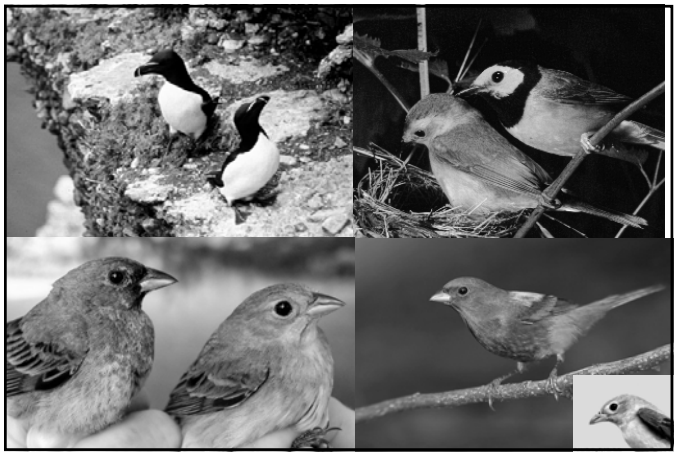
	Promiscuous or Polygamous	Monogamous
Males	ME – HIGH PE - LOW	ME – LOW PE - HIGH
Females	ME – LOW PE - HIGH	ME – LOW PE - HIGH
Opportunity for sexual selection	**high**	**low**



Definitions:

Extrapair mating: matings that occur outside of the pair bond (EPM)

EPC : extrapair copulation

EPF : extrapair fertilization

Therefore:

• must be a social pair bond in order to observe EPCs

EPM systems occur in a broad taxanomic range :

• Mammals
e.g. Alpine Marmots

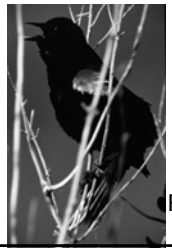
• Reptiles
e.g. Sleepy Lizard

• Birds (most studied)

• For many years it was assumed that in monogamous species, the social mating system accurately reflected the genetic mating system

BUT - this notion came under suspicion when Bray et al. (1975) performed their vasectomy experiments

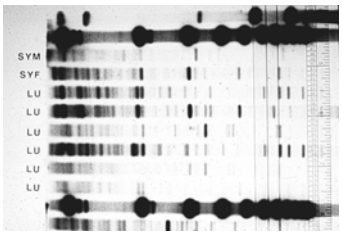
Golden-winged Warblers

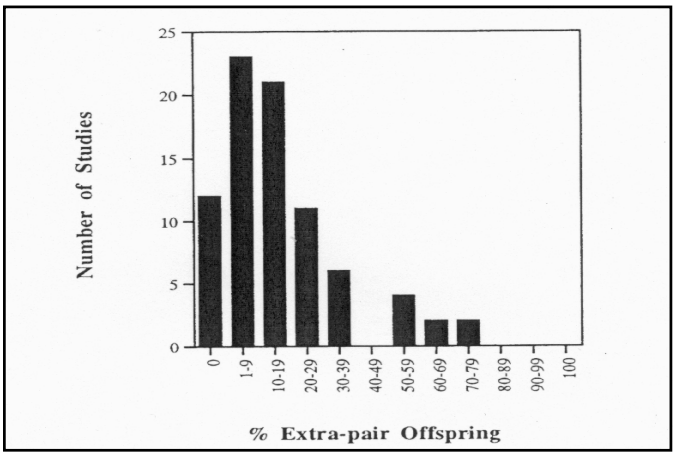


Red-winged Blackbird

• With the advent of DNA fingerprinting, we now realize that social monogamy does NOT necessarily mean genetic monogamy

• DNA fingerprinting has revealed that many socially monogamous species actually have high levels of EPFs





• EPFs are evolutionarily important because they result in very high skews in reproductive success

Therefore: contrary to conventional wisdom, there is a significant amounts of sexual selection pressure in monogamous species

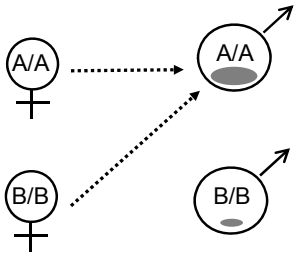
• this may explain why monogamous species are often dimorphic in nature (which is not expected in theory)

Costs and benefits of extrapair matings?

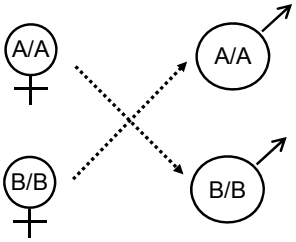
Benefits	**Costs**
• remating potential	• sperm depletion (m)
• infertility insurance	• risk of cuckoldry (m)
• material benefits (f)	• divorce
• genetic benefits	• disease (STDs)
i) good genes	• loss of paternal care (f)
ii) compatible genes	

Genetic Benefits

Good genes
additive genetic effects



Compatible genes
non-additive genetic effects



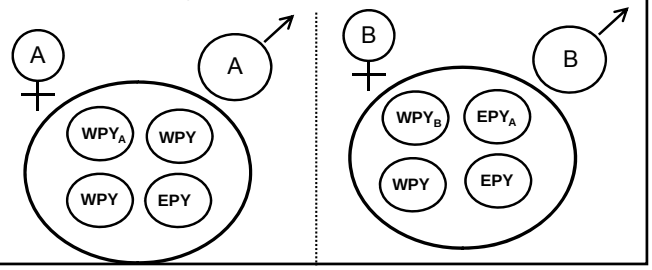
Extrapair matings & Immunocompetence

- bluethroats
- socially monogamous
- sexually dimorphic
- biparental care

Johnsen et al. 2000, Nature 406: 296-299

Introduction

- Extra-pair fertilizations allow us to examine the effect of different paternal genes on offspring fitness
- Why? Because sib groups share the same rearing environment and genes from mom



Introduction

- Extra-pair fertilizations allow us to examine the effect of different paternal genes on offspring fitness
- Why? Because sib groups share the same rearing environment and genes from mom

Predictions

Good genes

- EPY should perform better than WPY raised in the same nest

Compatible genes

- EPY should perform better than their paternal ½ sibs (i.e. the WPY of the extrapair male)

Methods

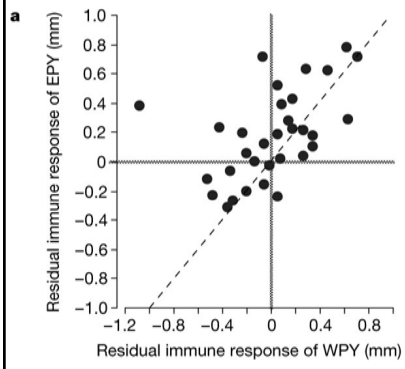
- examined cell-mediated immunity in nestlings
- HOW? via a subcutaneous injection of PHA (phytohaemagglutinin)
- measured swelling in wing and used it as a proxy of the T-cell activity

PHA response

i) heritable in passerines

ii) correlates with subsequent survival and longevity

RESULTS



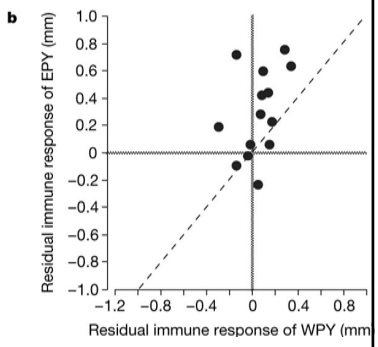
• EPY young were more immunocompetent than maternal ½ sibs raised in the same nest (24 of 32 pairs)

RESULTS (cont'd)

• For 14 males, immune response measured in both their EPY & WPY

• EPY were more immunocompetent in 12 of 14 paternal ½ sibs

• but in this case, the offspring are raised in different nest environments, which could explain the differences



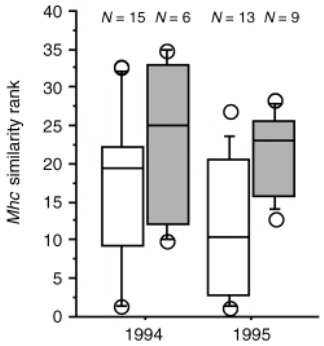
Summary

- males produce MORE immunocompetent offspring with extrapair females which suggests an interaction b/w male & female genotype

- extrapair mates seem to have a more favorable combination of genes than social mates

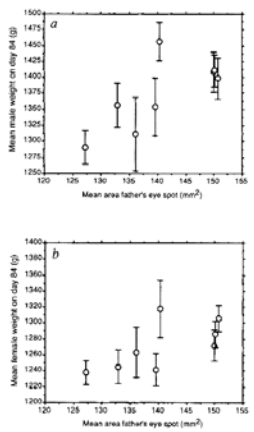
- thus, evidence for a genetic compatibility benefit of EPMs

MHC & Extrapair matings



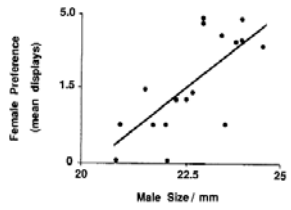
Freeman-Gallant et al. 2003

How else could you test for genetic benefits?



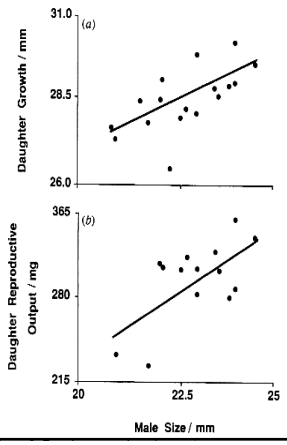
Good Genes in Peafowl: correlation approach

1. Marion Petrie measured peacocks and randomly assigned them to females
2. Eggs were later removed and incubated together
3. Tracked and measure offspring mass on day 84 post hatching
4. Mass used as a surrogate of fitness



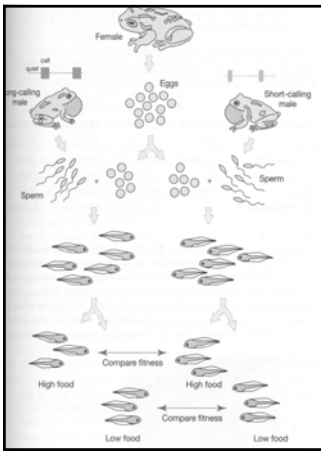
Good Genes in Guppies: correlation approach

1. Reynolds and Gross examined female mating preferences in guppies
2. In one population they found that females preferred long males
3. Female preference measured by the number of her receptive displays



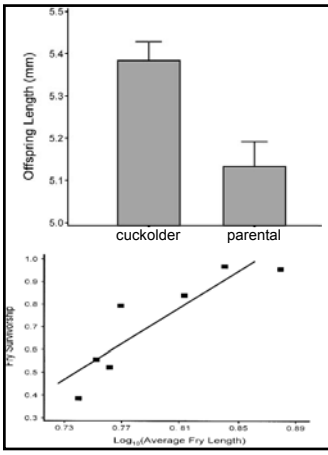
Mate choice in Guppies: correlation approach

4. They found that longer males produced daughters that grew faster and produced more offspring.
5. Daughter offspring output was measured by total mass of her offspring.



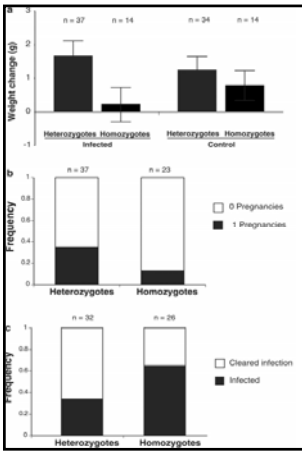
Good Genes in Frogs: split in vitro approach

1. Welch et al. split clutches from female gray tree frogs.
2. Half fertilized by long-calling males, other half by short-calling males.
3. Tracked performance of maternal half-sib offspring
4. Offspring on long-calling males outperform their half-sibs



Good Genes in Bluegill: split in vitro approach

1. Neff spit broods and fertilized eggs with sperm from either parental or cuckolder males
2. Measured offspring body length and survivorship in a predation challenge (*H. Canadensis*)
3. Cuckolder males produced longer offspring that had higher survivorship



Compatible Genes in Mice: effects of genes, genotypes

1. Penn et al. genotyped mice at the MHC and classified them as heterozygous or homozygous
2. Exposed the mice to a suite of pathogens including *Salmonella* and *Listeria*
3. Tracked performance and found heterozygotes outperformed homozygotes

Other Methods

1. Compare multiply mated females to singly mated females
2. Mate some females to preferred males and other females to non-preferred males
3. North Carolina Design II: Genetic breeding methods that mates males and females in all pairwise combinations. Use two-way ANOVA determine genetic effects

Source	F_{df}	σ^2 (×10^{-2})	%(p value)
Survivorship			
Dam	43.1 (10)	2.56	64 (0.001)
Sire	11.5 (10)	0.56	14 (0.001)
Dam × Sire	3.71 (100)	0.54	13 (0.001)
Total		3.95	