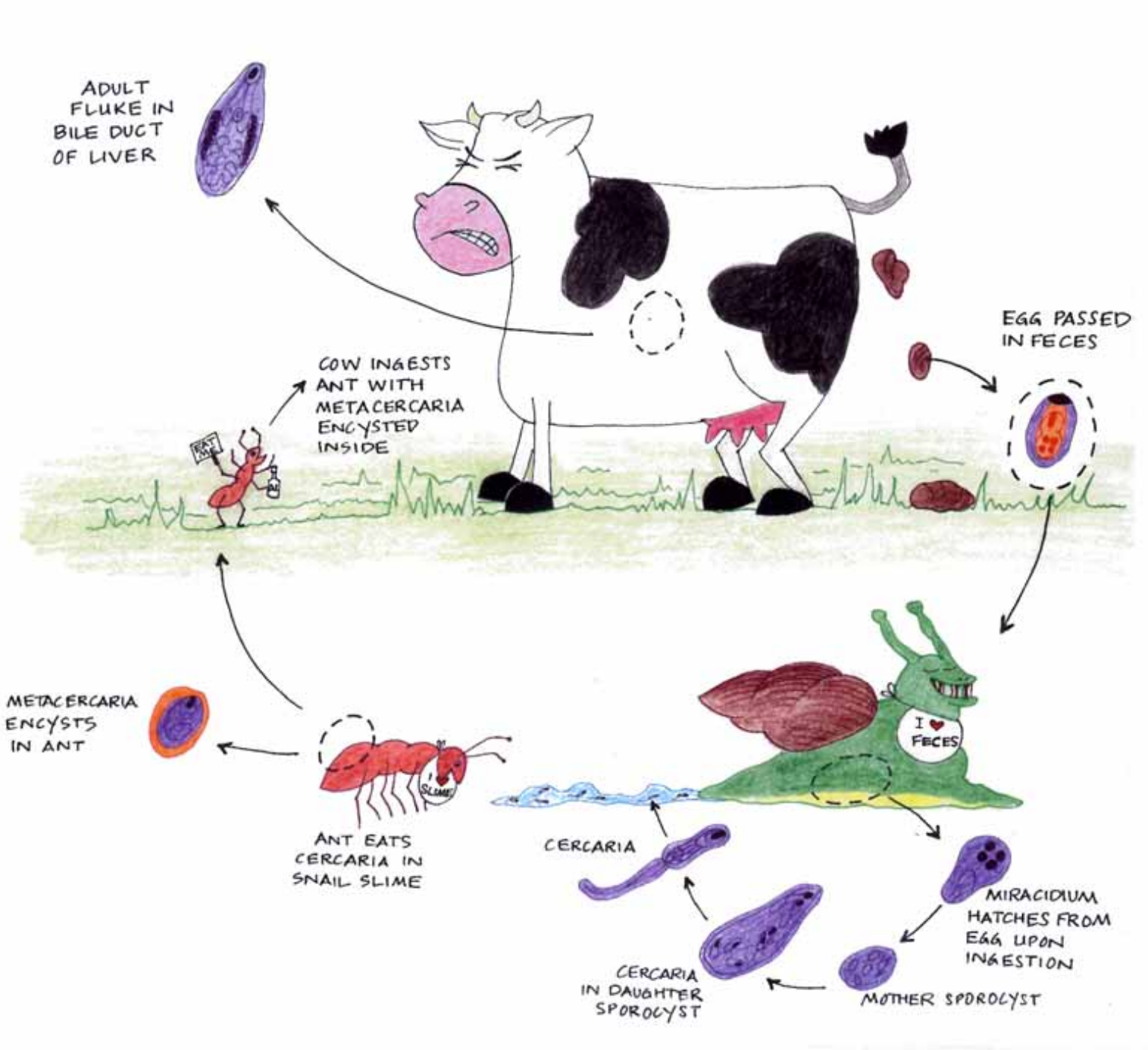
LIFE CYCLE OF *Dicrocoelium dendriticum*



Learning Objectives:

By the end of this lesson, you will be able to….

1. Recognize the main points in the history of the Group Selection debate.

2. Use pedigrees to calculate whether or not altruistic behaviour will evolve according to Hamilton's rule.

3. Explain the main requirements for selection to occur at the group level.

DEFINITIONS

GROUP SELECTION: the evolution of traits based on the differential survival and reproduction of groups

GROUP: a bunch of individuals in a population whose traits affect each other but not other individuals in the population

- do not have to be permanent

ALTRUISTIC TRAIT: a trait which when expressed results in reduced fitness to the individual expressing the trait, but increased fitness for members of its group

DARWIN in *The Descent of Man*:

… although a high standard of morality gives but a slight or no advantage to each individual man and his children over the other men of the same tribe . . . a tribe including many members who … were always ready to aid one another, and to sacrifice themselves for the common good, would be victorious over most other tribes; and this would be natural selection.

SEWALL WRIGHT (1945)
- shifting balance

G.C. WILLIAMS (1966)
- parsimony

W.D. HAMILTON (1963) and (1975)
- kin selection: br>c

D.S. WILSON & E.O. WILSON (1970's-2007)
- multilevel selection theory

HAMILTON'S RULE: **c<br**

c = cost to altruist
b = benefit to recipient
r = coefficient of relatedness

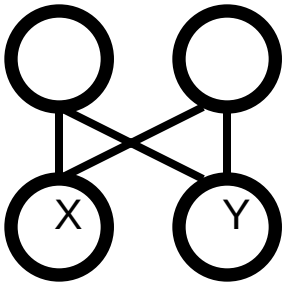
X = altruist
Y = recipient
XY = hypothetical offspring of X and Y, if they mated

$$\mathbf{r = \frac{2 F_{XY}}{(1 + F_X)}}$$

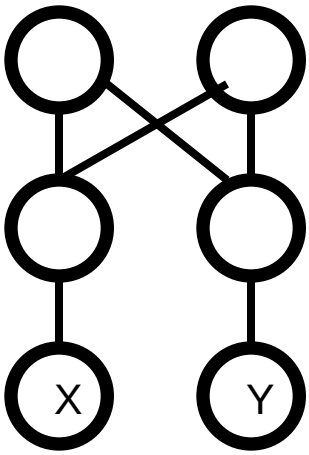
F = inbreeding coefficient

PROBLEM: For the following three pedigrees, calculate the value of the benefit (b) to the recipient of altruism, relative to a cost value c = 1 to the altruist, in order to ensure evolution of altruism (e.g. an increase in the gene for altruism). Assume that none of the common ancestors are inbred.

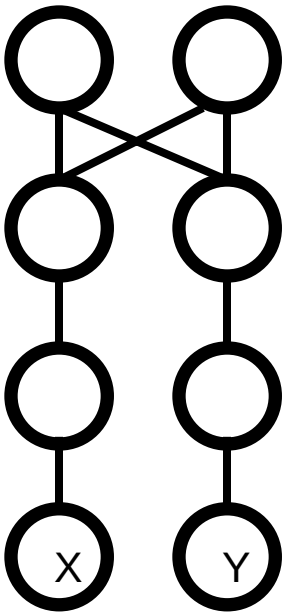
A)



B)



C)



REQUIREMENTS FOR GROUP SELECTION

1. More than 1 group.

2. Groups vary in proportion of a trait that is advantageous to the group.

3. Direct relationship between the proportion of individuals who have this trait, and the success of the group.

4. Groups that are more successful produce more groups like themselves.

Post-lesson Quick Quiz….