Reading Guidelines
Molecular Biology for Quantitative Geneticists
Last revised 2009-08-30

Teasers

Please take a look at the nice pictures in Griffiths et al. (any edition) An Introduction to Genetic Analysis, in chapters taking up the following subjects: DNA structure and replication, RNA transcription, protein synthesis, gene regulation, and development.

Give a definition of the following terms:

Locus vs. Gene vs. Allele;
(Just for the sake of clarity!)

Quantitative character vs. Qualitative character;
(Relate your answer to the phenotypic variance.)

Quantitative genetics vs. Population genetics;
(You may consult, if you want, relevant parts in a few QG and PG (Population Genetics) textbooks, such as: Hartl & Clark (2007) Principles of Population Genetics; Lynch & Walsh (1998) Genetics and Analysis of Quantitative Traits; and a paper by Kempthorn (1977) pp. 3-18 in Pollak et al. (Eds.) Proc. of the Interntl. Conf. on Quant. Genet.)

Minor gene vs. Major gene;
(Relate your answer to the number of genes.)

Additive gene effect vs. Dominance deviation;
(Which one is the rule and which one is the exception.)

Dominance vs. Epistasis;
(Think of 'imprinting' and gene duplication before answering this one!)

Hossein Jorjani

To be uncertain is uncomfortable, but to be certain is ridiculous.
Chinese proverb

Reading Guidelines
Statistical Inference & Statistical Tools
Last revised 2009-08-30

Review your undergraduate / postgraduate statistical books / notes. Please pay special attention to the common statistical tools: Expectations, mean, variance, regression, correlation and ANOVA.

Look for the meaning of the following words: Deduction, induction

Try to find some short description of: Plato's allegory of the cave, Aristotle's deductive system of reasoning, Sir Francis Bacon's inductivism, Max Planck's wave-particle duality of light, Heisenberg's uncertainty principle, Popper's hypothetico-deductive method and Kuhn's definition of paradigm

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Teasers

Try to watch (or at least think about) a couple of movies with alien characters in them. Any thing goes, from Godzilla to Alien, Star Trek to Star Wars, E.T. to Predator. Have fun!

Oh, now that you are at it, watch "Master and Commander" as well ☺

To be on the safer side, please explain the following terms:

- Mean vs mode vs median
- Standard deviation vs standard error
- Least square vs Maximum likelihood
- Confidence interval vs probability interval

Have you noticed that there are two common equations for calculation of variance (look at the following equations).

$$Var(X) = \frac{\sum_{i=1}^{N}(X_i - \bar{X})^2}{N-1} \quad \text{and} \quad Var(X) = \frac{\sum_{i=1}^{N} X_i^2 - \frac{(\sum_{i}^{N} X_i)^2}{N}}{N-1}$$

Can you prove that these are equivalent to each other?
(Obviously you know this, but I very much doubt it if you remember this from top of your head!)

Why are there two equations? How would you describe the two equations? Are they different?
(I am trying to turn this into an example of a larger issue! Can you guess what?)

Hossein Jorjani

It is a good morning exercise for a research scientist to discard a pet hypothesis every day before breakfast. It keeps him young.
Konrad Lorenz

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 1

Please pay special attention to the following sections:

Equations	: The last equation on page 14, 1.5
Examples	: 1.3, 1.6
Figures	: 1.3
Problems	: 1.10, 1.11
Sections	: 1.1.2, 1.3
Tables	: 1.1

Teasers

Write down your ideas on how the different chapters in F&M (1996) can / should be grouped. Are there any other books that you believe are equivalent to F&M (1996)? Which one is your favorite book? Why?

What is 'random mating'? Try to look at the definition of 'random mating' in at least 3 textbooks! Can you make any generalization about what constitutes 'randomness'? *(Think 'quantitatively', would you?)*

Degree of freedom (df) is usually df = n-1, but as you see in Example 1.4 for this χ^2 test df = n-2. Why? *(Can any one of you explain it to me as if I was a six-year old child?)*

Think about prerequisites (assumptions, explicit and implicit) of the Hardy-Weinberg law/equilibrium/model. Compare these with the causes of change enumerated in Section 1.1.2. *(You may also want to look at some other books to see different listings of these assumptions, if you want).*

Give one example of a real population fulfilling all of Hardy-Weinberg assumptions. *(Give?! I dare you, I challenge you to give)*

Choose two papers from your own field of research showing the depth (levels) and the width (magnitude) of the genetic variation. *(And please make a copy of them for me or send me them in PDF!)*

Hossein Jorjani

The causes in any individual case of inheritance are far too complex to admit of exact treatment."
Pearson, 1896

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 2

Please pay special attention to the following sections:

Equations	: 2.10, 2.16, 2.17, 2.21, last row of Table 2.2 (Eq. 5)
Examples	: 2.2, 2.4
Figures	: 2.1
Problems	: 2.5, 2.7
Sections	: 2.4.1
Tables	: 2.2

Teasers

Please use Excel and apply the last equations of Table 2.2 to some rages of initial allele frequencies and selection coefficients. *(Some textbooks, e.g. Hartl & Clark, present special situations in which certain relationships between s_1 and s_2 lead to some informative results.)*

The allele responsible for sickle-cell anemia is often mentioned as an example of an allele with overdominance effect. Can you give three more examples of overdominance effect?

Use Example 2.2 and speculate on the time needed for making other changes in human genetic constitution. For example, according to some racially motivated pseudo-scientific studies, the average IQ score among Afro-Americans is said to be about 85 in contrast to 100 among the Caucasians with European ancestry. The interesting point is that Asian-Americans are said to have an average IQ of 110. *(Alternatively, you may choose to think about what it is that different measurements are trying to measure. For the IQ example the question is what is it that the standard IQ tests measure?)*

There is a paragraph in the book (top of page 45) about neutral mutations. Would you please compare this paragraph with the similar paragraphs in previous editions of your textbook? *(So, how long would you think is the average useful age of a textbook? Or the references used in a book? Imagine a quote from a mental giant like Alan Robertson from 1955. How long can we rely on that quote? Say, 10 years, 25 years, 50 years or …?)*

What is this "Genetic Load"? *(Can any one of you explain it to me as if I was a six-year old child? And for you who are interested in PG, what this "Genetic Load" has to do with the "Neutral Theory"?)*

Hossein Jorjani

"Quote me as saying I was misquoted"
Groucho Marx

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 3

Please pay special attention to the following sections:

Equations	: 3.2, 3.5, 3.14, 3.15
Examples	:
Figures	: 3.3, 3.4
Problems	: 3.2 (!)
Sections	: Pre3.1
Tables	: 3.1

Teasers

Do you see any resemblance between the 'base population' in the idealized population concept and a population in Hardy-Weinberg equilibrium? How about any difference? *(Can you add anything to the prerequisites of the Hardy-Weinberg model?)*

Is there anything common between Equation 3.5 and Table 3.1?

It is very easy to see that the concept of panmictic index (Eq. 3.15) is related to the concept of panmixia. Can you re-write Equation 3.15 so that heterozyosity at generation t is related to all genotypes at generation 0?

In explanation of Fig. 3.2, the rise in frequency of the wild allele is attributed to 'natural selection'. Is there any way of preventing natural selection in an experiment?

Write down your own definition of 'inbreeding' as a pattern and as a 'process'. *(And the author(s) of the best definition(s) is (are) awarded by a cup of coffee.)*

Hossein Jorjani

For every complex problem, there is a simple solution … that does not work.
Anonymous

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 4

Please pay special attention to the following sections:

Equations	: 4.1
Examples	: 4.1
Figures	:
Problems	: 4.2
Sections	: 4.1.4, 4.4.1
Tables	:

Teasers

Use Equation 4.4a (or 4.4b) to calculate Ne for the following populations:

Population	Number of males	Number of females
A	1	10
B	1	100,000
C	100,000	1

There are a lot of approximate equations in Chapter 4. Can you think of a general formula that can take care of all situations, a formula whose approximation/simplification can lead to Chapter 4 equations? *(Well, why don't you look at Hill (1972) Animal Breeding Abstract, 40, 1-15, and references therein.)*

Write down your own definition of 'effective population size'.

Hossein Jorjani

If everything seems to be going well,
you obviously do not know what the hell is going on.
Murphy's law

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 5

Please pay special attention to the following sections:

Equations	: 5.1, 5.2, 5.17, and the non-numbered equation on top of page 96
Examples	:
Figures	:
Problems	: 5.8
Sections	: 5.1.2, 5.2.8
Tables	:

Teasers

What is the relationship between Equations 3.15 and 5.17?

What is this Wright's F-Statistics? *You are strongly advised to look at Hartl & Clark (2007) for this subject. This is especially important from a population genetics point of view.*

If 'assortative mating' is a form of non-random mating, what is the reason that it is not taken up by F&M in Chapters 3-5?

Biémont (1991; Genet. Sel. Evol. 23, 85-102) claims that inbreeding and imprinting are, …, well, somehow related to each other! Can you believe it?

Hossein Jorjani

He who stands still goes backwards
J.R. Hoey

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 6

Please pay special attention to the following sections:

Equations	:
Examples	:
Figures	: 6.1, 6.2
Problems	: 6.3, 6.4
Sections	:
Tables	:

Teasers

What is this 'Infinitesimal model'? Where does it come from? When and where was this term used for the first time? Does the 'concept' precede the 'term'? How do you define it? Can you name some quantitative criteria for infinitesimality! *(IN-FINI-TESI-MALITY! What a word! Makes one to wake up!); (I'll buy you a cup of coffee (!) if you read Jorjani et al (1997) Acta Agric. Scand., Sec. A, Anim. Sci. 47, 65-73 and the references therein pertaining to the infinitesimal model.)*

There are no equations in this chapter! Can you accept the following equation as the definition of the infinitesimal model?

Start from the basic quantitative genetics model:

P = G + E; where
P = the phenotypic value;
G = the genotypic value; and
E = the environmental deviation.

Then, according to the infinitesimal model:

$$G = \sum_{i=1}^{N \to \infty} g_i$$

Where
g_i = the genotypic value at the i^{th} locus;
N = the number of loci.

(Compare this equation with Equation 7.9 in the book.)

Hossein Jorjani

"... when you have eliminated all which is impossible, then whatever remains, however improbable, must be the truth."
Sir Arthur Conan Doyle

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 7

Please pay special attention to the following sections:

Equations	: 7.1, 7.7, 7.8, 7.9, 7.10
Examples	: 7.3, 7.7
Figures	: 7.1, 7.2
Problems	: 7.3, 7.4, 7.9
Sections	:
Tables	: 7.3

Teasers

Give a definition (*preferably a quantitative definition*) of the following terms:

Average effect vs. Breeding value;
(To be on the safer side, read Falconer, 1985.)

Dominance vs. Neutrality(!);
(I'd let you die of the curiosity's pain rather than deprive you of the discovery's ecstasy!)

What is the relationship between additive gene effect and dominance deviation? (Which one is the rule and which one is the exception? (*What kind of question is this?!*)

What is the relationship between the genetic background and the dominance deviation?

Do you think dominance and epistasis are two different things?
(Think about 'gene duplication' before you answer this one!)

Do you think there is any similarity between linkage disequilibrium and epistatic interaction?

Hossein Jorjani

We should not confuse information with knowledge
T. S. Eliot

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 8

Please pay special attention to the following sections:

Equations	: 8.1, 8.2, 8.10, 8.11
Examples	: 8.3
Figures	: 8.1, 8.2
Problems	: 8.3, 8.6
Sections	: 8.2.3, 8.2.4, 8.3.1, 8.3.2
Tables	: 8.5

Teasers

This chapter and the next one are quite straightforward. However, here lie the sources of much confusion. Just look at the large number of combinations that the following words have created:

Phenotype	Variance	Additive	Causal
Genotype	Covariance	Dominance	Observational
Environment	Correlation	Epistasis	Relatives
	Interaction		

These words come together in many combinations and it is not quite clear what is the difference between them. So, the summary of this meeting's list of specific questions is:

Clarify all combinations of the above mentioned words!
(Damn it! What kind of question is this?! 17!)

Hossein Jorjani

Nothing can take the place of persistence. Talent will not; nothing is more common than unsuccessful people with talent. Genius will not; un-rewarded genius is almost a proverb. Education will not; the world is full of educated derelicts. Persistence and determination alone are omnipotent.
Anonymous

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 9

Please pay special attention to the following sections:

Equations	: Un-numbered equations in page 146, 9.10, 9.13
Examples	:
Figures	:
Problems	: 9.1, 9.4
Sections	: Introductory remarks (pages 145-146)
Tables	: 9.3 (and 9.3 and 9.3), 9.4, 9.5

Teasers

This chapter and the previous one are quite straightforward. However, here lie the sources of much confusion. Just look at the large number of combinations that the following words have created:

Phenotype	Variance	Additive	Causal
Genotype	Covariance	Dominance	Observational
Environment	Correlation	Epistasis	Relatives
	Interaction		

These words come together in many combinations and it is not quite clear what is the difference between them. So, the summary of this meeting's list of specific questions is:

Clarify all combinations of the above mentioned words!
(Damn it! What kind of question is this?! 17!)

Hossein Jorjani

Celibacy is not hereditary.
Murphy's law

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 10

Please pay special attention to the following sections:

Equations	: 10.1 – 10.5
Examples	: 10.4, 10.5
Figures	: 10.1
Problems	: 10.1, 10.8, 10.9
Sections	: 10.3
Tables	: 10.2, 10.3, 10.4, 10.6

Teasers

The concept of heritability is one of the most misunderstood and abused concepts in quantitative genetics. Because of this I have chosen to recommend some relevant papers. I strongly recommend that you read the book first and then look at these papers. If and when you decide to read them, please read them in the following order:

Lewontin (1974) The analysis of variance and the analysis of causes. American Journal of Human Genetics 26: 400-411.
Feldman & Lewontin (1975) The heritability hang-up. Science 190: 1163-1168.
Jaquard (1983) Heritability: One word, three concepts. Biometrics 39: 465-477.
Eisenhart (1947) The assumptions underlying the analysis of variance. Biometrics 3: 1-21.

Eisenhart's paper might be a bit too much for those of you not working intensively with QG. However, this is a very good background to a lot of statistical analyses in QG and animal breeding, for example, Henderson's methods 1-4. If you find the language of Eisenhart difficult, you can equivalently read chapter 13 from the third edition of the book 'Biometry' by **Sokal & Rohlf** (1995)

Please try to find some examples of misunderstandings and/or abuse of heritability in the literature. I promise that your search would prove to be a very useful exercise.

Hossein Jorjani

"The assumption that biological superiority is correlated with color of skin, with religious belief, with social status, or with success in business is imbecile in theory and vicious in practice."

G. G. Simpson

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 11

Please pay special attention to the following sections:

Equations	: 11.1-11.5, 11.7-11.9, 11.5, 11.8, un-numbered equation at bottom of page 201 and top of page 202
Examples	: 11.4, 11.5
Figures	: 11.1 (compare with Figure 10.1), 11.5, 11.6
Problems	: 11.2, 11.5, 11.3
Sections	: 11.1 - 11.4, 11.2.2
Tables	: 11.1, 11.2

Teasers

Last paragraph on page 186: What do you say about that?

Middle of page 202: Competition between genes? Is this what Richard Dawkins is talking about?

In Figure 11.1 and in the paragraph explaining that figure: The text is … well, .., how should I say it, …, *alluding* to a "regression" analysis. If that was the case, what would be the H_0 and H_A? What is it that you are trying to test? What is it that you are trying to reject? (*Formulate your hypothesis and let me know if you think you have gone mad!*)

Realized selection differential? What is that?

Can you relate Figure 11.1 to the discussions on the Bulmer effect? *(Think about the negative covariance caused by selection and defined as the Bulmer effect. What is the nature of this covariance. Try to answer this question at two levels: At the phenotypic level and at the level of loci.)*

Is there any difference between Equation 11.8 and Crow and Kimura (1970) Equation 5.8.13?

According to Table 11.1 it is claimed that the within family variance in the progeny generation is not affected by selection. Do you agree with this claim? *(Free your mind! Is the within family variance impervious to everything? Are there any processes that can affect it? No? How about inbreeding? How about assortative mating?)*

Hossein Jorjani

Whenever you are caught between two evils,
take the one you have not tried yet.
Dan Graur

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2012-01-24

Chapter 12

Please pay special attention to the following sections:

Equations	: 12.2
Examples	:
Figures	: 12.3a, 12.3b, 12.4
Problems	:
Sections	: 12.1.2, 12.2.2, 12.2.4, 12.1-12.2, 12.1.3
Tables	:

Teasers

Causes of selection limit: Can you think of more reasons than are described in the book?

Are you now in a position to pass judgment on the infinitesimal model? How many loci do you need to have an infinitesimal model? Are you happy with 12 loci? How about 2880 loci?

Do you believe in selection limit? *(Look again at Figure 12.3 before answering this question!)*

Have you ever heard of selection limit in any non-experimental breeding population? And why not? *(If you really, really believed in the infinitesimal model, would you ever be worried about selection limit?)*

Do the selection experiments have anything more to contribute to quantitative genetics (or animal breeding)? (*I am sure you would make Bill Hill happy if you can show that new valuable knowledge can be acquired from selection experiments. See also Hill, W.G. (2011) Can more be learned from selection experiments of value in animal breeding programmes? Or is it time for an obituary? J. Anim. Breed. Genet. 128 (2011) 87-94*)

Hossein Jorjani

Research is to teaching like sin is to confession:
without the first, there would be nothing to talk about in the latter.
Anonymous

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 13

Please pay special attention to the following sections:

Equations	: 13.1, 13.2, 13.3
Examples	: 13.1
Figures	: 13.1
Problems	:
Sections	:
Tables	: 13.2, 13.4

Teasers

Can you see any similarity between Equation 13.1 and the partitioning of the variance into within and between group components? How?

Compare Equations 13.2 and 13.3 with Equation 11.2.

Now, the fun starts! Compare Table 13.2 with Table 9.3! (*Have I told you the story about Charles Darwin resting on a hammock in his backyard? Have you ever had a hammock moment?*)

Hossein Jorjani

A shortcut is the longest distance between two points.
Murphy's law

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 14

Please pay special attention to the following sections:

Equations	: 14.1, 14.2, 14.3, 14.4, 14.7, 14.8, 14.10
Examples	: 14.2, 14.3
Figures	: 14.3, 14.5
Problems	: 14.3, 14.6
Sections	: 14.1-14.2
Tables	: 14.2

Teasers

It might seem too early to ask this question; however, do you think the concept of "width of cross" has any bearing on detection of QTLs? *(This has to do with the efficiency of experimental crosses to detect QTLs with the epistatic gene action.)*

Given the prevalence of inbreeding depression and heterosis observed in experiments and in breeding programs, do you think that directional dominance is a common phenomenon? *(It would be nice if you could relate your answer to different biochemical control theories, e.g. Kacser-Burns model and the recent refinements to it.)*

Hossein Jorjani

Some luck lies in not getting what you thought you wanted but getting what you have, which once you have it you may be smart enough to see is what you would have wanted had you known.

Garrison Keillor

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 15

Please pay special attention to the following sections:

Equations	: unnumbered equation on pages 264, 265, 270, and 271
Examples	: 15.2
Figures	: 15.1, 15.2
Problems	:
Sections	: 15.1.1, 15.3.2
Tables	: 15.1

Teasers

There are a number of concepts developed in chapters 14 and 15 that rely on division of a large population into a number of sub-populations (not unlike the model discussed under the idealized population). Do you think these equations can be extended to other situations, e.g. to the families within a line? *(Can you think of replacing within and across lines with within and between families?)*

Are there any similarities between the discussions on combining ability and di-allele crosses? *(There has been an insurgence of interest towards di-allele crosses among evolutionary geneticists recently. Of course, as it is the case in many other discussions in modern evolutionary discourse, it must have a fancy name of some sort. Try with the Cockerham model!)*

Is there anything common between Equation 3.5 and Tables 3.1 and 15.1?

Hossein Jorjani

If I had a horse, I'd horsewhip you!
Groucho Marx

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 16

Please pay special attention to the following sections:

Equations	:
Examples	:
Figures	:
Problems	:
Sections	:
Tables	:

Teasers

What are your feelings about the relative importance of general versus specific combining ability? *(I hope you will forgive me for asking about your feelings!)*

After all discussions we have had about overdominance (or heterozygote advantage), it might seem obvious that we may need to shift from overdominance to associative overdominance. Do you think that associative overdominance is a plausible explanation?

At least those of you who have studied our department's undergraduate course on animal breeding have heard about synthetic populations, and three-way or four-way crosses. These methods have widespread use in smaller animals, especially poultry and to a lesser extent in pigs. Are these methods used in larger animals? Where? How? *(Or let's ask another question: Why aren't these methods widely used in large farm animals?)*

Hossein Jorjani

There are some things about you that I like;
I just can't put my fingers on them.
Anonymous

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 17

Please pay special attention to the following sections:

Equations	: 17.1
Examples	:
Figures	: 17.2
Problems	:
Sections	: The first three paragraphs of the chapter
Tables	:

Teasers

Give a definition of the transformation.
(Think in terms of mathematical functions.)

Choose two papers from your own field of research with extensive use of transformations.
(and please make a copy of them for me!)

Extra Reading

Lewontin, R.C. (1974) The analysis of variance and the analysis of causes. American Journal of Human Genetics 26: 400-411.
Sokal, R.R. & F.J. Rohlf (1995) Biometry. Third edition. Chapter 13, Pages 392-450.

Hossein Jorjani

There's never time to do it right, but there's always time to do it over.
Murphy's law

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 18

Please pay special attention to the following sections:

Equations	: 18.1
Examples	: 18.1, 18.3
Figures	: 18.3
Problems	: 18.2, 18.5 (it is important that you try to solve these two problems)
Sections	: 18.1.1
Tables	:

Teasers

Give a definition of the following terms:

Acquired character;
(Relate your answer to soft and hard inheritance.)

Genetic assimilation.

Hossein Jorjani

"One forms provisional theories and waits for time or fuller knowledge to explode them. A bad habit, Mr. Ferguson, but human nature is weak."
Sir Arthur Conan Doyle

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 19

Please pay special attention to the following sections:

Equations	: 19.3, 19.6, 19.16, 19.17
Examples	: 19.1, 19.3, 19.4, 19.5, 19.6
Figures	:
Problems	: 19.1
Sections	: 19.2, 19.4
Tables	:

Teasers

Make sure that you understand the distinction between "family selection, within family selection and combined selection" on one hand, and "tandem selection, independent culling level and index selection" on the other hand. What is the difference between "index selection" in Chapter 13 and Chapter 19? *(And what is the difference between combined selection and index selection? What is this thing called "selection index"? So, first explain to me, as if I were a six years old child, the relationship between combined selection and index selection, and second, explain to me the difference between index selection and selection index.)*

The terminology in quantitative genetics and animal breeding is like a living entity and it changes constantly. Try to find out more about the meaning of "accuracy" (mostly discussed in Chapter 13) and relate it to "precision", "bias", and "prediction error variance". (*Please ask a few colleagues about these terms.*)

Hossein Jorjani

After a number of decimal places, nobody gives a damn.
Anonymous

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 20

Please pay special attention to the following sections:

Equations	: 20.1, 20.2, 20.5b (compare with Equation 19.6), 20.7
Examples	:
Figures	: 20.1 (compare with Table 1.1), 20.2
Problems	: 20.1, 20.2
Sections	: 20.2, 20.3, 20.4.3. 20.5.1, 20.6
Tables	:

Teasers

Give a definition of the following terms:

Fit vs. vigor *(This is an exercise in linguistics!)*;

Stabilizing selection vs. Negative assortative mating; and Disruptive selection vs. Positive assortative mating *(Well, a good source of confusion is Bulmer(1976))* ;

Developmental homeostasis vs. Canalization; Genetic homeostasis vs. phenotypic plasticity; Heterozygote advantage vs. Genetic homeostasis *(How many synonyms can you count for genotype-environment interaction?!)* ;

Page 343, middle of second paragraph: “experimental selection … results in a reduction of … fitness.” Why? *(Good people: We have almost finished reading Falconer’s book. How many explanations can you think of for genetic correlation between two traits?)*

What does Fisher’s fundamental theorem of natural selection tell you about fitness related economical traits of domestic animals? For example, what are its consequences for fertility traits in dairy cattle? *(Try to use Figure 20.2 and speculate which curve applies for the trait of your interest, e.g. fertility in dairy cattle, and where on this curve were the dairy cattle 50 years ago and today?)*

Try to visualize Equation 20.7 in a graphic way. Draw (by hand!) a normal distribution. Apply some sort of selection by showing the selected individuals by small dot. Make the selection in such a way that j becomes negative or positive.

Can you relate the discussion on the “Mutational variance” (Page 349) to the discussion on selection limit? How do you think about selection limit now?

Hossein Jorjani

"As a rule", said Holmes, "the more bizarre a thing is the less mysterious it proves to be."
Sir Arthur Conan Doyle

Reading Guidelines
Falconer, D. S. & Mackay, T. F. C. (1996)
Introduction to Quantitative Genetics
Last revised 2009-08-30

Chapter 21

Please pay special attention to the following sections:

Equations	: 21.1b
Examples	:
Figures	: 21.2, 21.4
Problems	:
Sections	: 21.1.1
Tables	: 21.2, 21.3

Teasers

Give a definition (preferably a quantitative definition) of the following terms:

Linkage disequilibrium vs. Epistatic interaction.
(Find this one between the lines in F&M, 1996.)

In the first paragraph of Chapter 21 there is some reference to the unrealistic assumptions in QG.

a) Name more assumptions of QG.
b) Which one of these assumptions do you think is unrealistic?
c) Compare F&M (1996) statement about 'indefinitely large number of genes affecting the trait' with the metabolic control theory's claim that virtually all genes affect all traits, especially look at Kacser (1989) pp 219-226 in Hill & Mackay (Eds.) Evolution and animal Breeding.

Hossein Jorjani

Murphy's golden rule: whoever has the gold makes the rules.
Murphy