LECTURE GOALS:

- ☐ Behavior as phenotype that can evolve (i.e. has a genetic basis).
- ☐ Understand the difference between "heritability" and "inherited"
- ☐ Understand Genotype-by-Environment interactions (GXE)

LECTURE OUTLINE:

1. Tinbergen encouraged us to consider behavior as a phenotype that was the result of natural selection.
2. The observed phenotype is the result of both the influence of genes and the influence of the environment.
3. Historically, there were two approaches to behavioral genetics which are now more closely unified in part due to advances in genetic/genomic tools.
    a. single gene - white lab coat behavior
    b. quantitative - rubber boot behavior
4. All forms of behavioral genetics rely on good reproducible behavioral assays.
5. Examples of the single gene approach include circadian behavior, taxis behaviors, and courtship.
6. Examples of the quantitative approach in Drosophila include foraging behavior, aggression, courtship.
7. The quantitative approach has also been applied to many other organisms and behaviors including cricket song, burrow building in mice, tameness in foxes etc.
8. The goal of behavioral genetics is to determine the genetic contribution to behaviors.
9. Heritability is the proportion of phenotypic variation in a population in a given environment that is due to genetic variation between individuals.
10. Many phenotypes that have a strong genetic component may have low heritability if there is little genetic variance in the observed population.
11. Research tools to demonstrate/quantify heritability of a behavioral phenotype.
    a. Pedigree Analysis
    b. Parent/Offspring regression - slope = heritability
    c. Cross Fostering
    d. Artificial selection – heritability = Response/Selection
12. Genes and Environment interact!

HELPFUL FIGURES & NOTES:
(All PowerPoint files will be available on the courses server after lecture. The subset of figures and notes here are meant to assist your note taking or studying.)

GOAL:

Genes that are necessary for:
Single Gene

Historic figure

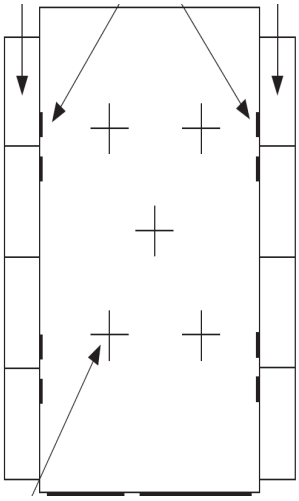
Immediate goals

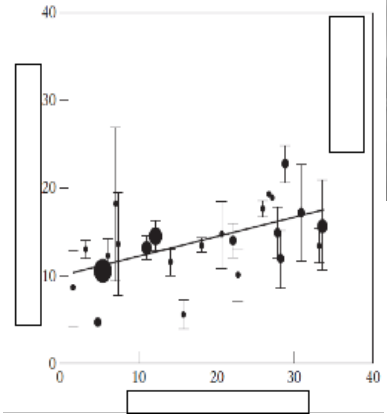
Raw Materials used

Tools used

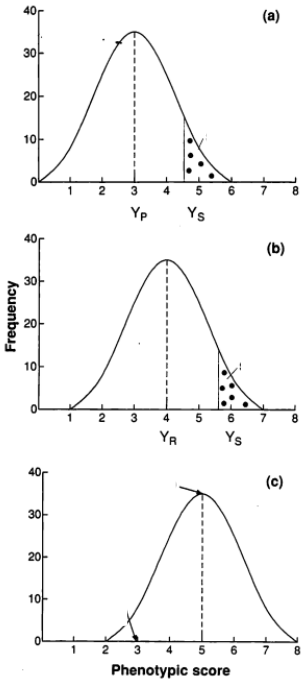
Type of Result

Genotype	aabb	Aabb	AAbb	AABb	AABB	AaBb	aaBb
1. Additive effect Phenotypic score							
2. Dominance effect Phenotypic score							
3. Dominance plus epistatic effect Phenotypic score							

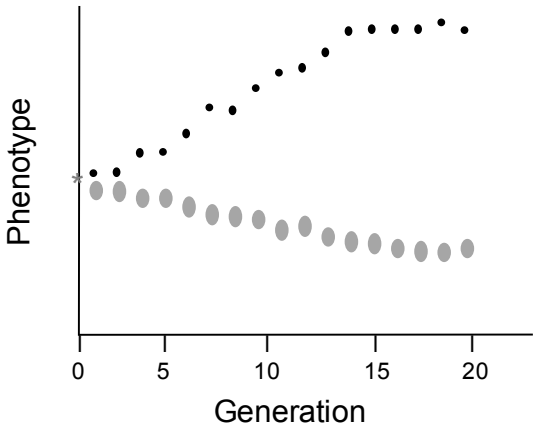


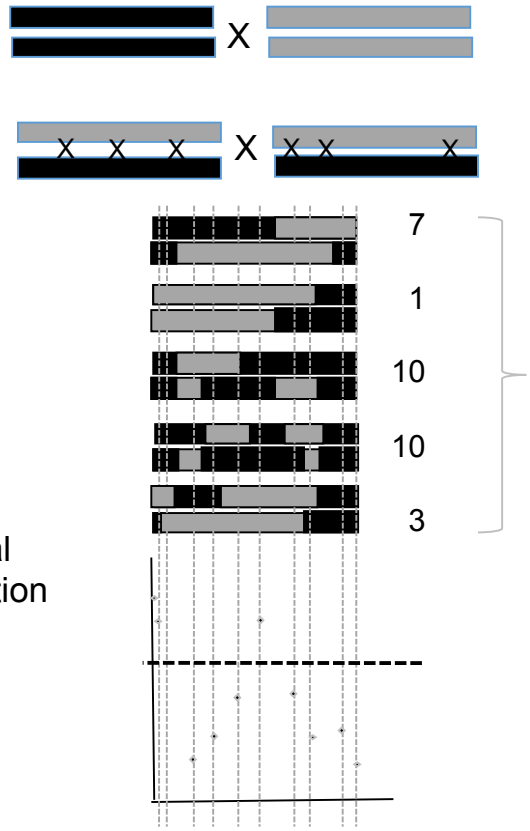


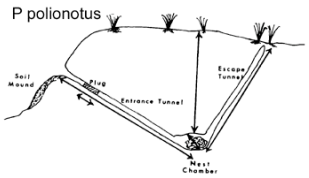
H2 = slope

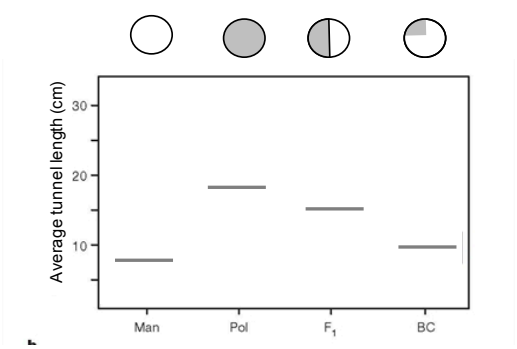


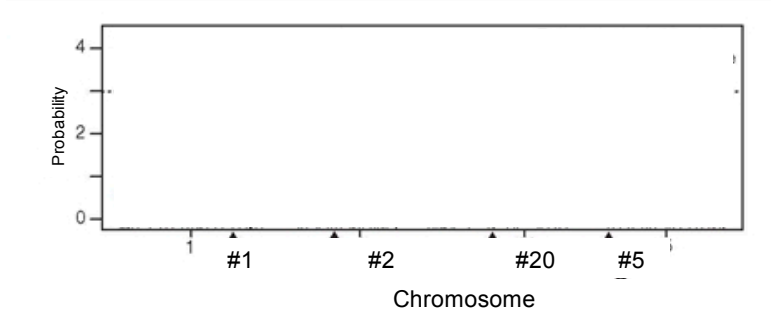
H2 = R/S

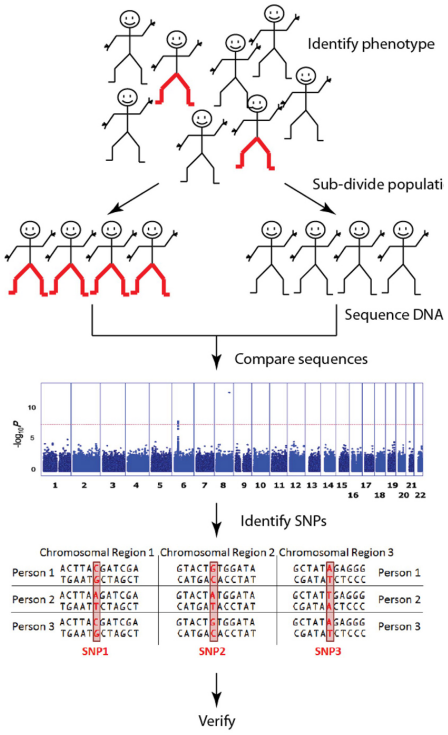

Phenotype
0
5
10
15
20
Generation

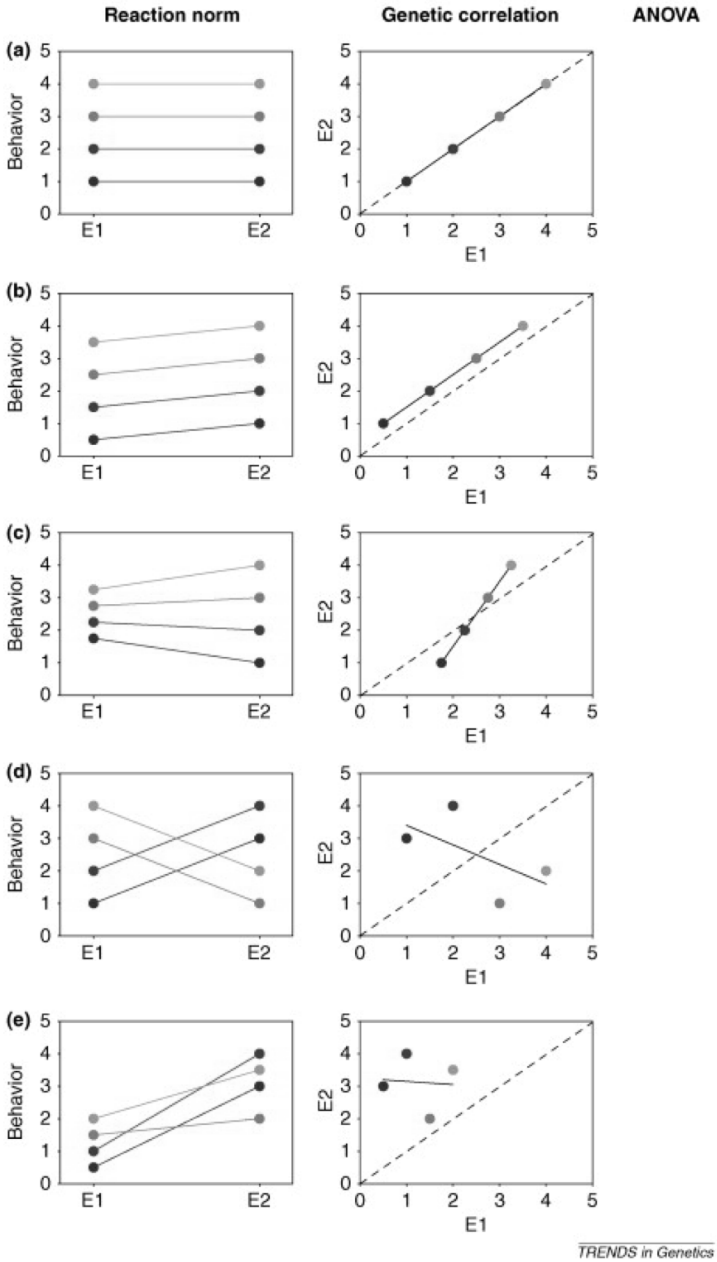

X
X
7
1
10
10
3
Statistical
Association


P polionotus
Soil Mound
Plug
Entrance Tunnel
Escape Tunnel
Nest Chamber
P maniculatus
Nest


Average Genome Composition
Average tunnel length (cm)
30
20
10
Man
Pol
F1
BC


Probability
4
2
0
1
#1
#2
#20
#5
Chromosome


Identify phenotype
Sub-divide populati
Sequence DNA
Compare sequences
Identify SNPs
Chromosomal Region 1
Chromosomal Region 2
Chromosomal Region 3
Person 1
Person 2
Person 3
SNP1
SNP2
SNP3
Verify


Reaction norm
Genetic correlation
ANOVA
(a)
(b)
(c)
(d)
(e)
Behavior
E1
E2
TRENDS in Genetics

VOCABULARY:
(Practice writing interesting, informative sentences that include, and capture the meaning of, 4-5 words from this list. To simply memorize a definition, is not sufficient.)

Heritability
Inherited
GXE
Dominant
Recessive
Epistatic
Pleiotropic
Quantitative Genetics
QTL
Genetic Marker
Forward genetics
Reverse genetics

PRACTICE EXAM QUESTIONS:

1. What observations or experiments can be used to partition phenotypic variance into its genetic and environmental components?
2. Why is it wrong to say "the gene for behavior X"?

READING FOR TODAY:
Byers Chapter 8
Population Genetics/Quantitative Genetics chapter (available on course website)

READING FOR THURSDAY:
R&W Chapter 8

Okhovat M, Berrio A, Wallace G, Ophir A, Phelps SM (2015) Sexual fidelity trade-offs promote regulatory variation in the prairie vole brain. Science 350: 1371-1374. (be prepared to explain figures, discuss results etc)

Donaldson ZR and Young LJ (2008) Oxytocin, Vasopressin, and the Neurogenetics of Sociality. *Science* 322:900-904.

Frankie Williams	Emily Duval	Eve Marder
Sol Taylor-Brill	Michael Meaney	Allison Doupe
Senta Wiederhol	Emily Duval	Annaliese Beery
Susa Oram	Catherine Carr	Frans de Waal
Avantika Vivek	Annaliese Beery	Eve Marder
Noah Radetsky	Daphne Soares	Myron (Mike) Baker
Ari Coester	Michael Meaney	Karen Warkentin
Isaac Schumann	Catherine Carr	Emily Duval
Alec Lobnitz	Vanessa Ezenwa	Katherine Dulac
Julia Yuan	Annaliese Beery	Vanessa Ezenwa
Lenny Blair	Allison Doupe	Jim Goodson
Celia Morell	Katherine Dulac	sapolsky
Gabe Preising	Vanessa Ezenwa	Daphne Soares
TYLER	Marlene Zuk	Justin Rhodes
Xochitl Berns	Kerry Shaw	Ellen Ketterson
Luke Steiger	Myron (Mike) Bak	Vanessa Ezenwa
Eli Sobel	Katherine Dulac	Myron (Mike) Baker
Xavier Gonzalez	Myron (Mike) Bak	Frans de Waal
Ashlee Cook	sapolsky	Catherine Carr
Amy Rose Lazar	Judy Stamps	Michael Meaney
Natasha Baas-Th	Eve Marder	Catherine Carr
Miriam Bern	Frans de Waal	Katherine Dulac
Sammi Goldberg	Frans de Waal	Michael Meaney
Andrew Harman	Allison Doupe	Daphne Soares
Sophia Bruno	Jim Goodson	Annaliese Beery
Eva Licht	Daphne Soares	Allison Doupe
Olivia Dao	Justin Rhodes	Marlene Zuk
David Snower	Karen Warkentin	Judy Stamps
Justyne Wyer	Ellen Ketterson	Emily Duval
Maddy Doak	Eve Marder	Kerry Shaw

Each student will review 2 websites (assignments left).

Put the name of the **Researcher at top left** of the page

Put **your own name at top right** of the page

Answer the following questions

Bring a hard copy of each review (separate pages so they can be handed back to the authors) to class by Tuesday Nov 13th) (typed or hand written is OK)

Content

1. In your own words, describe the data figures that are presented on this Blog/website?
2. What important area of animal behavior do these data represent?
3. In your own words, why are these results/interpretations an important contribution to the field?
4. If you find the above questions difficult to answer, provide recommendation about how the student author(s) could improve information transfer in their blog/website.

Style

1. Would you suggest alternate headings to the different subsections that might be more informative about the content of those sections?
2. Are there additional types of figures that you would like to see included in the blog/website?
3. Though the assignment is not about stylistic web design, what aspects of the website/blog are the most effective?
4. Though the assignment is not about stylistic web design, what aspects of the website/blog are the least effective?

NAME _____

FOR THURSDAY:
Each student must find an example of a Behavioral Genetic Study

First Author _____ year: _____

Title: _____

Journal _____ Vol. _____ pages _____

Organism: _____

Description of the behavioral phenotype(s): (2-3 sentences)

What approaches did they use (quantitative, candidate gene, forward, reverse etc.):

Description of the genetic findings: