Welcome to SISG, Module 9
Introduction to Quantitative Genetics

- Your instructors
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  - Guilherme Rosa
- Our TAs
  - Arthur Fernandes
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Breakout groups

- You will be randomly assigned with four other students (which will change each time we send you to a room), so at the start of each, please introduce yourself (plan on at most a minute per person)
  - Name (also, type for name in the Chat box)
  - Current position (student, researcher, professor, etc)
  - Where you are currently working
  - A QUICK 15-20 second summary of what you are working on
  - A fun fact about yourself!
  - Hint! Takes notes on these details for your group mates, as each new group will be different.

Questions for first breakout

- What are breeding values and additive genetic variances?
- How are these concepts important in your project/work?
- Spend 20-25 minutes discussing these in your group and then we will reform and discuss this in four larger groups (roughly 35 people each)

Quick break

- Back at 11: xx PDT
- We will return from groups at xx PDTA

Questions for breakout three

- 1) What is the additive-genetic covariance between a fully inbred parent and an offspring that is inbred to f = ½.
- 2) Consider the additive-genetic covariance between two full sibs, where the father is not inbred and the mother is fully inbred. Further, the COC between the two parents is ¼

Answers

- 1) $\Theta_{PO} = (1 + f_p + 2f_o)/4$

  $= (1 + 1 + 2[1/2])/4 = ¾$

  $Cov(P, O) = 2\Theta_{PO} Var(A) = 1.5*Var(A)$

  3 times the value for noninbred relatives

- 2) $\Theta_{FS} = (2+f_m+f_f +4\ \Theta_{mf})/8$
  - $= (2 + 0 + 1 + 4[1/4])/8 = (4)/8 = 1/2$
  - $Cov(FS) = 2\Theta_{FS} Var(A) = Var(A)$
  - Twice the value for noninbred relatives

Questions for breakout three

- Compare and inbreeding depression and heterosis and discuss how these concepts revenant to your project
- ~ 25 minutes in your group
  - 5 minutes (total) introductions
  - ~ 20 minutes
- We will then reform to four larger groups for discussion of this questions and other issues/ questions from the first three lectures

Discussion Problem 1

- (From slide 23) Here is the generalized breeder's equation (below)
- 1) Discuss the significance of its components and how they can be exploited by breeding design
- 2) Genomic selection uses marker information in place of phenotypes to select individual. How might this enhance response?

$$R_y = \frac{i_m + i_f}{L_m + L_f} \, r_{uA} \sigma_A$$

- r is the correlation between the index used to choose parents and the breeding values of those parents (marker information, phenotypes of relatives)
- i is the selection intensity
- L is the generation interval
- Genomic selection
  - Does not really improve r, but can greatly increase i and greatly shorten L

Discussion Problem 2

- Suppose G(1,1) = 10, G(1,2)= G(2,1) = -3, and G(2,2) = 4. Likewise, suppose Beta(1) = 1 and Beta(2) = 0. What are the responses in both traits?
- Suppose you want trait 1 to change but trait two unchanged. Again, suppose Beta(1) =1, what value for Beta(2) will accomplish this goal?

$$\mathbf{G} = \begin{pmatrix} 10 & -3 \\ -3 & 4 \end{pmatrix}, \quad \beta = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

$$\mathbf{R} = \begin{pmatrix} 10 & -3 \\ -3 & 4 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 10 \\ -3 \end{pmatrix}$$

Response in trait 2 =

$$G(2,1)\beta_1 + G(2,2)\beta_2 = 0$$

$$-3 \cdot 1 + 4 \cdot \beta_2 = 0$$

for $4\beta_2 = 3$, or $\beta_2 = 3/4$

$$\mathbf{R} = \begin{pmatrix} 10 & -3 \\ -3 & 4 \end{pmatrix} \begin{pmatrix} 1 \\ 3/4 \end{pmatrix} = \begin{pmatrix} 10 \cdot 1 - 3 \cdot (3/4) \\ -3 \cdot 1 + 4(3/4) \end{pmatrix} = \begin{pmatrix} 7.75 \\ 0 \end{pmatrix}$$