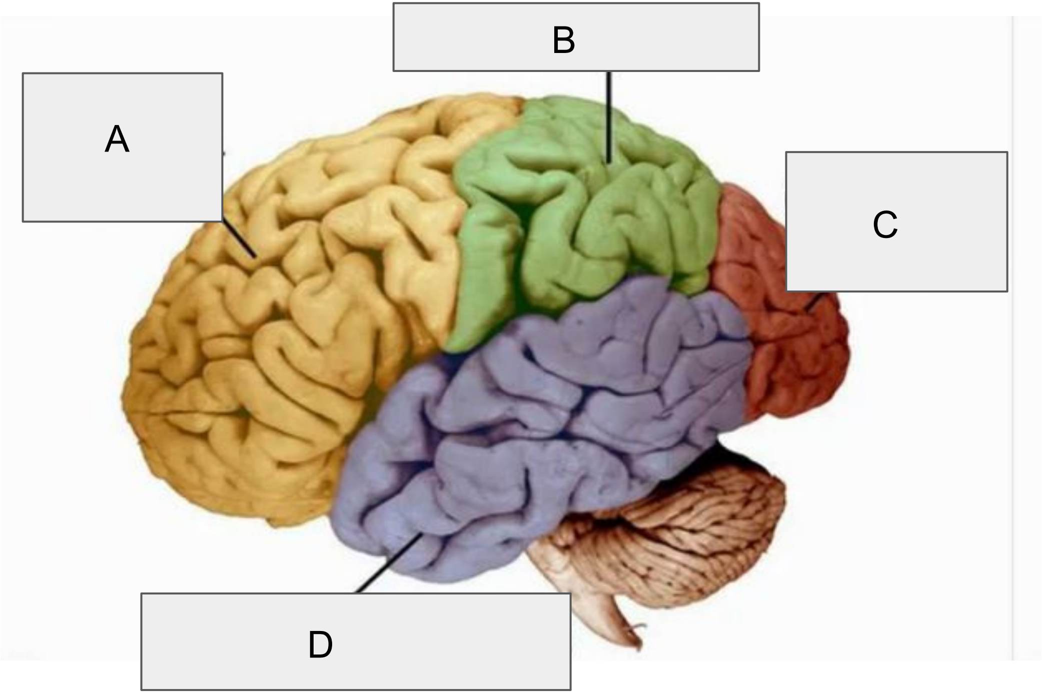
Left side
- Language
- Cause & effect reasoning
- Schema
- Visual search task
- Local-level visual stimulus processing



Right side
- Face
- Emotion
- Visuomotor task
- Global-level visual stimulus processing

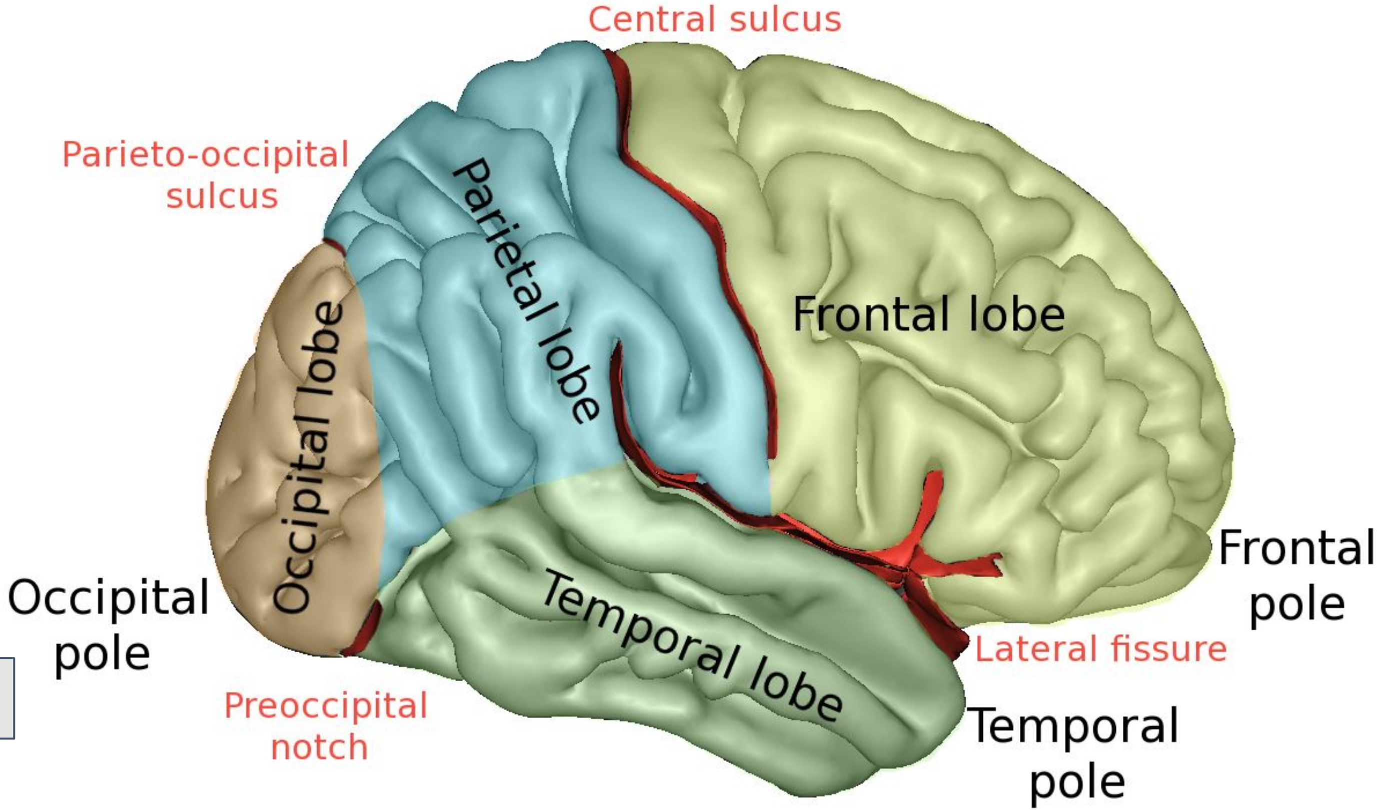
All Ques.

2. Know the major functions of the four lobes.



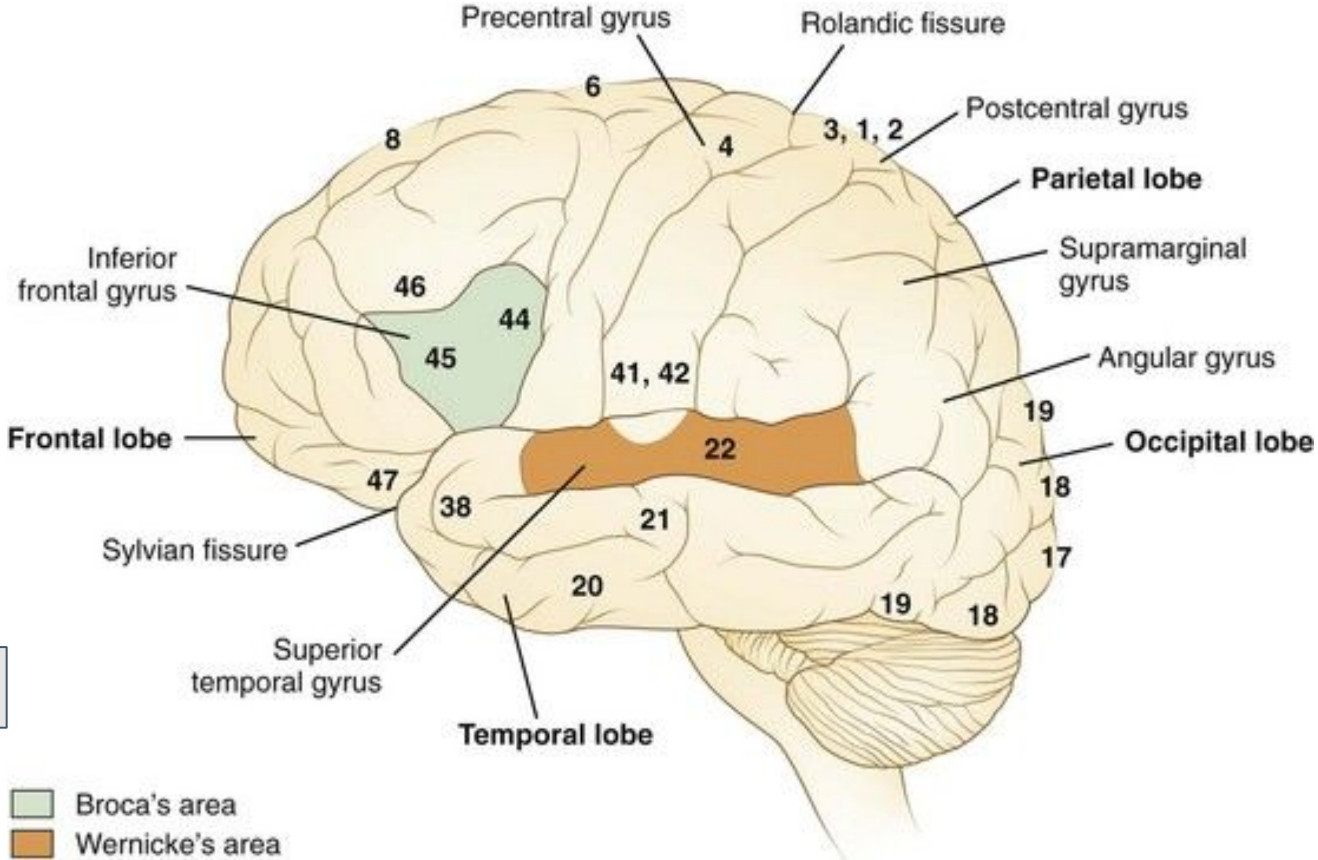
[3D Brain App]

2. Know the major functions of the four lobes.



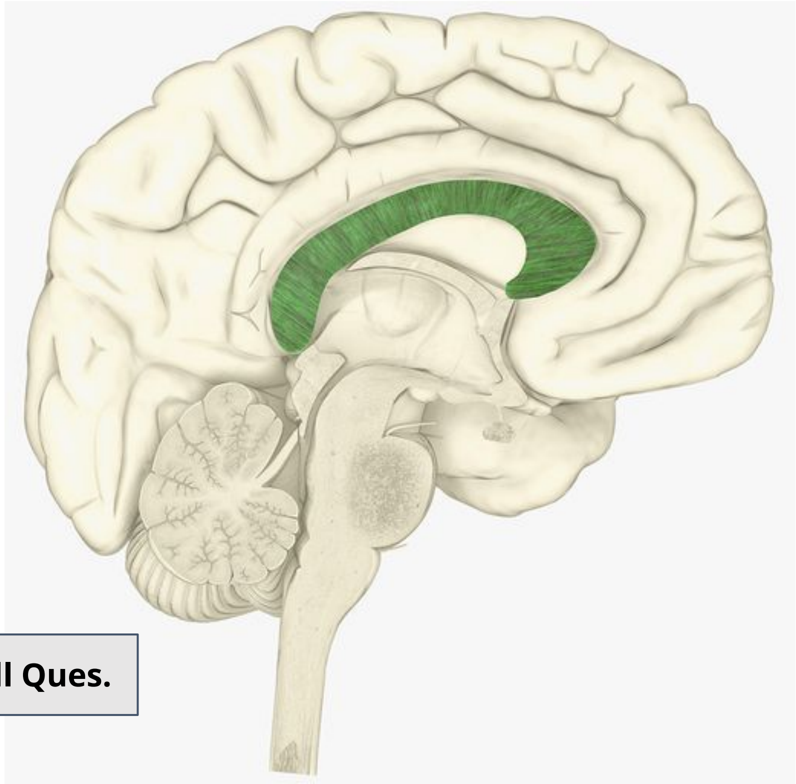
All Ques.

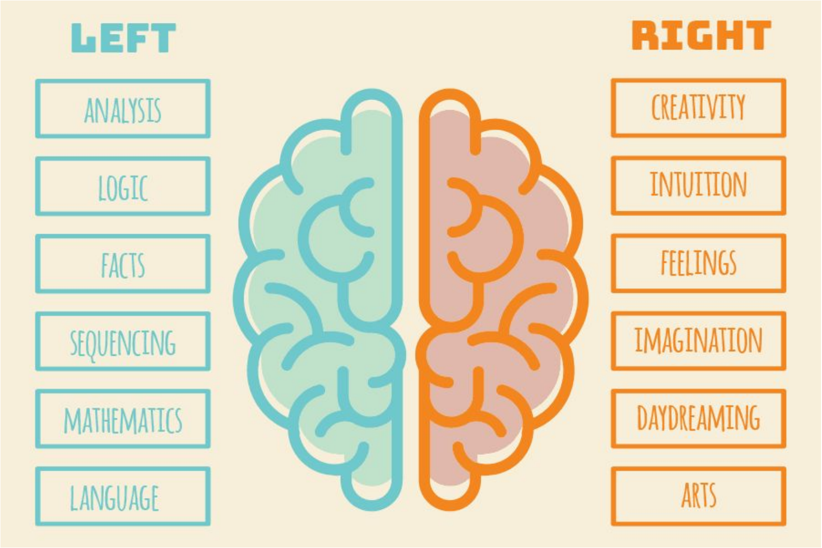
3. What are the language centers of the brain? Where are they?



All Ques.

4. What is Corpus Callosum? Where is it?





All Ques.

5. What is the Wada Test? What's the purpose of it?

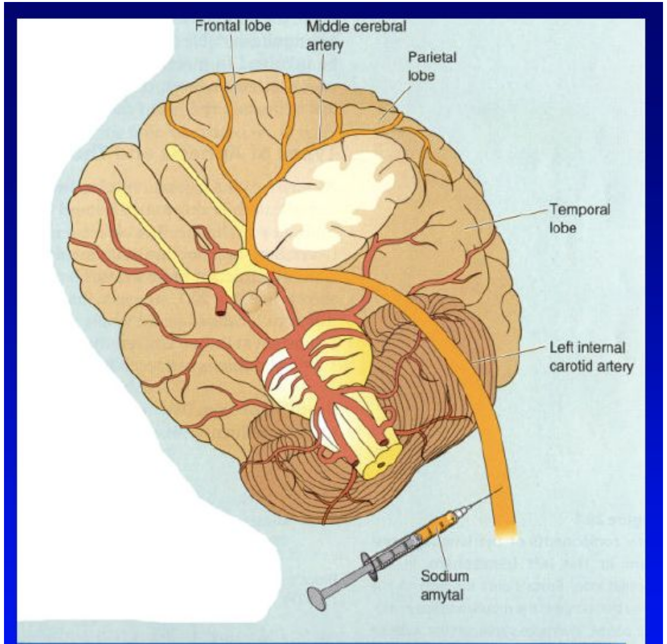
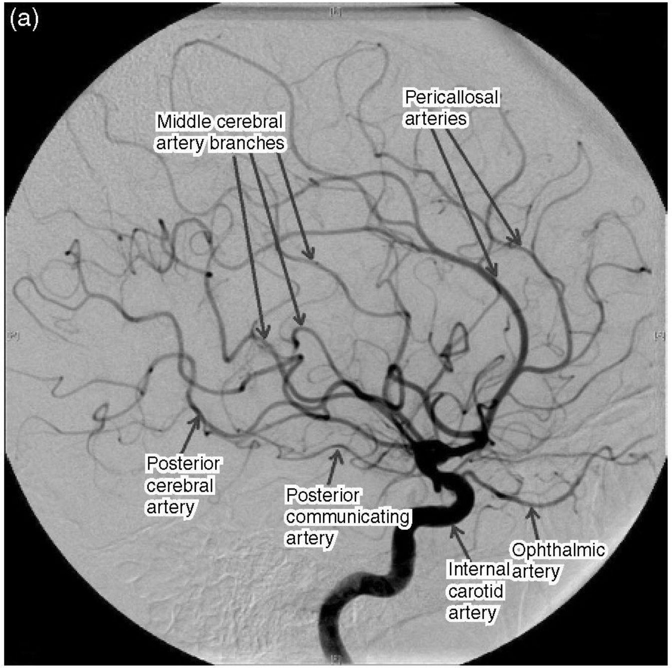


Table A Hemispheric Control of Speech in Relation to Handedness

		SPEECH REPRESENTATION (%)		
HANDEDNESS	NUMBER OF CASES	LEFT	BILATERAL	RIGHT
Right	140	96	0	4
Left	122	70	15	15

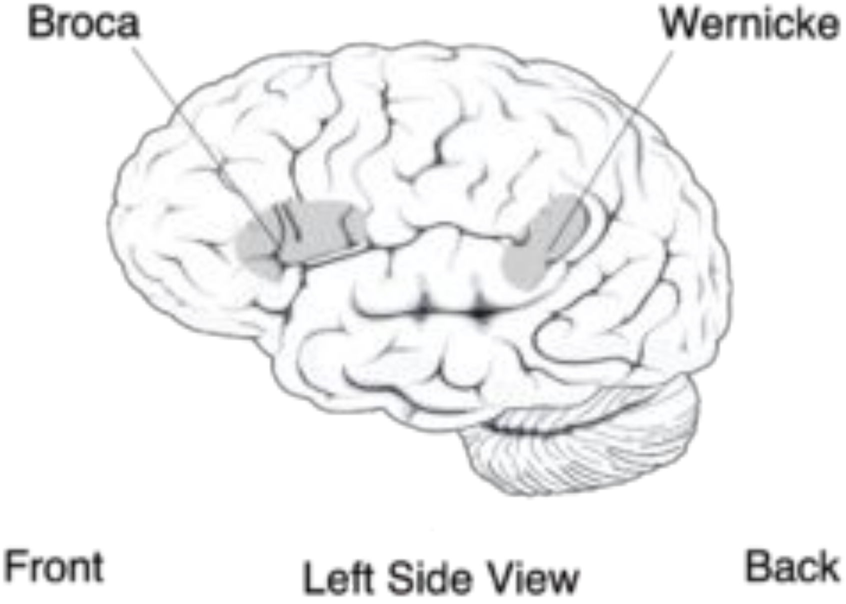


All Ques.

6. What are the differences between Broca’s aphasia and Wernicke’s aphasia?

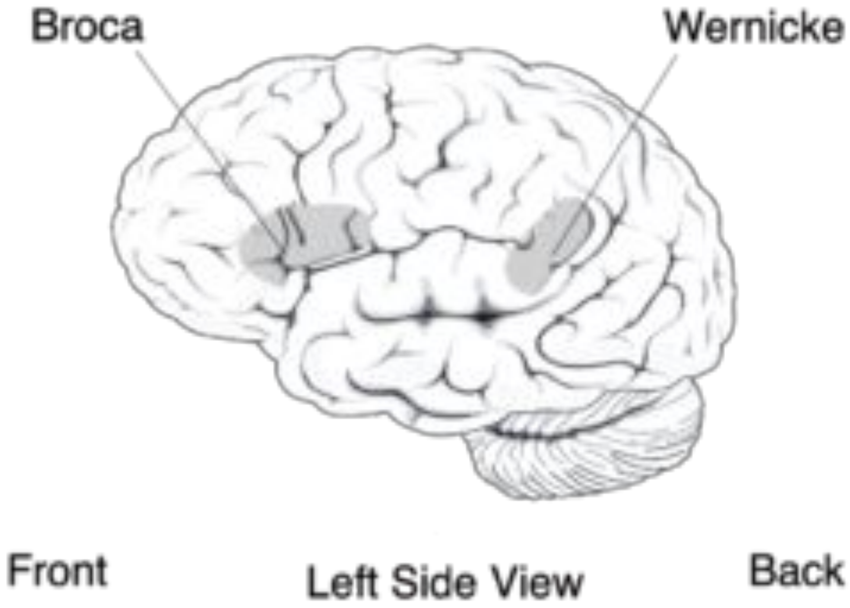
a. Lesion area?

- Broca’s Aphasia
  - Frontal Lobe
- Wernicke’s Aphasia
  - Temporal Lobe



6. What are the differences between Broca's aphasia and Wernicke's aphasia?

B. Impairment?

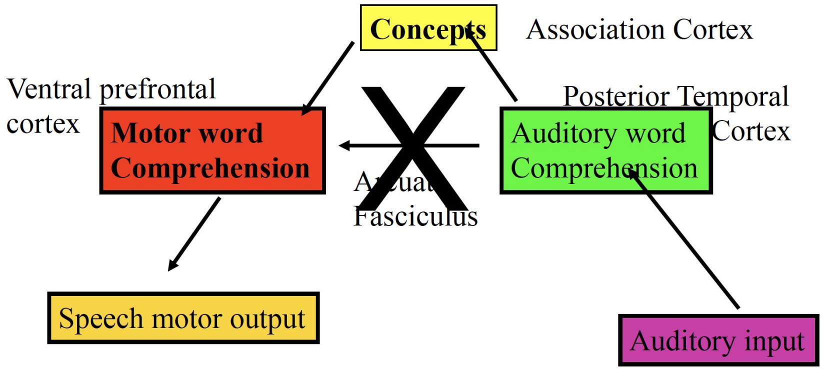


- Broca's Aphasia:
  - Production
- Wernicke's Aphasia
  - Comprehension

6. What are the differences between Broca's aphasia and Wernicke's aphasia?

C. Conduction aphasia?

- Capable of understanding what they are hearing
- But fail to encode phonological information for production
- Caused by damage to Arcuate Fasiculus

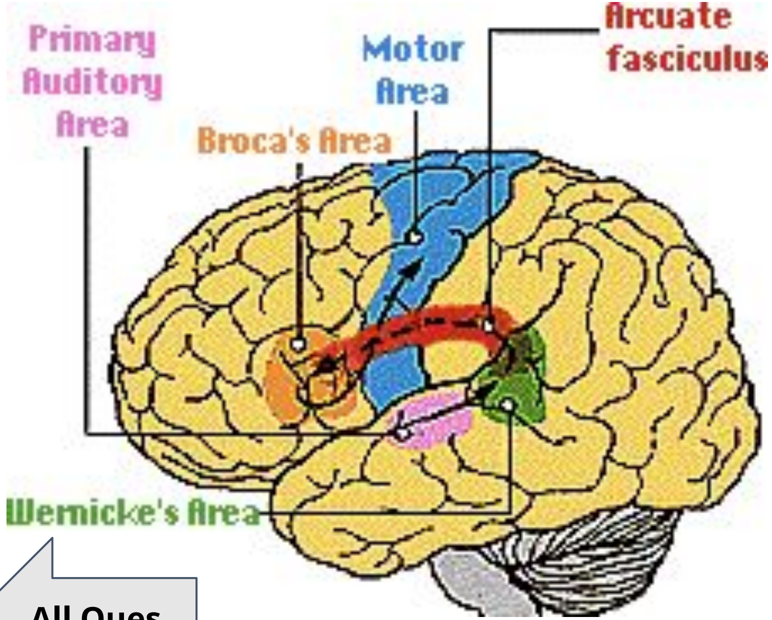


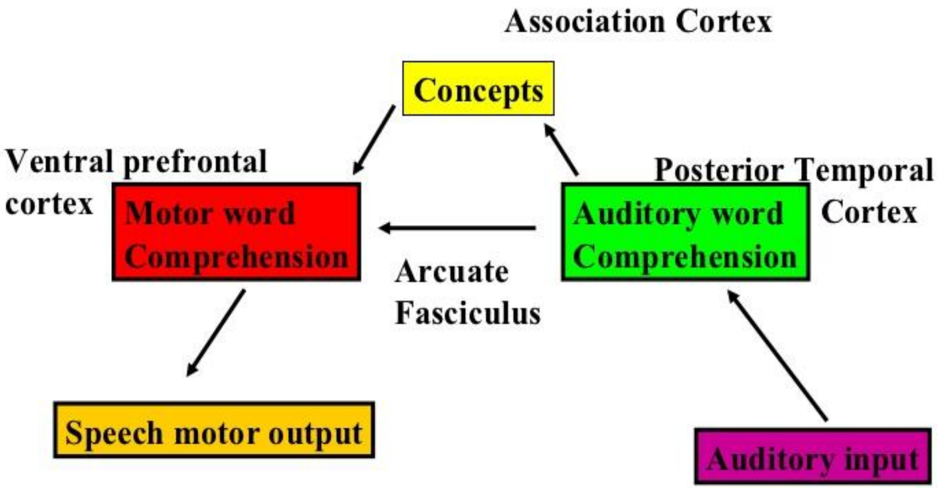
Conduction Aphasia

psychology.rutgers.edu/~rypma/

All Ques.

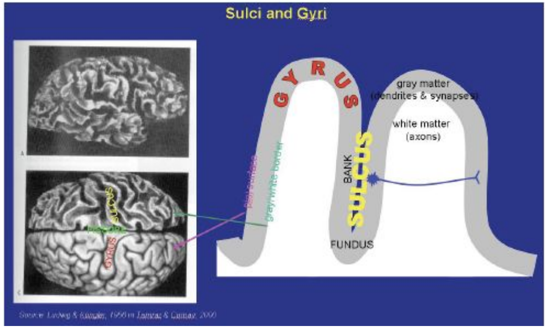
7. What is the simplified Wernicke-Geschwind model of different aphasia? Are there ways in which the model is simplistic?

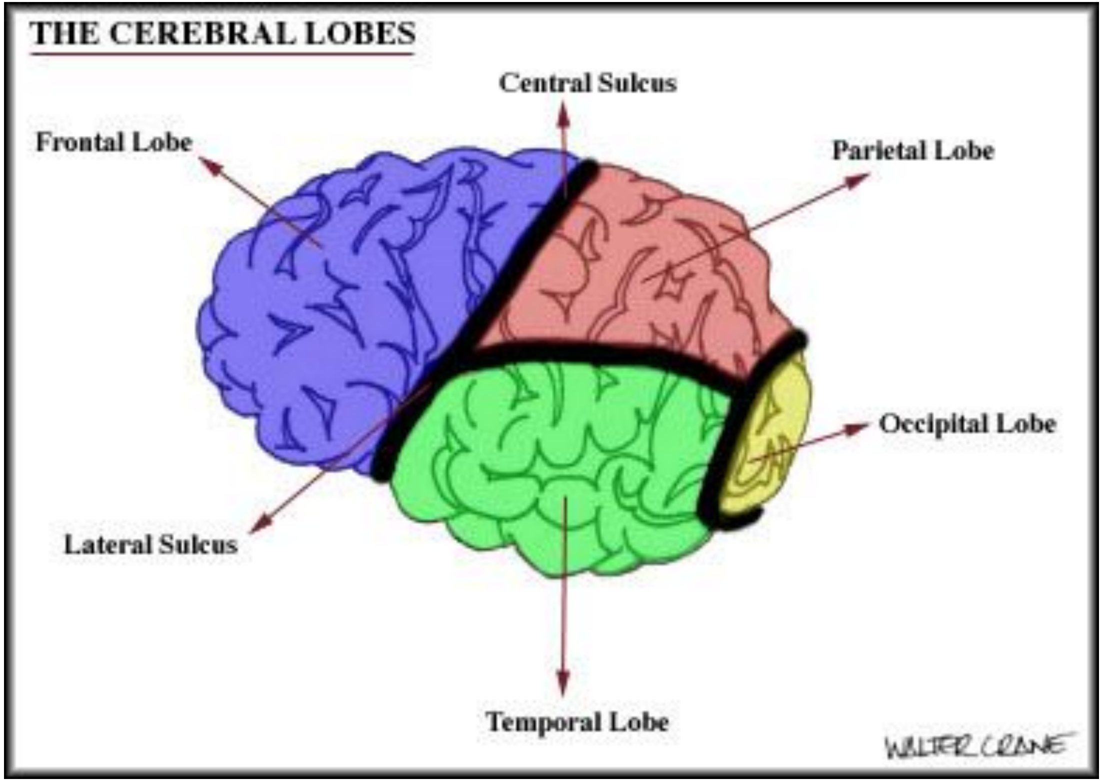




All Ques.

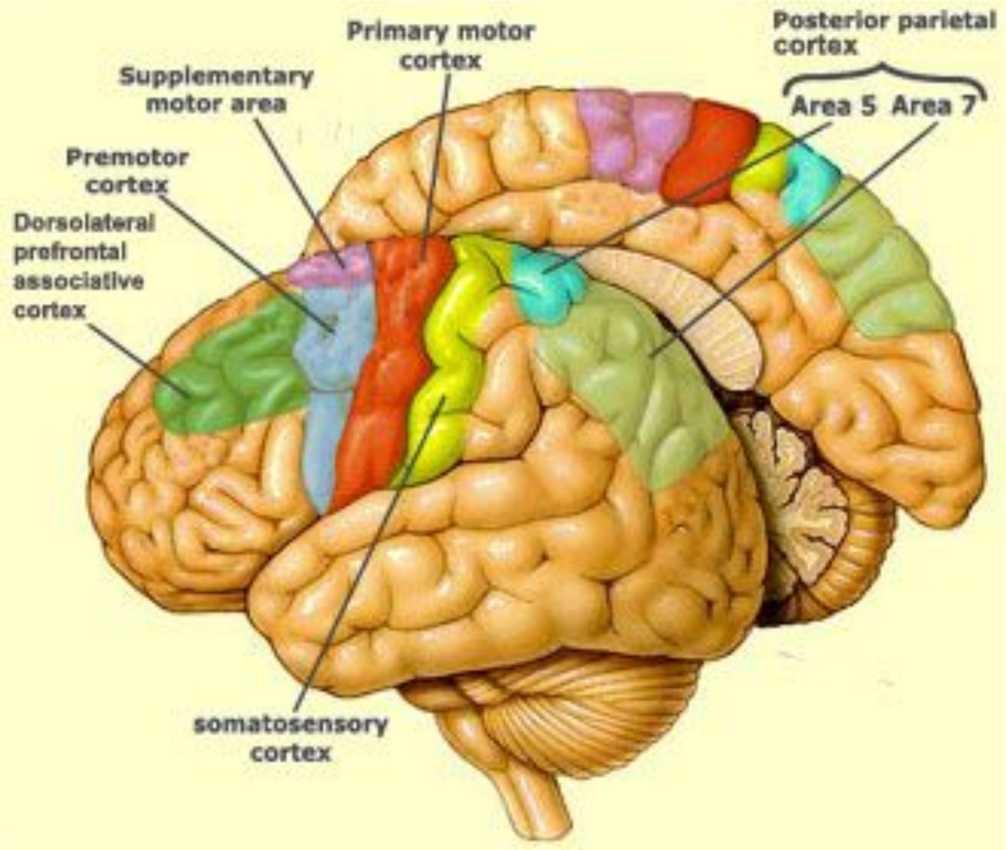
8. What are the major sulci that divide the different lobes?





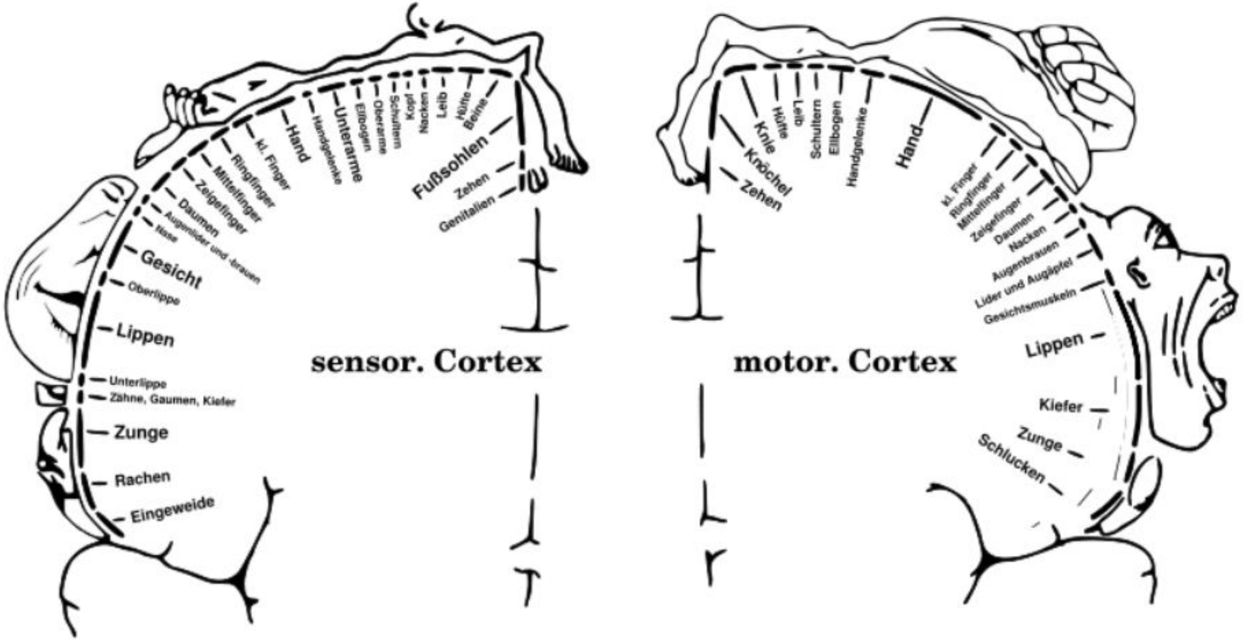
All Ques.

9. Where are the primary motor & primary somatosensory cortices located in the brain?



All Ques.

10. What does the word ‘homunculus’ mean? What are motor and somatosensory homunculi?



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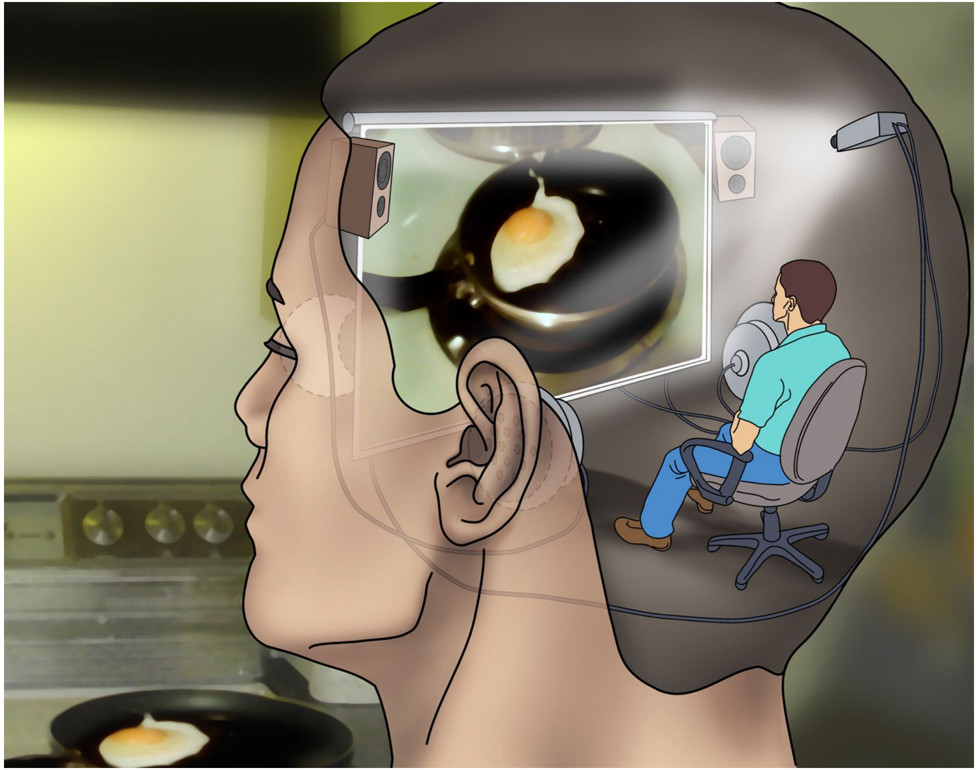

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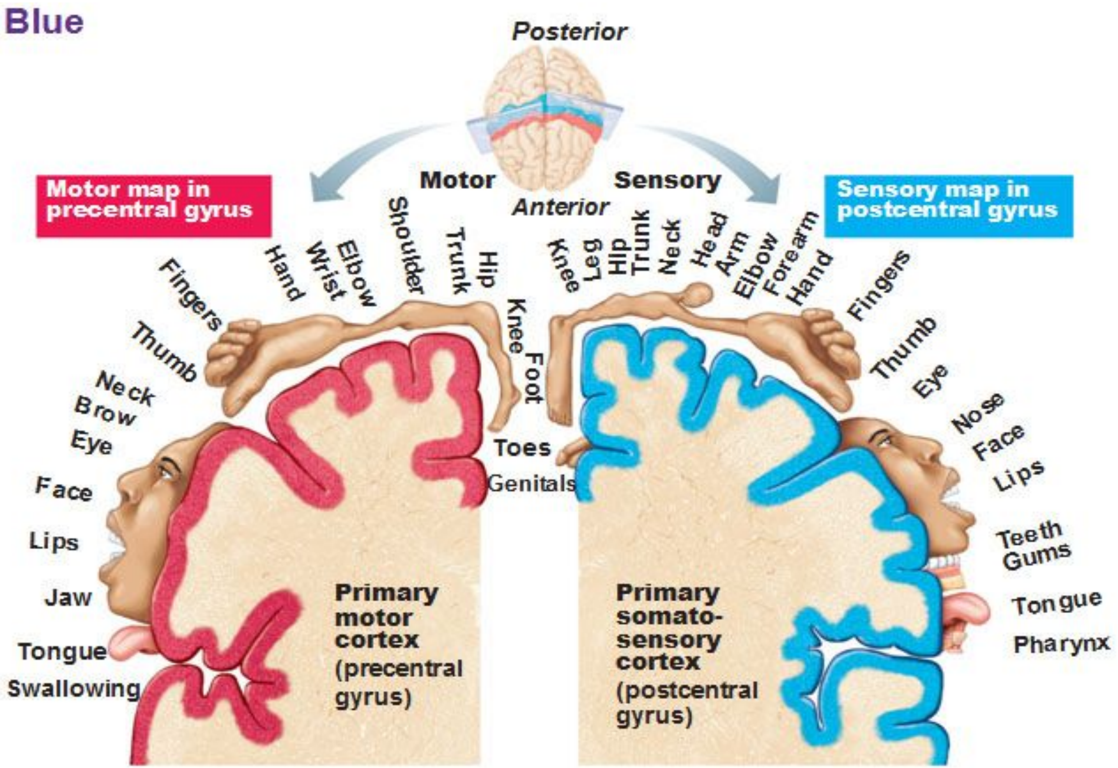


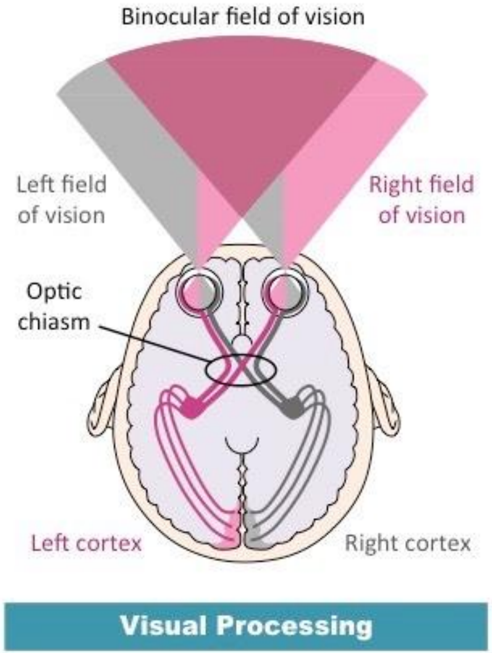
10. What does the word 'homunculus' mean? What are motor and somatosensory homunculi?

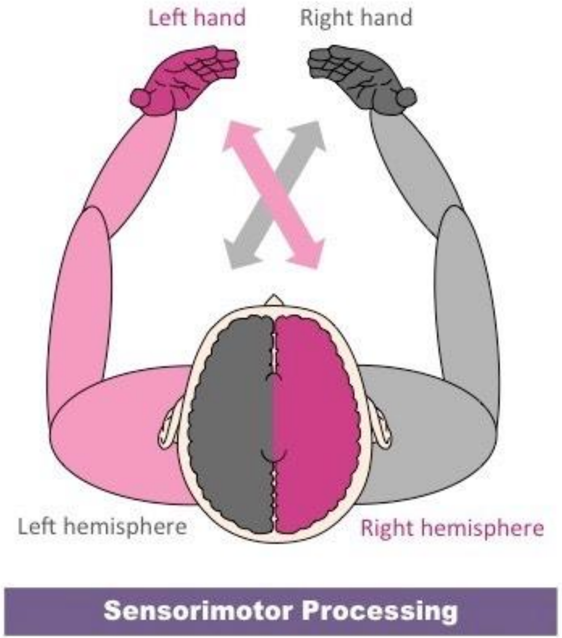
All Ques.

Which is somatosensory and which is motor?

12. What is the relationship between hand and hemisphere dominance?

Contralateral Processing:
The left side of the forebrain mostly represents the right side of the body and the right side of the brain represents mostly the left side of the body.

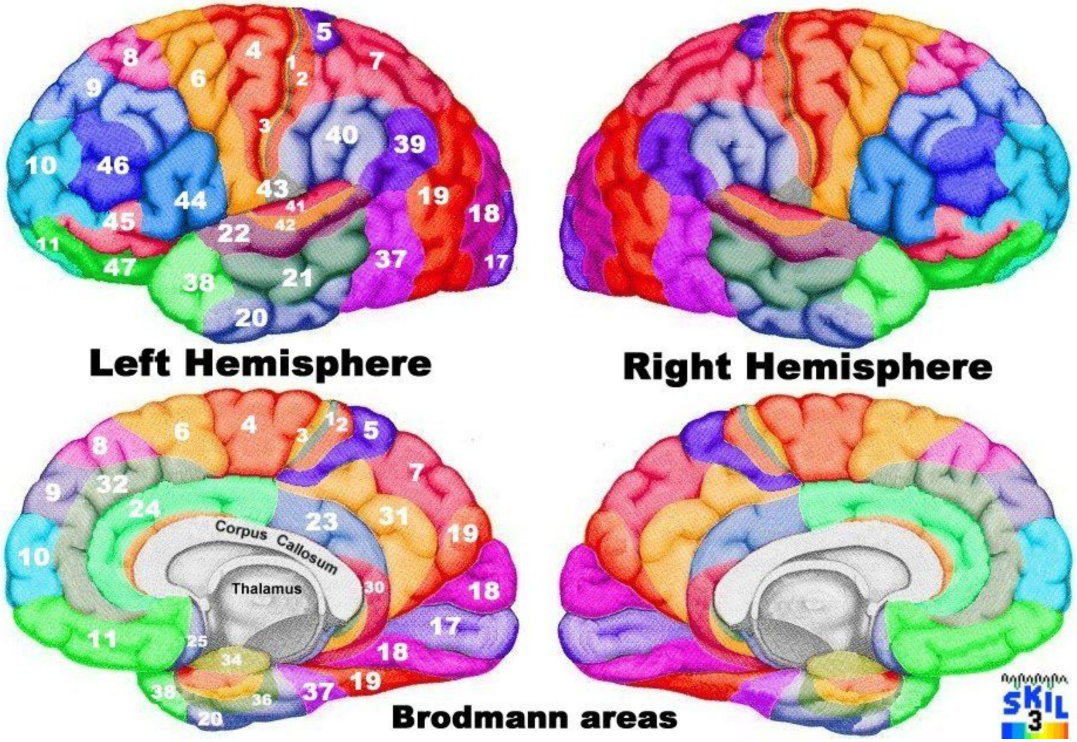




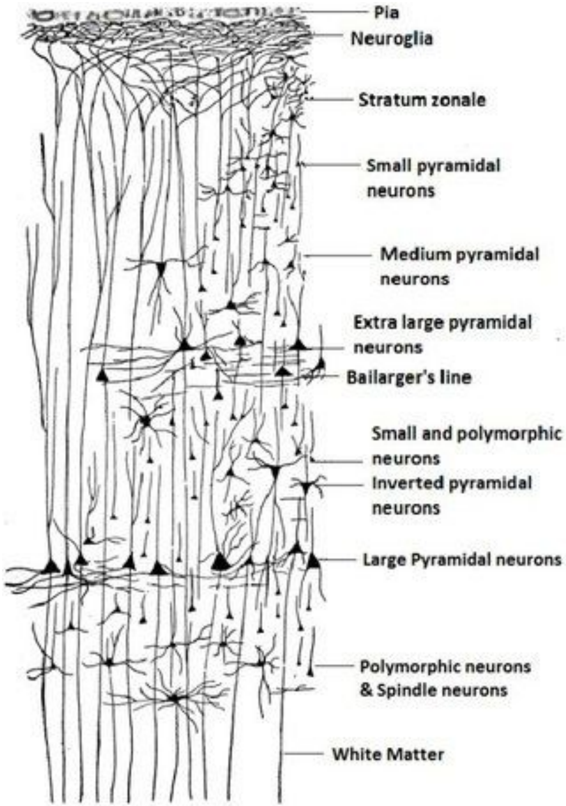
All Ques.

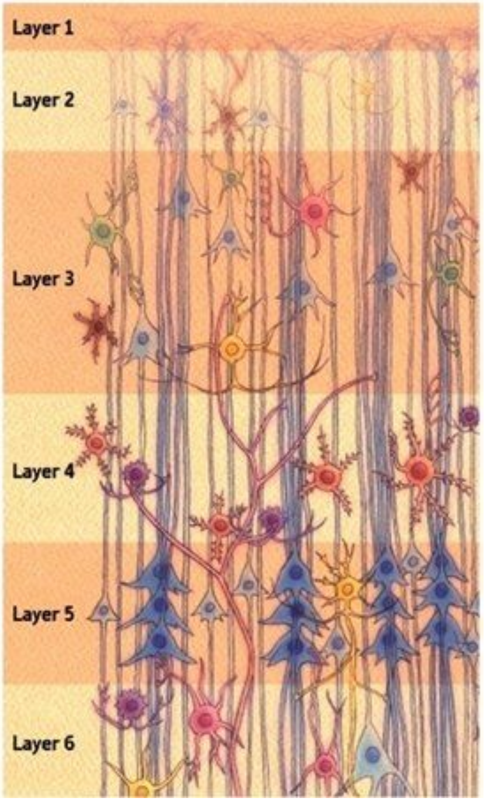
13. What are Brodmann’s Areas?

A patch of cortex that is <u>cytoarchitectonically</u> distinct from its neighbors.
In other words, they differentiate brain areas with respect to the arrangement of their cells.

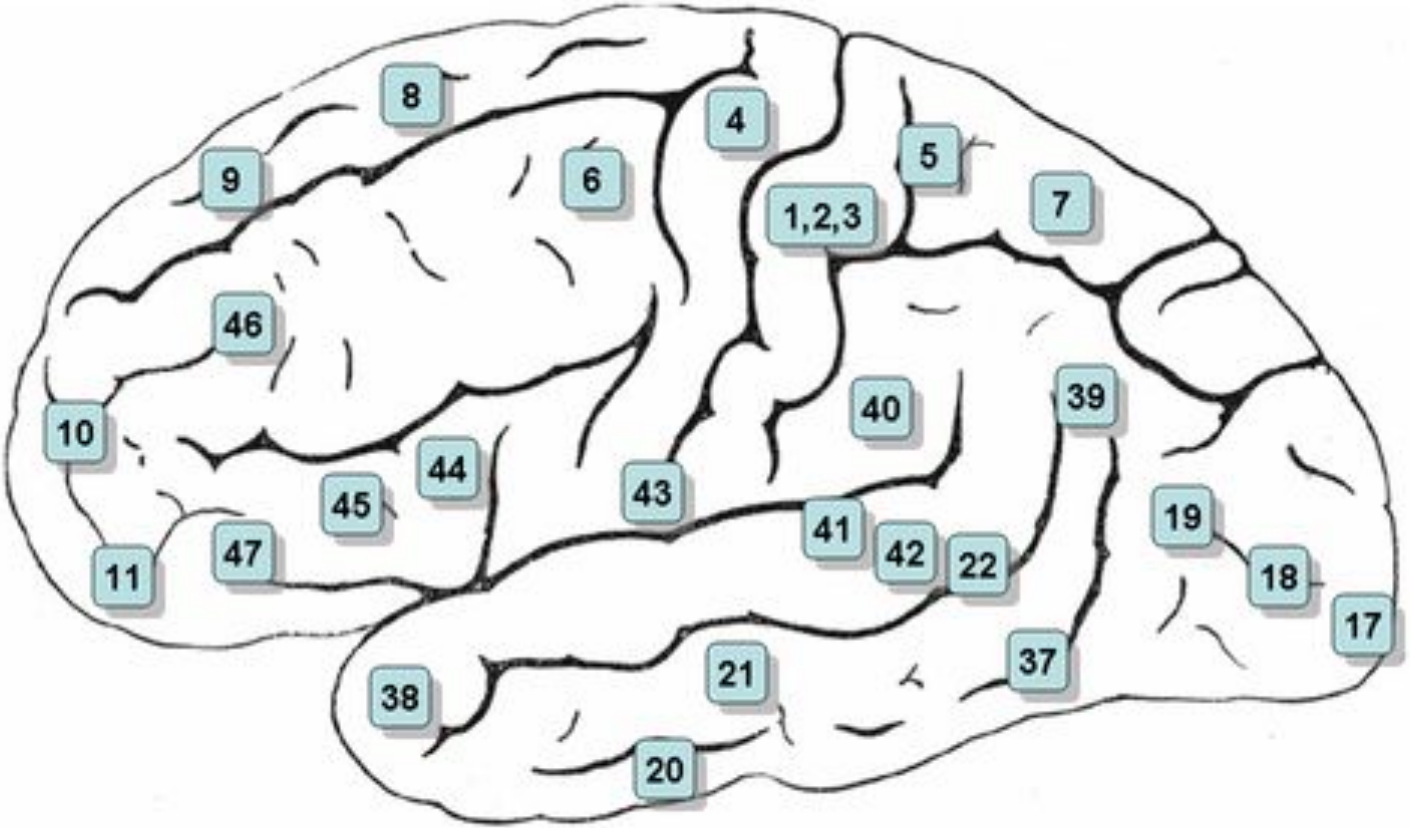


13. What are Brodmann’s Areas?



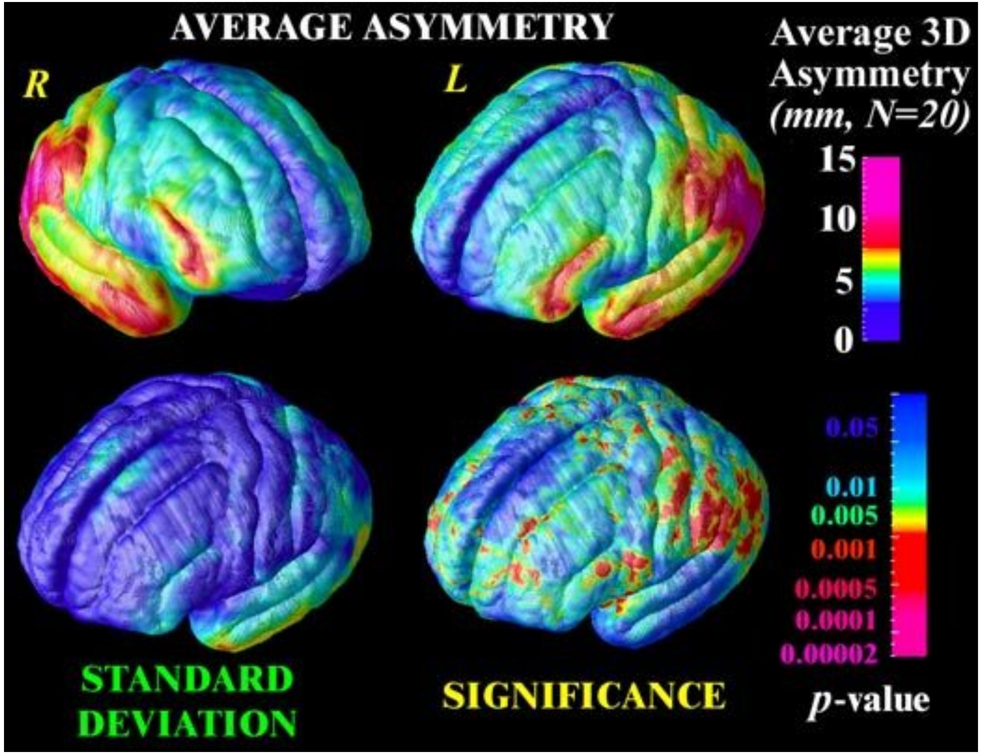


13. What are Brodmann's Areas?



All Ques.

14. What is meant by the “average brain is skewed”?



Asymmetric in volume, function of the two hemispheres.

All Ques.

15 & 16. What are the general differences between hemispheres? (also Q11)

All Ques.

17. Identify important regions of the brain that are vulnerable to damage when undergoing brain surgery.

a. **Why would someone being undergoing this procedure in the first place?**
b. **How are these regions mapped out?**

Language area

a. Patients with epilepsy, need brain surgery to remove certain part of the brain
b. Recording the electrical activity from the surface of the brain

All Ques.

18. Provide examples of when brain function was altered but enabled localization of function.

- **Language**
- Compare with the example of car
- Identify the language area through brain lesions

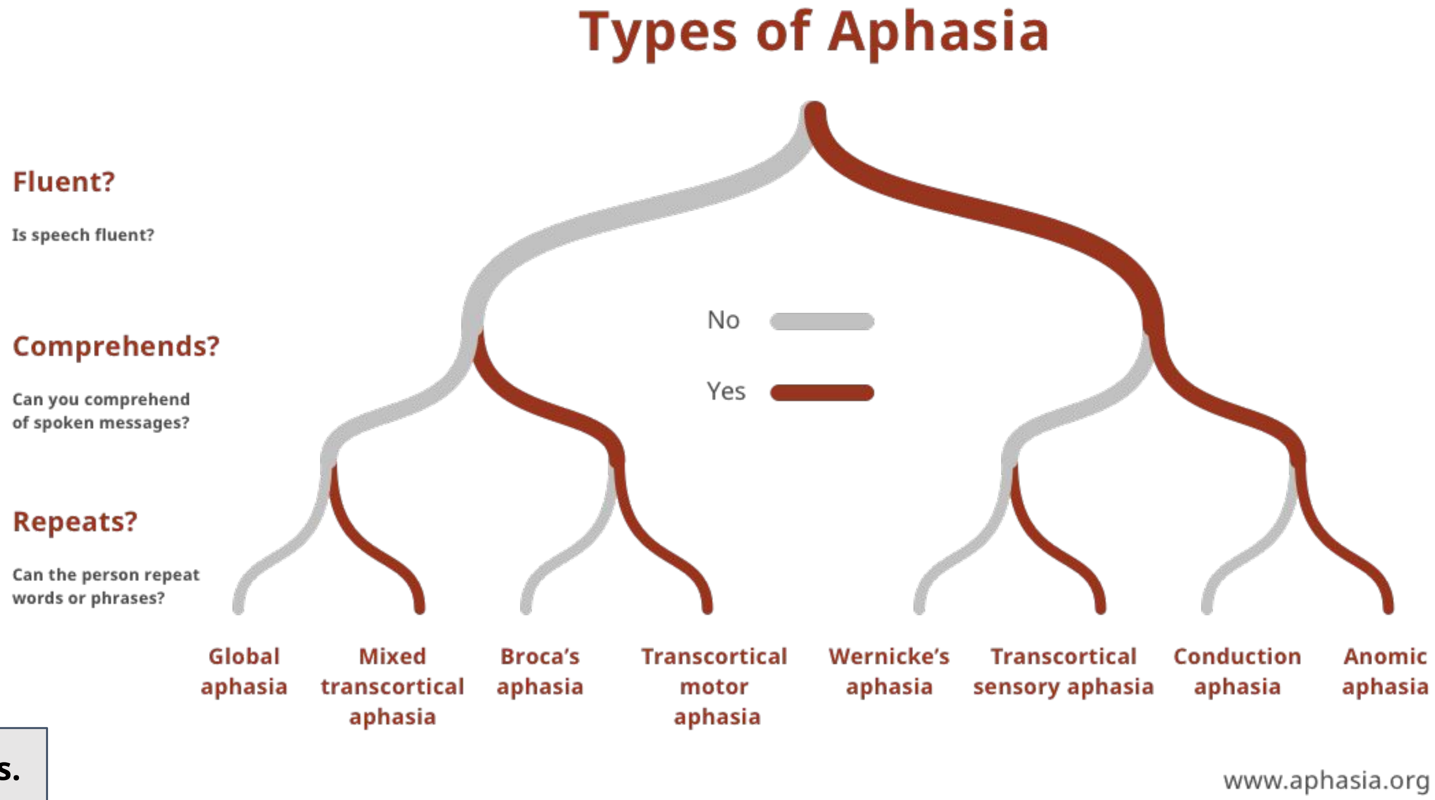
All Ques.

19. Be able to describe anomia and aphasia.

- Anomia: the inability to utter the name after successfully speaking the preamble. (“find the right name”)

- Aphasia: loss of ability to understand or express speech, caused by brain damage.

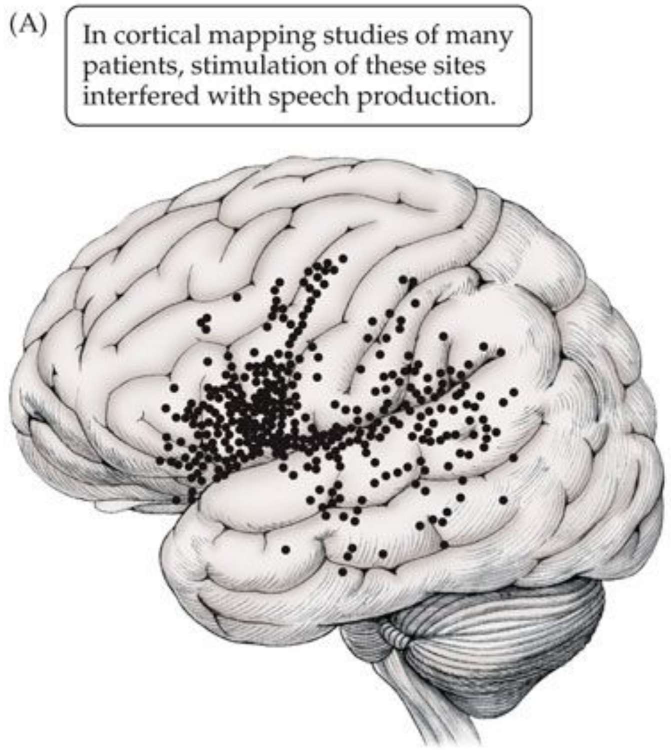
19. Be able to describe anomia and aphasia.



All Ques.

20. What is the purpose of electrically stimulating Neil's cortex while he names off the objects on each slide?

- Localize functions to tiny areas
- "Naming site"
- Do we have an "elephant site"?



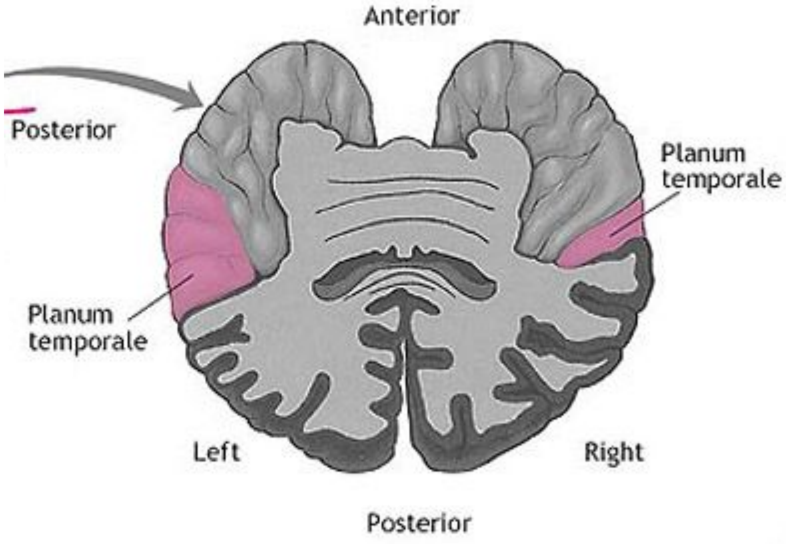
All Ques.

21. What was significant about the planum temporale?

a. Where is it located?

b. How does it differ across both hemispheres?

A. A region of the brain that extends through both hemispheres; in the temporal lobe
B. The planum temporale is larger in the left



All Ques.

Lecture 4

From Genetics to Data Science

Dr. Ellis

Lecture 4 | Review Questions (1 of 3)

Vote!!

1. Who set the framework for genetics?
2. What is the basic structure of DNA and RNA?
3. What are the functions of each?
4. What is GWAS? What does it stand for and what does it measure?
5. Understand the central dogma of genetics.
6. What is the epigenome?
7. What is DNA methylation?
    a. How is it studied?
    b. How does it affect RNA transcription and gene expression?

Lecture 4 | Review Questions (2 of 3)

Vote!!

8. What differences in DNA and glial cells are observed in individuals with autism?
9. What is Recount 2? How does it facilitate biological studies?
10. Can we use expression data to predict tissue?
11. What is CBDS?
    a. Who does it target?
12. What factors influence genetics research? What are some variables that must be accounted for?

Reading (Ellis) | Review Questions (3 of 3)

Vote!!

13. What is polygenic inheritance? How does this affect the risk of diseases like diabetes?

14. What are the applications of GWAS? Give an example of its applied analysis.

15. What are some limitations of such a kind of study?

16. What are SNPs and how are they utilized in GWAS?

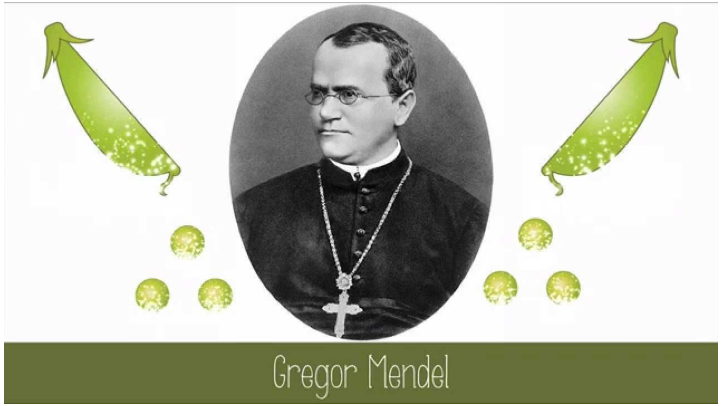
17. How did GWAS seek to find the relationship between one's genes and their educational attainment?

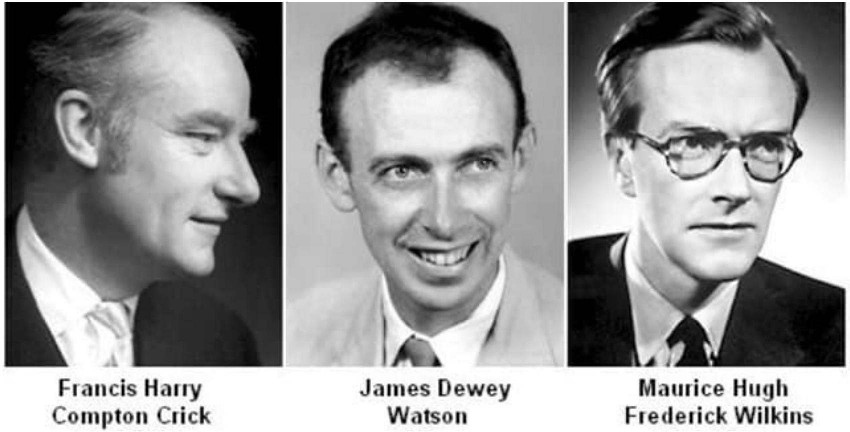
18. What is the relationship between sample size and the ability of GWAS to detect correlation?

19. Identify the potential misuse of genetic prediction.

1. Who set the framework for genetics?

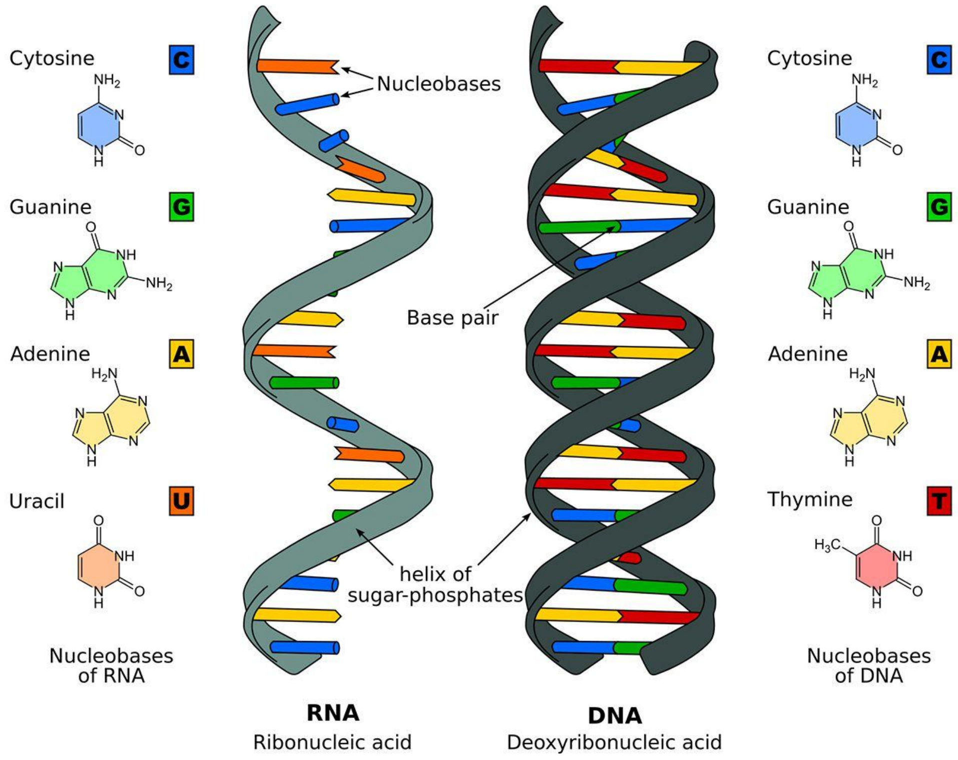
- Gregor Mendel: Father of Genetics
- James Watson, Francis Crick, Maurice Wilkins, and Rosalind Franklin: Structure of DNA





All Ques.

2. What is the basic structure of DNA and RNA?



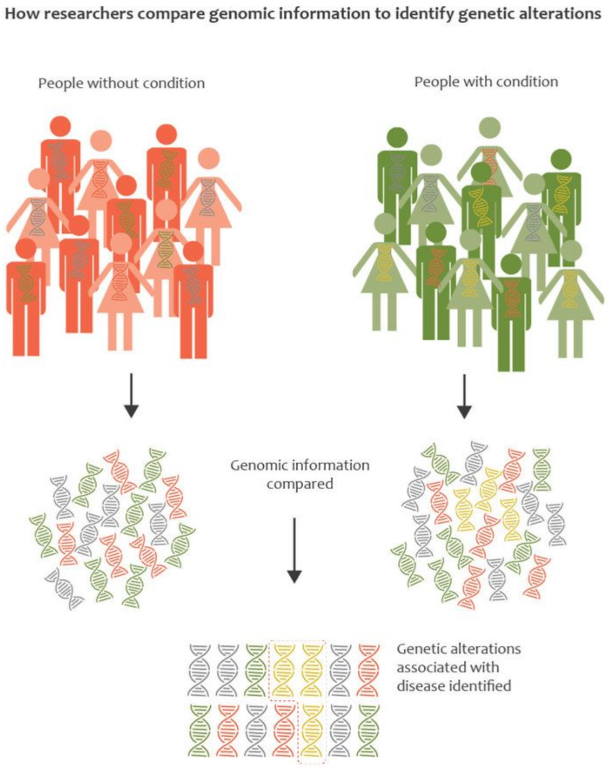
All Ques.

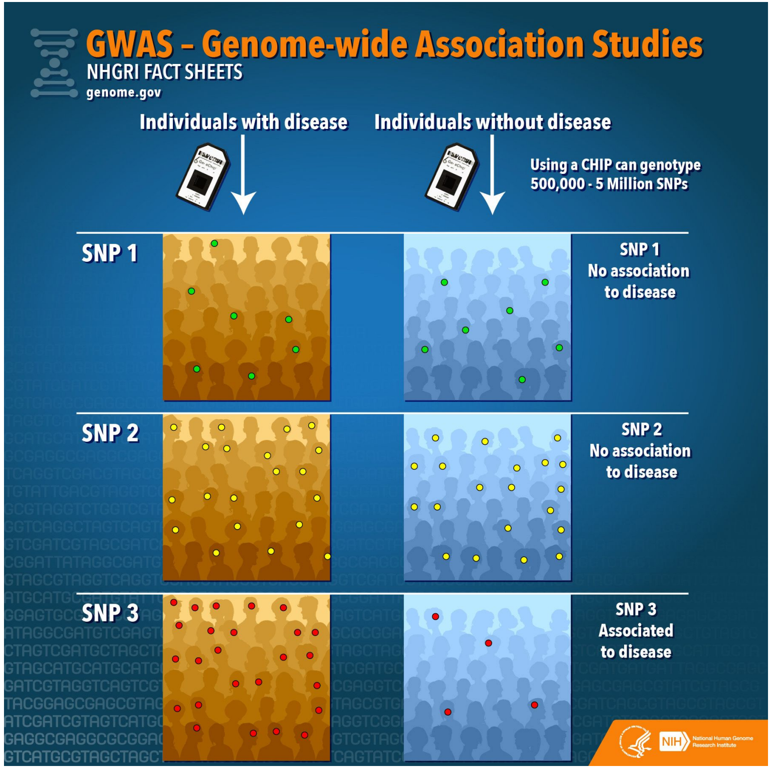
3. What are the functions of each?

Feature	DNA	RNA
Function	Holds genetic information	Transcribes and regulates the genetic information
Strandedness	Double stranded	Single stranded
Nucleotides	A, T, C and G	A, U, C and G
Sugar	Deoxyribose	Ribose
Size	Large polymers	Variable in size but smaller than potential length of DNA polymers
Stability	Stable	Unstable
Location in the cell	Nucleus (a very small amount in mitochondria)	Moves from nucleus (specifically the nucleolus) to cytoplasm/ribosomes

All Ques.

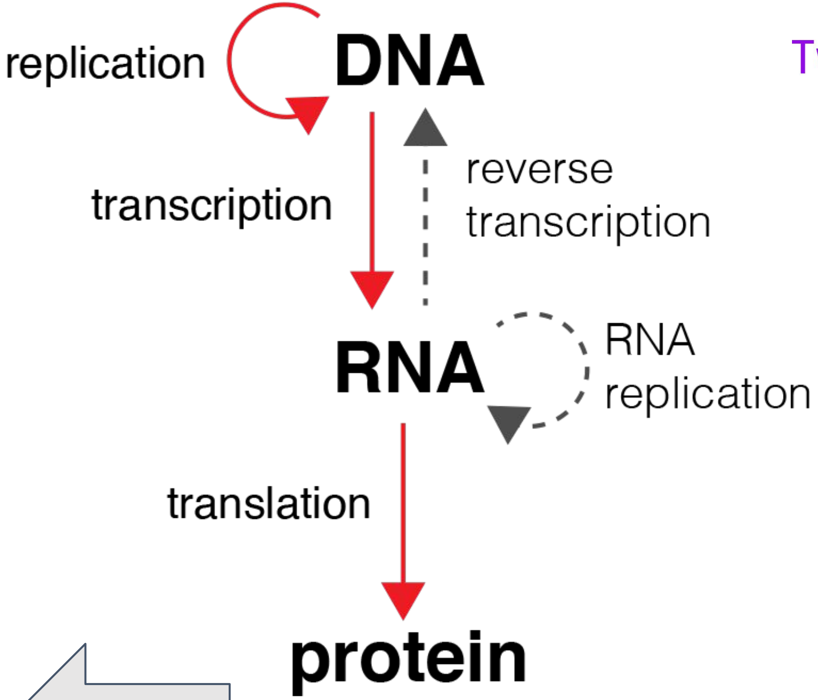
4. What is GWAS? What does it stand for and what does it measure?





All Ques.

5. Understand the central dogma of genetics.

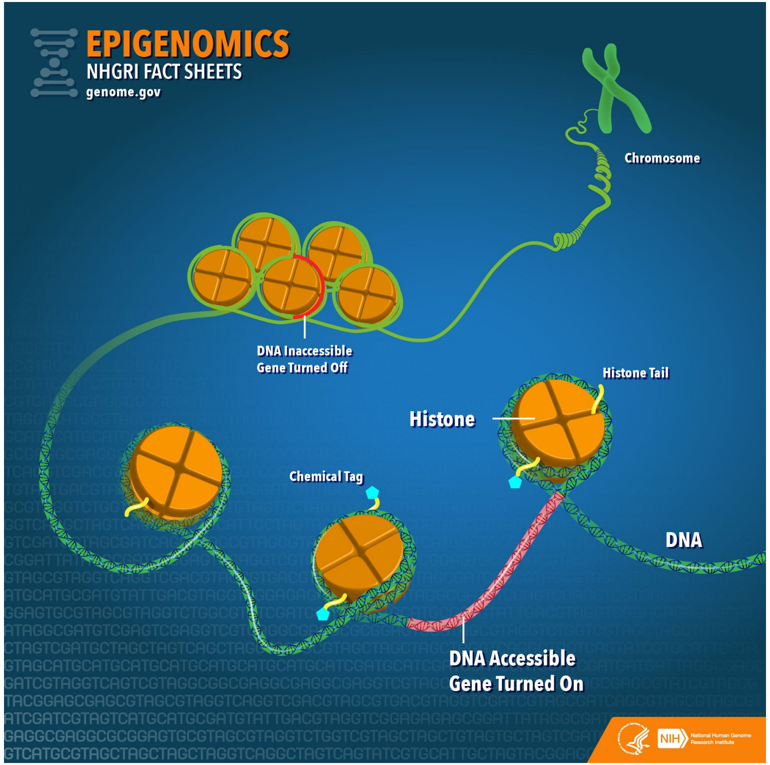


Two copies of **DNA** -> many **transcripts** -> many **proteins**

	role in the cell	*# copies/cell*	*functional unit*	*# unique functional units*
DNA	*blueprint*	*2*	*gene*	*20,000*
RNA	*messenger*	*varies ~360,000*	*transcript*	*~100,000*
proteins	*carry out cellular functions*	*varies ~10^{10}*	*proteins (metabolites, hormones, etc.)*	*~100,000*

All Ques.

6. What is the epigenome?

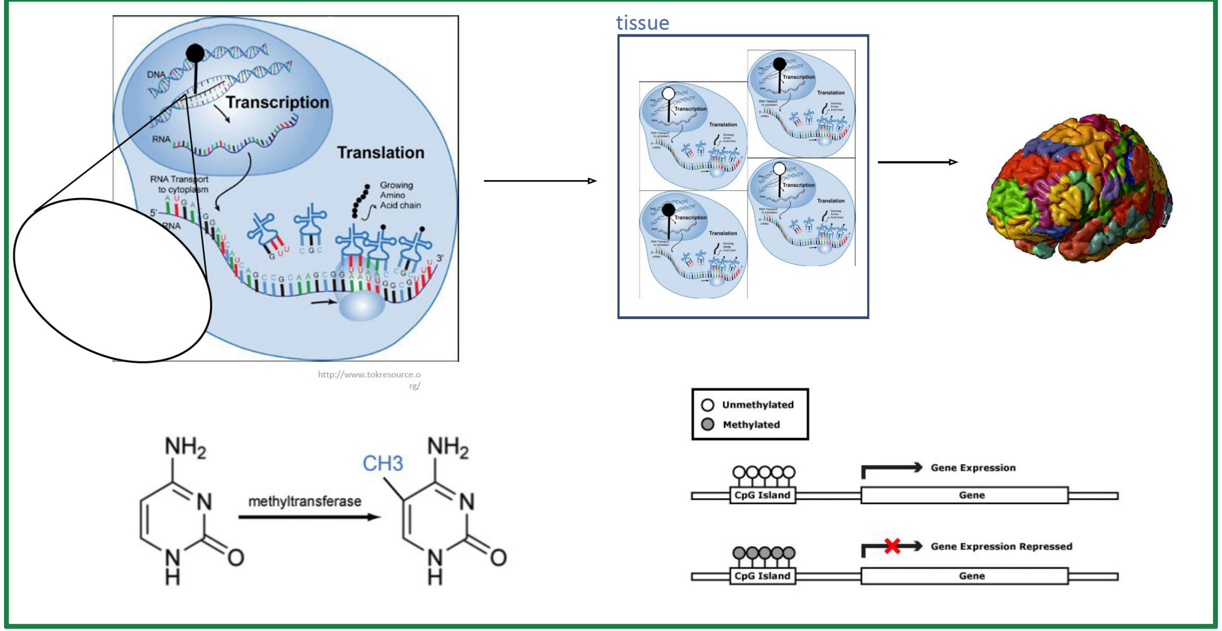


- Set of chemical modifications to the DNA and DNA-associated proteins in the cell, which alter gene expression, and are heritable.
- Example: DNA Methylation

All Ques.

7. What is DNA methylation? How is it studied? How does it affect RNA transcription and gene expression?

DNA methylation is most often studied at CpG dinucleotides



All Ques.

8. What differences in DNA and glial cells are observed in individuals with autism?

Results in a single slide

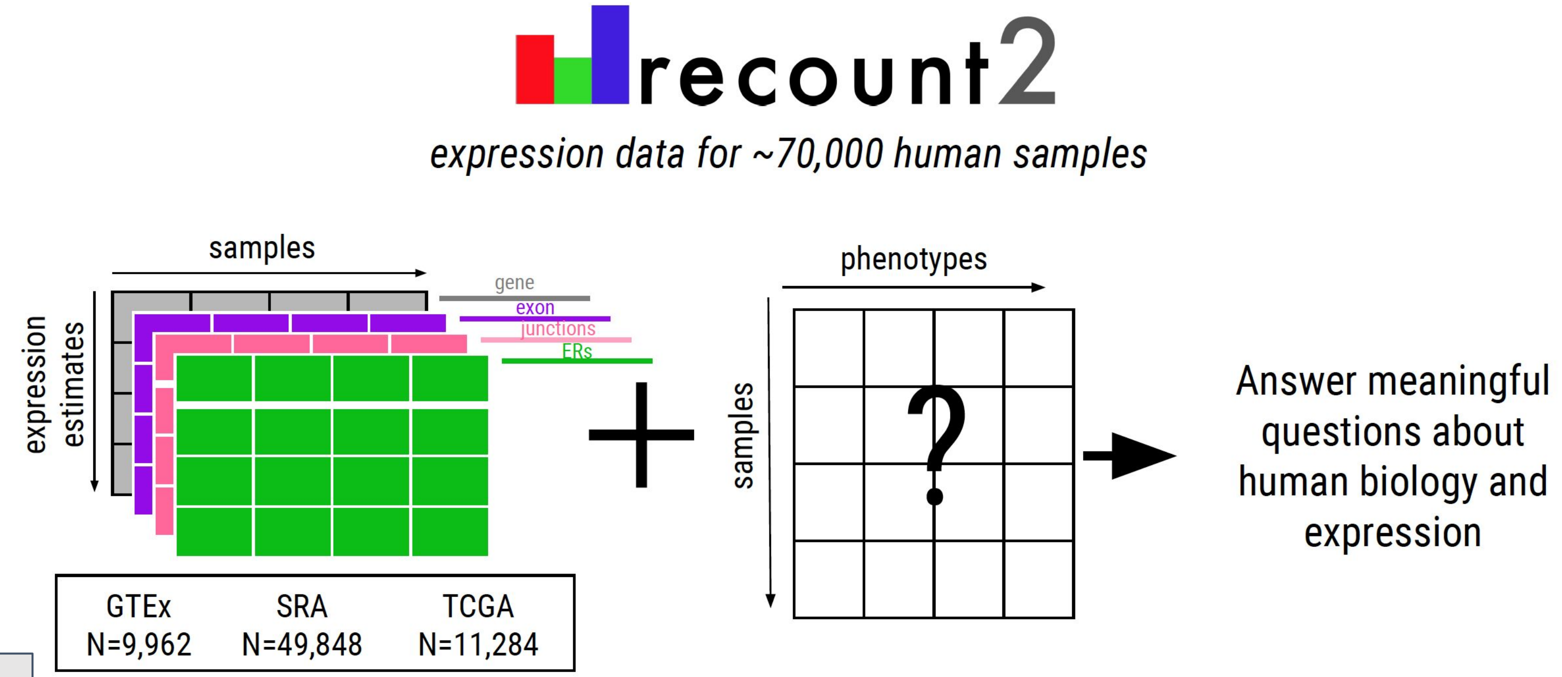
I. Autism Background

II. Transcriptome Analyses
   A. Microglia playing a role in the autistic brain
   B. RNA levels show similar patterns across conditions

III. Epigenome of the Autistic Brain
   A. CpG methylation does not differ
   B. Increased global nonCpG methylation

All Ques.

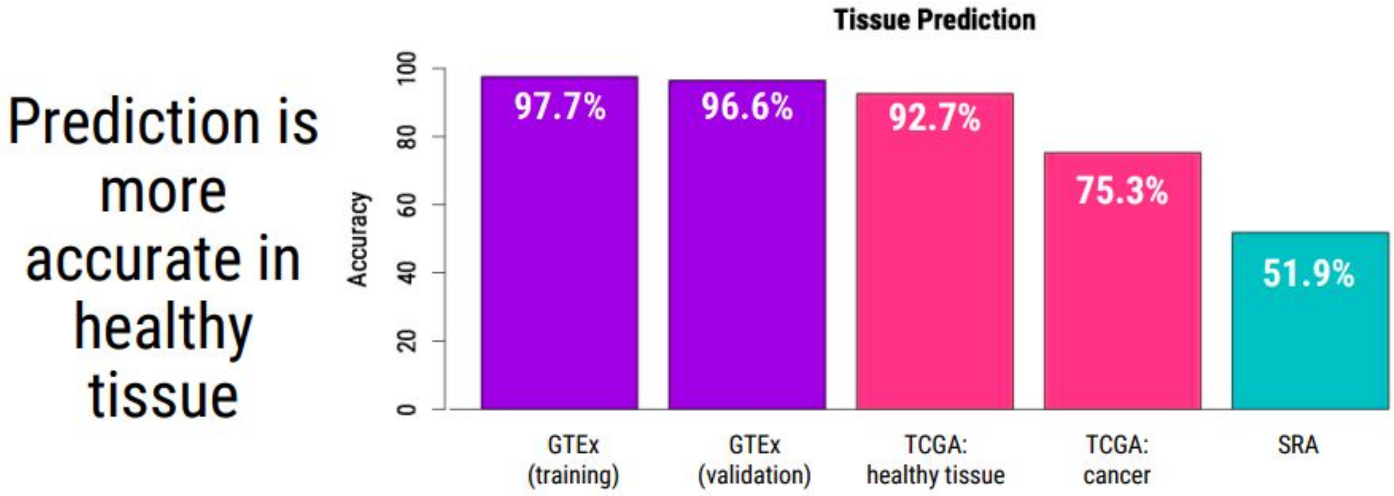
9. What is Recount 2? How does it facilitate biological studies?



All Ques.

10. Can we use expression data to predict tissue?

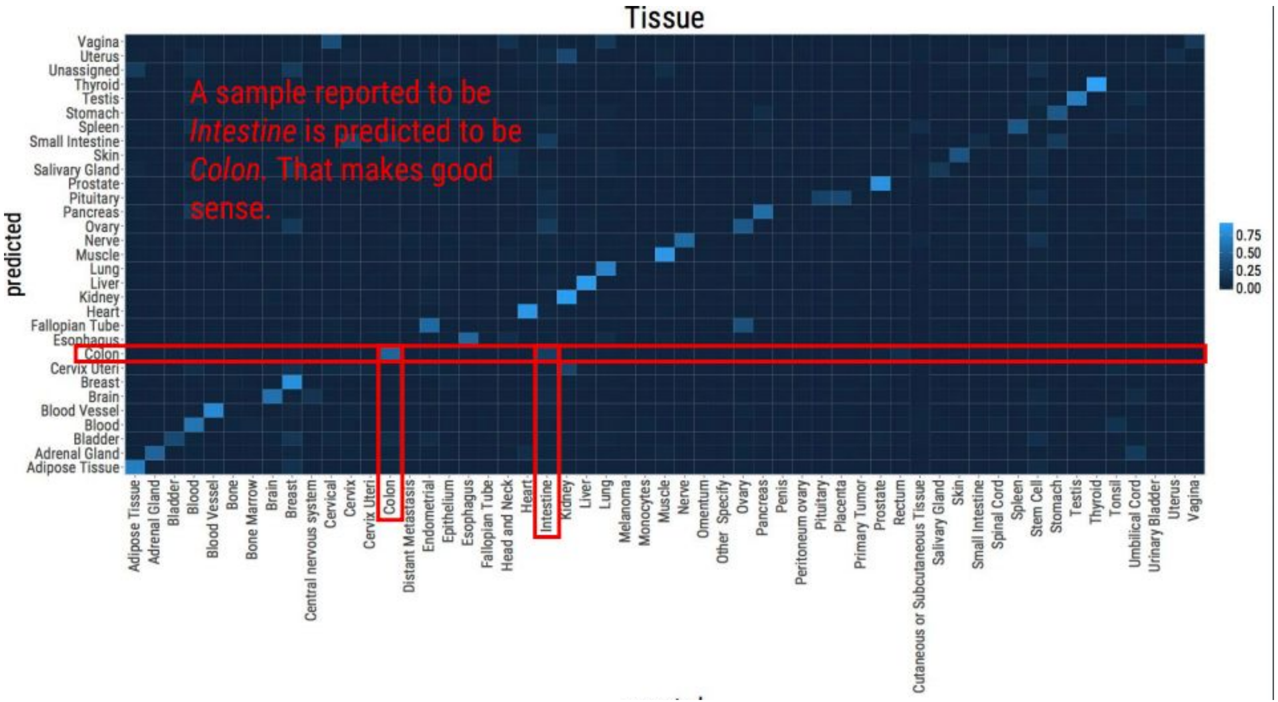
- Previously we used data from GTEx to predict phenotype of TCGA data and SRA...
-



All Ques.

10. Can we use expression data to predict tissue?

- Decompose the tissue types we have...
-



All Ques.

10. Can we use expression data to predict tissue?

Tissue prediction is largely accurate across *recount2*

Tissue can be accurately predicted from expression data.	Discordant predictions are often made to biologically similar tissues.	Sometimes, predictions are inaccurate.

All Ques.

11. What is CBDS? Who does it target?

Chromebook Data Science (CBDS)

- Find a **partner organization**
- Collaboratively **develop course content**
- Develop **new technology** as needed
- Design in-person **tutoring program**
- Launch program, **teach the stuff** & get learners **jobs**

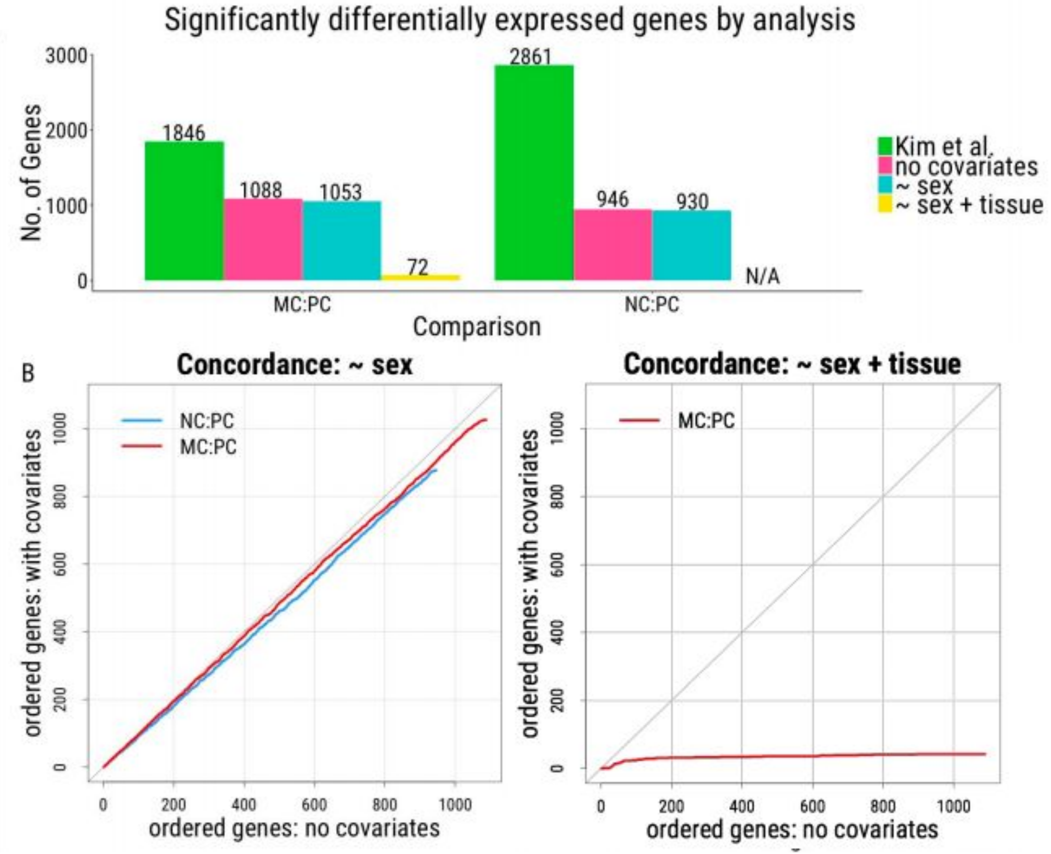
All Ques.

12. What factors influence genetics research?

a. What are some variables that must be accounted for?

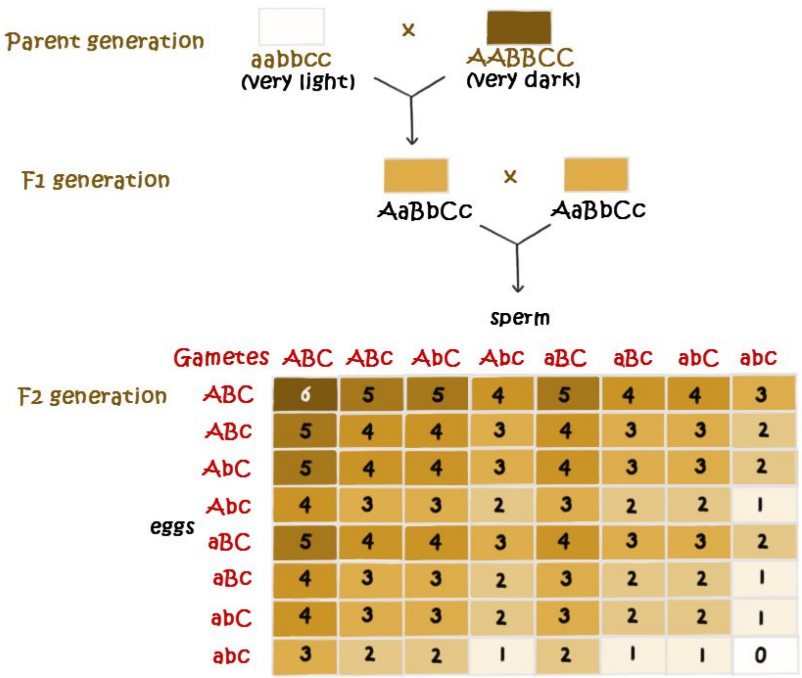
Phenotypic Differences:

- Sex
- Age
- Tissue types
- Race

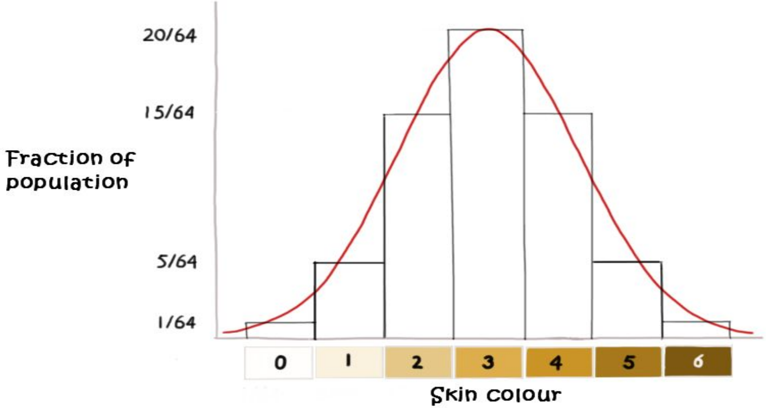


All Ques.

13. What is polygenic inheritance? How does this affect the risk of diseases like diabetes?



Gametes	ABC	ABc	AbC	Abc	aBC	aBc	abC	abc
ABC	6	5	5	4	5	4	4	3
ABc	5	4	4	3	4	3	3	2
AbC	5	4	4	3	4	3	3	2
Abc	4	3	3	2	3	2	2	1
aBC	5	4	4	3	4	3	3	2
aBc	4	3	3	2	3	2	2	1
abC	4	3	3	2	3	2	2	1
abc	3	2	2	1	2	1	1	0

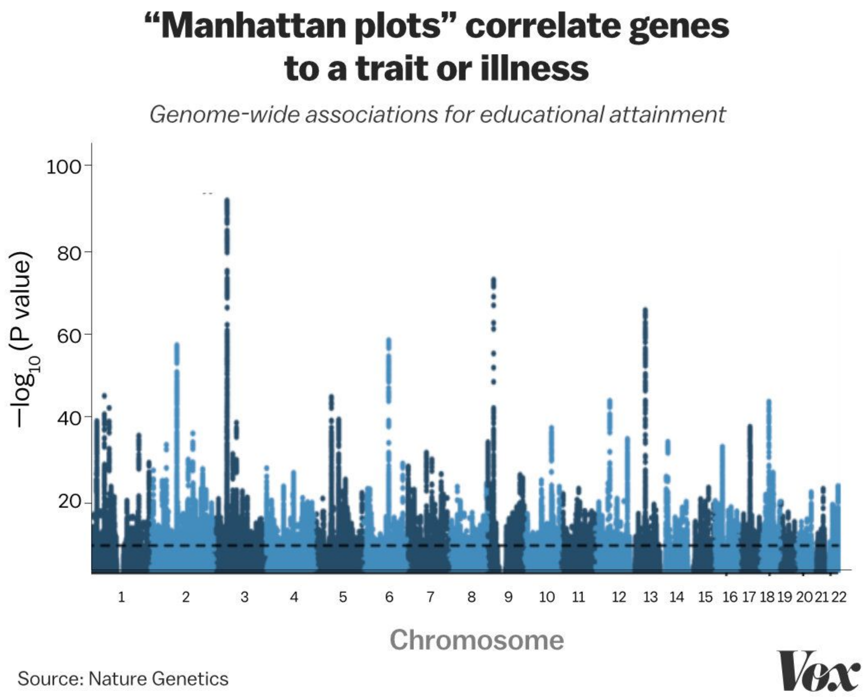


- **Polygenic inheritance** occurs when one characteristic is controlled by two or more genes.
- There are <u>hundreds</u> of locations in the genome that influence diabetes.

14. What are the applications of GWAS? Give an example of its applied analysis.

GWAS has two main applications in science:

1. Understand the underlying biological architecture of disease and human variation.
2. Predicting the risk of developing conditions like heart disease and diabetes, from a very early age or even before birth.



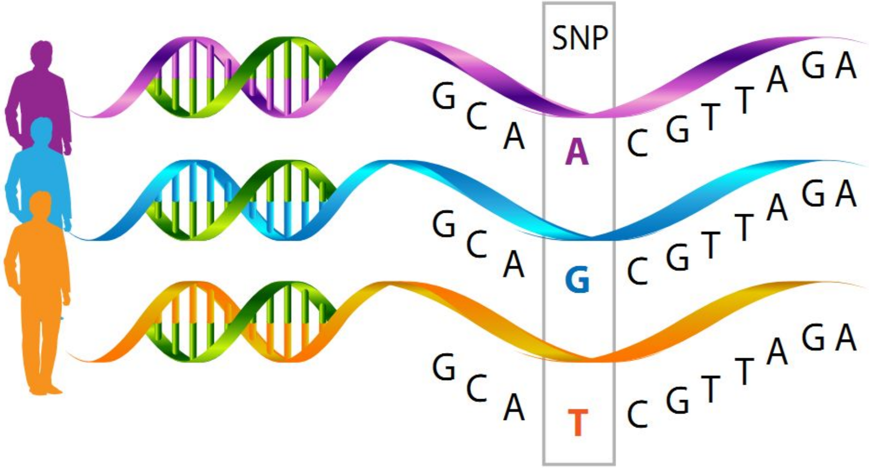
All Ques.

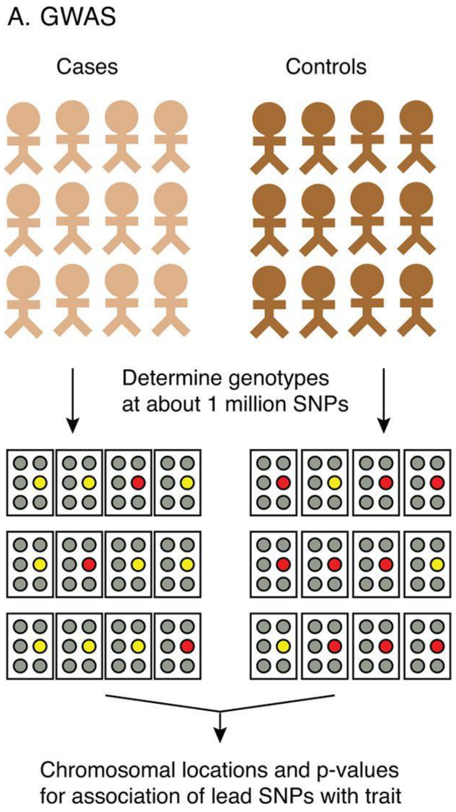
15. What are some limitations of such a kind of study?

- Predictive ability of these tests is quickly hitting a ceiling and will not necessarily be useful for most individuals seeking to understand their genetic fate.
- Predictions can also be wildly misinterpreted, leading to genetic astrology.
- There’s another huge limitation to most GWAS studies — they’re only done on white Europeans.

All Ques.

16. What are SNPs and how are they utilized in GWAS?



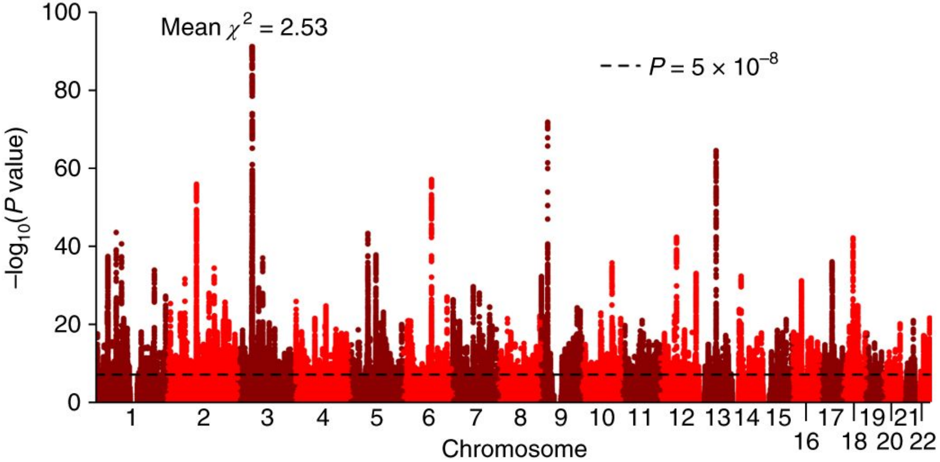


- Each SNP represents a difference in a single DNA building block, called a nucleotide.
- For example, a SNP may replace the nucleotide cytosine (C) with the nucleotide thymine (T) in a certain stretch of DNA.

All Ques.

17. How did GWAS seek to find the relationship between one's genes and their educational attainment?

- The genes flagged by GWAS on height tend to relate to the skeletal system; particularly active in the growth plate regions of bones, and point to genes that are involved in the manufacture of connective tissues like collagen.
- The ones associated with educational attainment were clustered in regions having to do with the central nervous system; related with the development of our minds.

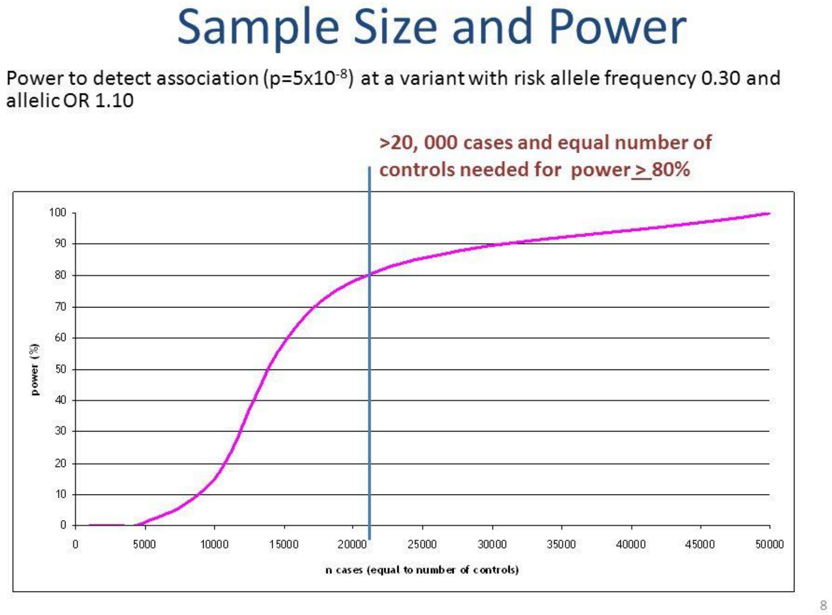


Manhattan Plot for GWAS of EduYears

All Ques.

18. What is the relationship between sample size and the ability of GWAS to detect correlation?

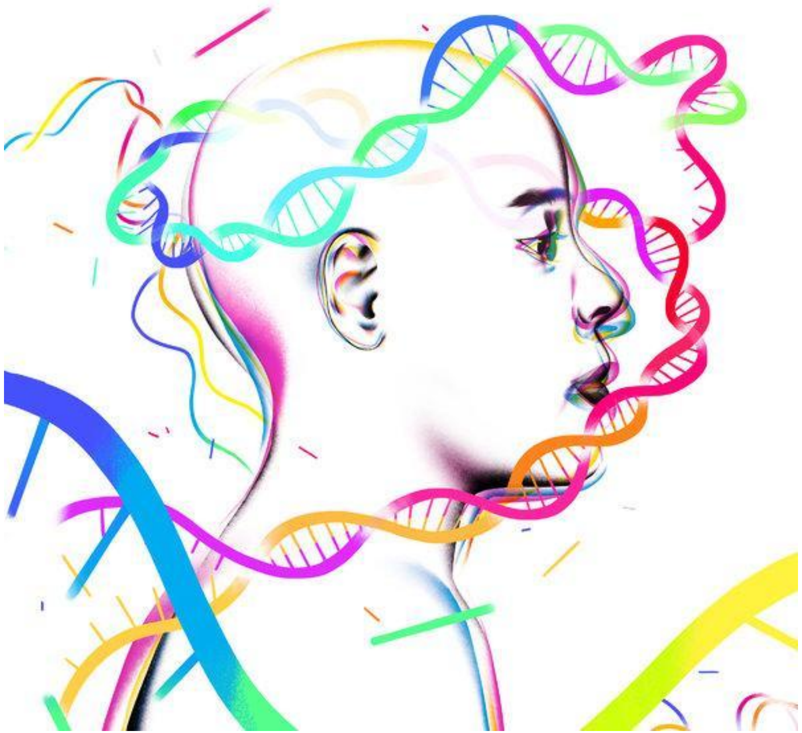
- As GWAS sample sizes grow, so does the ability to find correlations.
- Bigger the sample size, the more genetic markers will be identified, and the more ways we can identify the influence of genetics our lives.



All Ques.

19. Identify the potential misuse of genetic prediction.

- Predictive tests of traits like intelligence are like "genetic astrology," and are said to be a waste of money.
- GWASs, at best, provide an incomplete picture from which to draw predictions.
- Polygenic scores of certain characters are an approximation.



All Ques.

Quiz Time!

- No talking, signaling, or communicating of any kind.
- Put away your books, notes, computers, phones, etc.
- Pen or pencil is okay (just make sure it's a black pen and you press hard with a pencil).
- Write your name in the "Name" box, write and circle in your PID, and sign the academic integrity agreement.
- Bubble in this section
- Please have your student ID out when you turn in your quiz!

Write and circle in your PID

Write down your name here

UC SAN DIEGO – DEPARTMENT OF COGNITIVE SCIENCE

STUDENT PID NUMBER								
A/U								
[0]	0	0	0	0	0	0	0	0
[1]	1	1	1	1	1	1	1	1
[2]	2	2	2	2	2	2	2	2
[3]	3	3	3	3	3	3	3	3
[4]	4	4	4	4	4	4	4	4
[5]	5	5	5	5	5	5	5	5
[6]	6	6	6	6	6	6	6	6
[7]	7	7	7	7	7	7	7	7
[8]	8	8	8	8	8	8	8	8
[9]	9	9	9	9	9	9	9	9

Last NAME, First NAME							
COURSE NUMBER							
COGS 1							
SPRING 2019							
Dr. Mary ET Boyle							
Quiz A							
April 9-12, 2019							
Quiz VERSION							
A	B	C	D	E	F	G	H
■	B	C	D	E	F	G	H

Section you are taking this quiz:	
Please Bubble only one!	
[1]	1 Monday @ 9 Lexi D.
[2]	2 Monday @ 4 Elena
[3]	3 Wednesday @ 2 Adrian
[4]	4 Wednesday @ 3 Audrey
[5]	5 Wednesday @ 5 Devansh
[6]	6 Friday @ 11 Lori
[7]	7 Friday @ 12 Elena
[8]	8 Friday @ 1 Lexi F.

Bubble in the current section

Quiz will not be graded without Academic Integrity Signature.

ACADEMIC INTEGRITY

By taking this quiz, you agree that you will follow ALL UCSD ACADEMIC INTEGRITY policies.
It is YOUR responsibility to know and understand all of the policies.
Failure to follow all UCSD Academic Integrity policies could result in expulsion from UCSD.
DO NOT DISCUSS THIS QUIZ CONTENTS WITH FELLOW STUDENTS!!!

Signature Date

Your **signature above certifies** that you *will follow* and that you know that you will suffer the consequence for ANY academic integrity violation.

Sign and date here

YOUR ANSWERS GO HERE

	[A]	[B]	[C]	[D]	[E]
1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E
6	A	B	C	D	E
7	A	B	C	D	E
8	A	B	C	D	E
9	A	B	C	D	E

Bubble in the answers