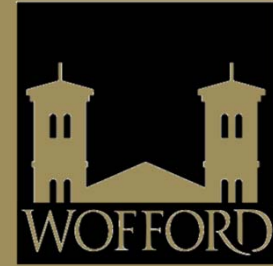


**THE MYSTERY OF MULTIPLE MATING
IN FEMALE *DROSOPHILA
MELANOGASTER*:**

**DO GENETICALLY DIVERSE
OFFSPRING OFFSET THE COSTS OF
MATING?**



Stephanie
Ackerson

Paul Cox

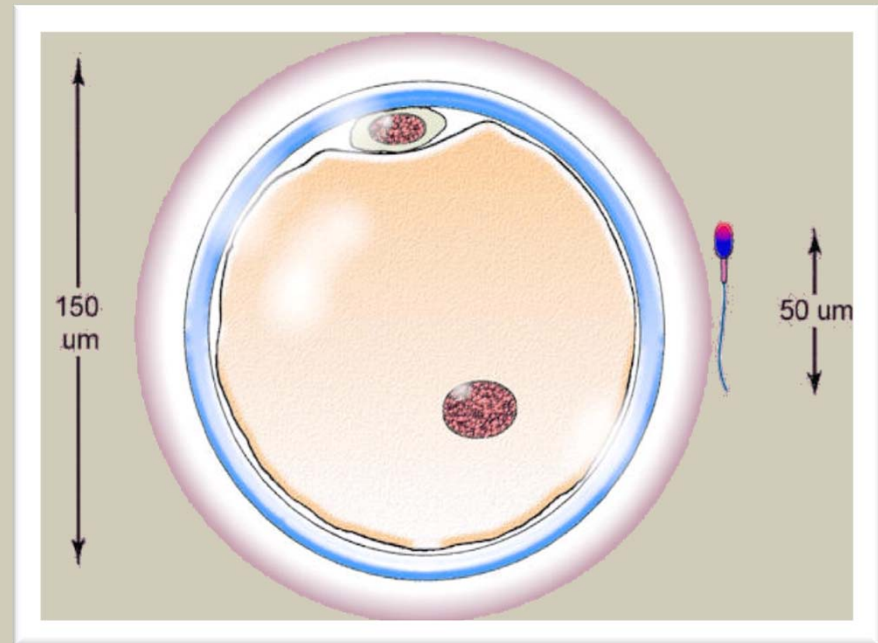
Harmony
White

On behalf of
Bio 352,
Research in
Evolutionary
Biology

MATING SYSTEMS - THEORY

- **Males should mate multiply**
 - Sperm are energy efficient to produce
- **Females should be monogamous**
 - Eggs are larger and more costly to produce

(Bateman 1948)



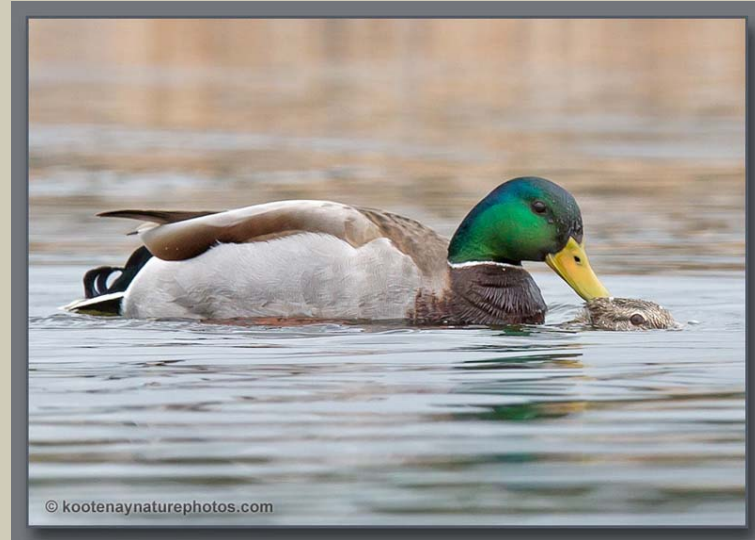
COST OF MATING TO FEMALES

- Maternal care of offspring
- Harm from males



Female brown bear and cubs

Mallard male and female



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POLYANDRY IS COMMON

- Despite theoretical predications and costs of mating to females, polyandry is common in animals.



Honeybee queen



Emperor tamarin pair (*Saguinus imperator*)

BENEFITS TO FEMALES

Dance flies (genus *Empis*)



■ Direct (Arnqvist & Nilsson 2000)

- Food gifts
- Access to resources



■ Indirect (Jennions & Petrie 2000)

- Good genes
- Genetic diversity of offspring

Gray tree frog

DROSOPHILA MELANOGASTER

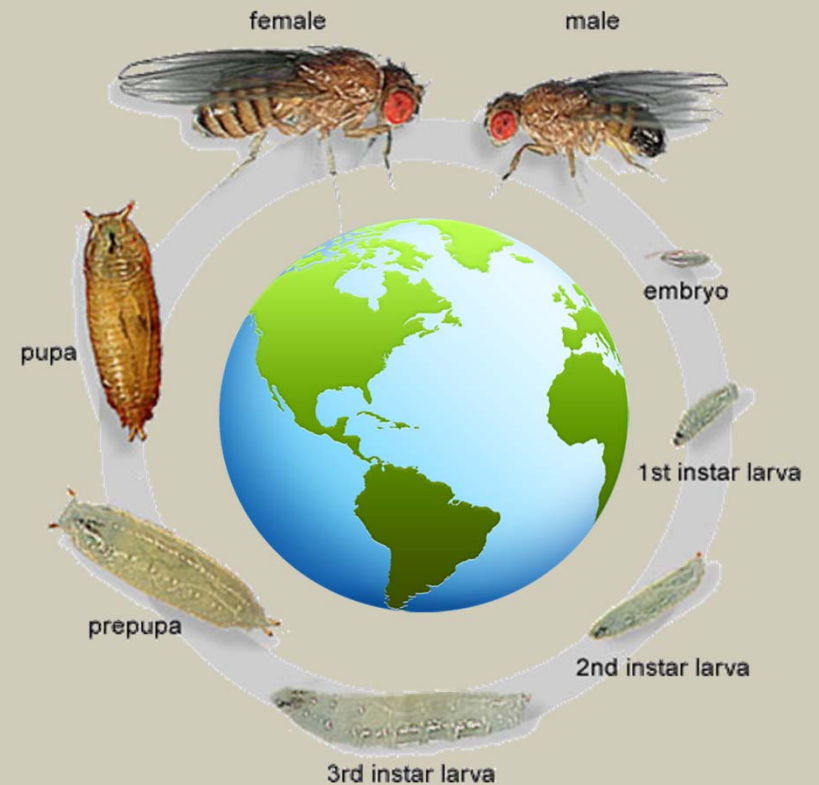
■ Model Organism

- Genetics well-understood
- Easy to rear in the lab



Drosophila on fruit

The life cycle of *Drosophila melanogaster*



MATING IN *DROSOPHILA*

- Both sexes promiscuous (Imhof et al. 1998)
- High costs to females (Chapman et al. 2003)
 - Harassment
 - Toxic male seminal fluid
- Direct benefit → fertilization (Gromko & Pyle 1981)
- Indirect benefits → not found



Drosophila melanogaster mating pair

HOW CAN WE EXPLAIN THE PARADOX?



Hypothesis:

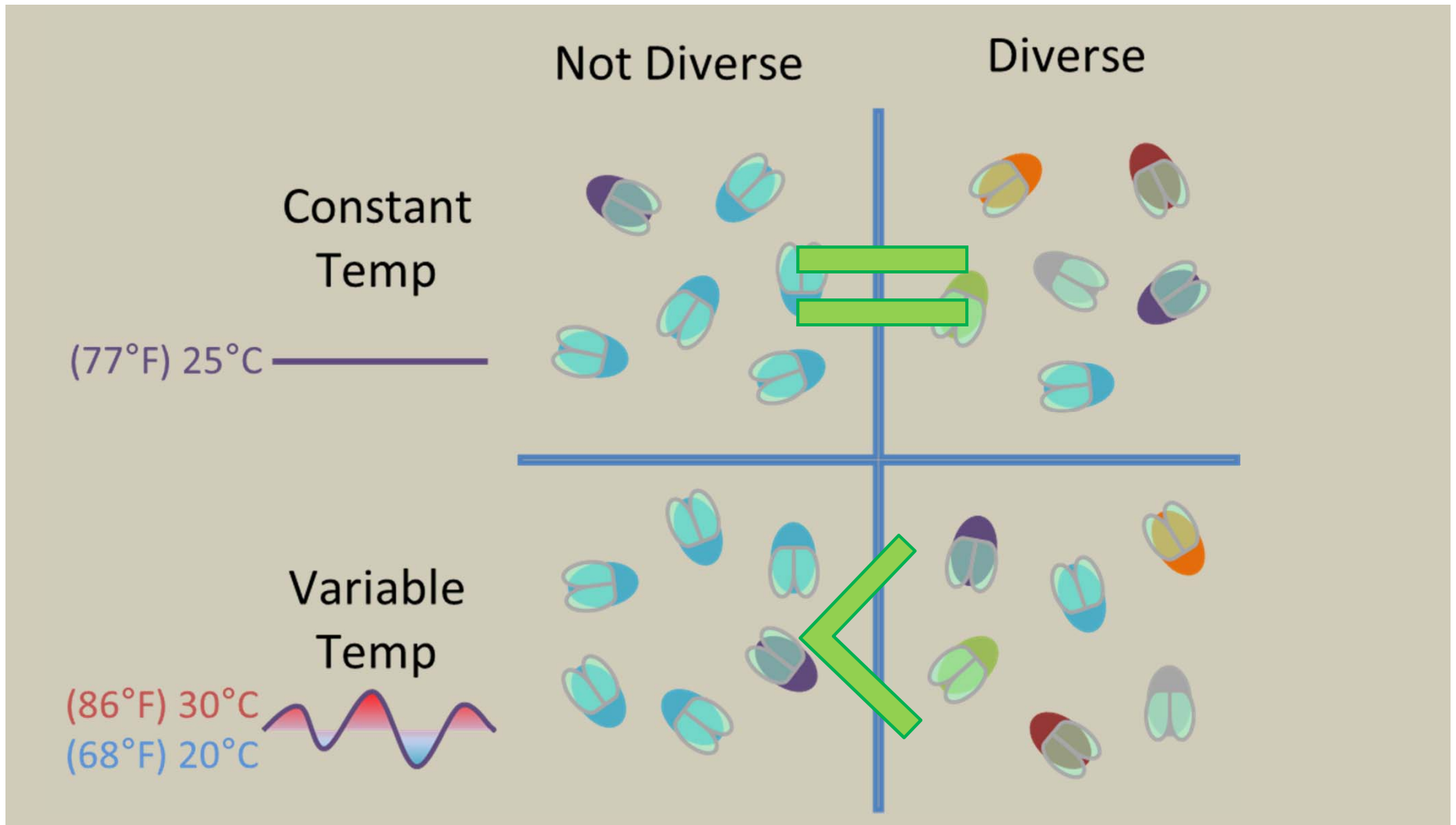
- Females mate with multiple males to produce genetically more diverse offspring.
 - Genetic bet hedging
 - Increases female reproductive success in changing environments
- (Fox & Rauter 2003)

FLIES

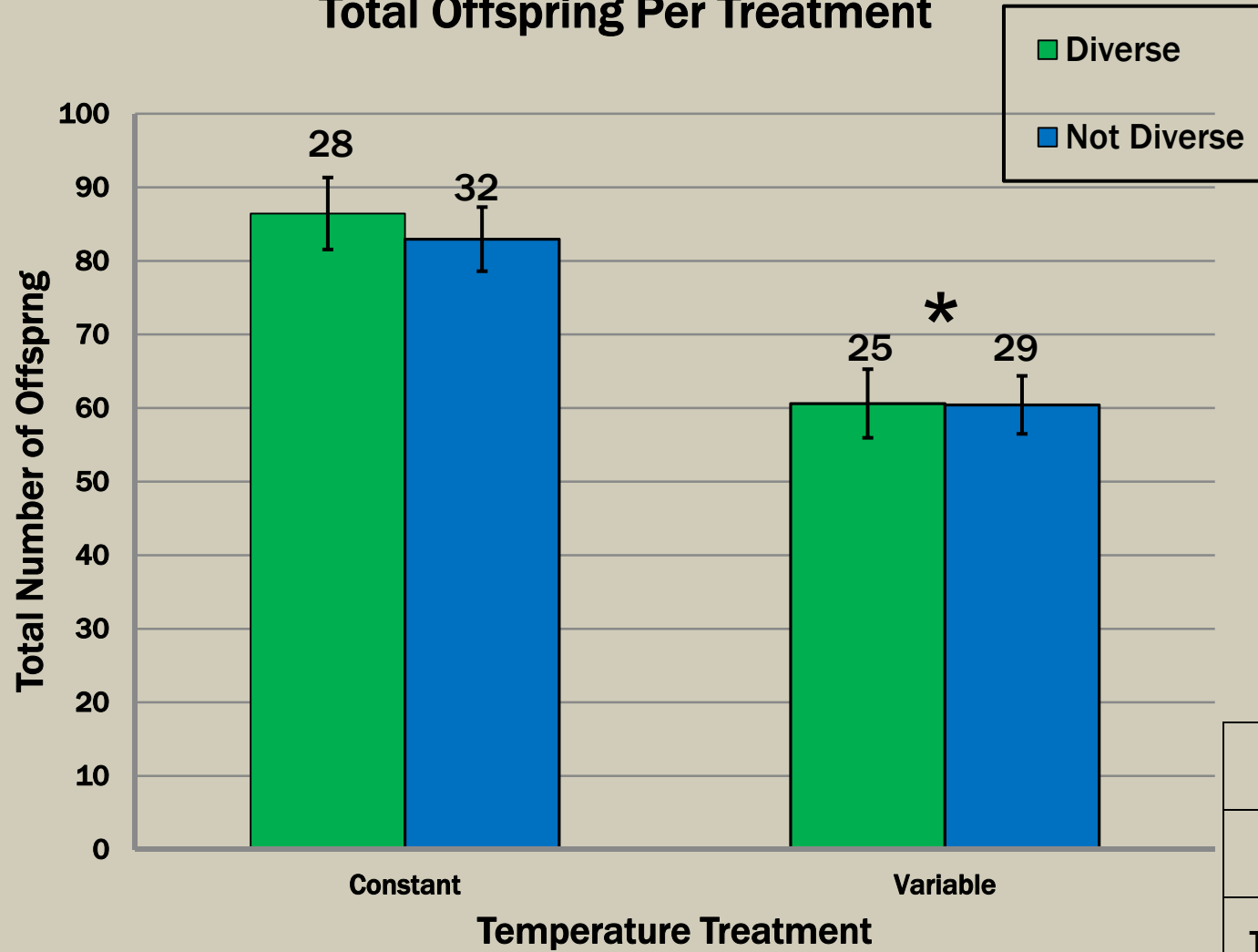
- Recombinant inbred lines from *Drosophila* Synthetic Population Resource (DSPR)
 - 8 female and 9 males lines
- Agar molasses food



METHODS OVERVIEW

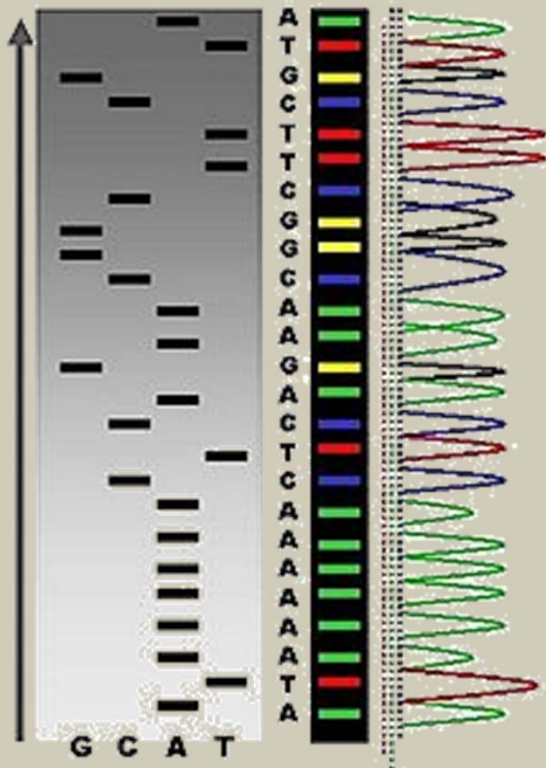


Total Offspring Per Treatment



Source	P-Value
Treatment	0.6829
Temperature	<0.0001
Temperature by Treatment	0.7135

LIMITATIONS OF STUDY



- Genetic variability in lab populations
 - Generally high, but can be depleted in some traits (Berger 1971, but see Briscoe et al. 1992)
- Matings were not observed
 - Offspring kept for genetic analysis

ALTERNATIVE HYPOTHESES

- **Many small benefits?**
(Pyle & Gromko 1981)
- **Indirect selection**
(Pyle & Gromko 1981)
- **Convenience Polyandry**
(Cordero Rivera & Andrés 2002)



Calopterygid damselflies mating

SUMMARY

- **Hypothesis:** Polyandry produces genetically more variable offspring.
- **Result:** Temperature, but not mating treatment, influences female reproductive success.
- **Conclusion:** polyandry in fruit flies still remains a mystery.

BIO 352: RESEARCH IN EVOLUTIONARY BIOLOGY



Paul Cox



Diandra Landa



Harmony White



Dr. Ivy
a.k.a Lord of the Flies



Corey McCubbin



Hamp Freshley



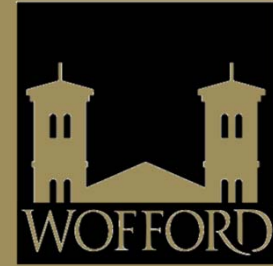
Stephanie Ackerson

LITERATURE CITED

- Arnqvist G and Nilsson T. 2000. The evolution of polyandry: multiple mating and female fitness in insects. *Anim Behav.* 60(2): 145-164.
- Bateman AJ. 1948. Intra-sexual selection in *Drosophila*. *Heredity*, 2(3): 349-368.
- Berger EM. 1971. A temporal survey of allelic variation in natural and laboratory populations of *Drosophila melanogaster*. *Genetics* 67(1): 121-136.
- Briscoe DA, Malpica JM, Robertson A, Smith GJ, Frankham R, Banks RG, and Barker, JSF. 1992. Rapid loss of genetic variation in large captive populations of *Drosophila* flies: implications for the genetic management of captive populations. *Conserv Biol.* 6(3): 416-425.
- Chapman T, Arnqvist G, Bangham J, and Rowe L. 2003. Sexual conflict. *TREE* 18(1): 41-47.
- Cordero Rivera A and Andrés JA. 2002. Male coercion and convenience polyandry in a calopterygid damselfly. *J Insect Sci.* 2: 1 – 7.
- Fox, CW, and Rauter CM. 2003. Bet-hedging and the evolution of multiple mating. *Evol Ecol Res* 5(2): 273-286.
- Gromko MH and Pyle DW. 1978. Sperm competition, male fitness, and repeated mating by female *Drosophila melanogaster*. *Evolution* 32(3): 588-593.
- Imhof M, Harr B, Brem G, and Schlötterer C. 1998. Multiple mating in wild *Drosophila melanogaster* revisited by microsatellite analysis. *Mol Ecol.* 7(7): 915-917.
- Jennions MD and Petrie M. 2000. Why do females mate multiply? A review of the genetic benefits. *Biol Rev.* 75(1): 21-64.
- Partridge L, Green A & Fowler K. 1987. Effects of egg-production and of exposure to males on female survival in *Drosophila melanogaster*. *Journal of Insect Physiology*, 33(10): 745-749.
- Pyle DW and Gromko MH. 1981. Genetic basis for repeated mating in *Drosophila melanogaster*. *Am Nat.* 117(2): 133-146.
- Welch AM, Semlitsch RD, and Gerhardt HC. 1998. Call duration as an indicator of genetic quality in male gray tree frogs. *Science* 280(5371): 1928-1930.

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