

# Hot Science Cool Talks

UT Environmental Science Institute

# 10

## *Sexual Selection*

**Dr. Michael Ryan  
January 26, 2001**

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*There are many other structures and instincts which must have been developed through sexual selection- such as the weapons of offence and the means of defence of the males for fighting with and driving away their rivals- their courage and pugnacity- their various ornaments- their contrivances for production of vocal or instrumental music- and their glands for emitting odours, most of these latter structures serving only to allure or excite the females.*

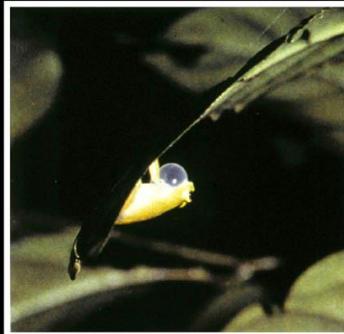
- Darwin

# Sexual Selection

**Dr. Michael J. Ryan**



# Sexual Dimorphisms

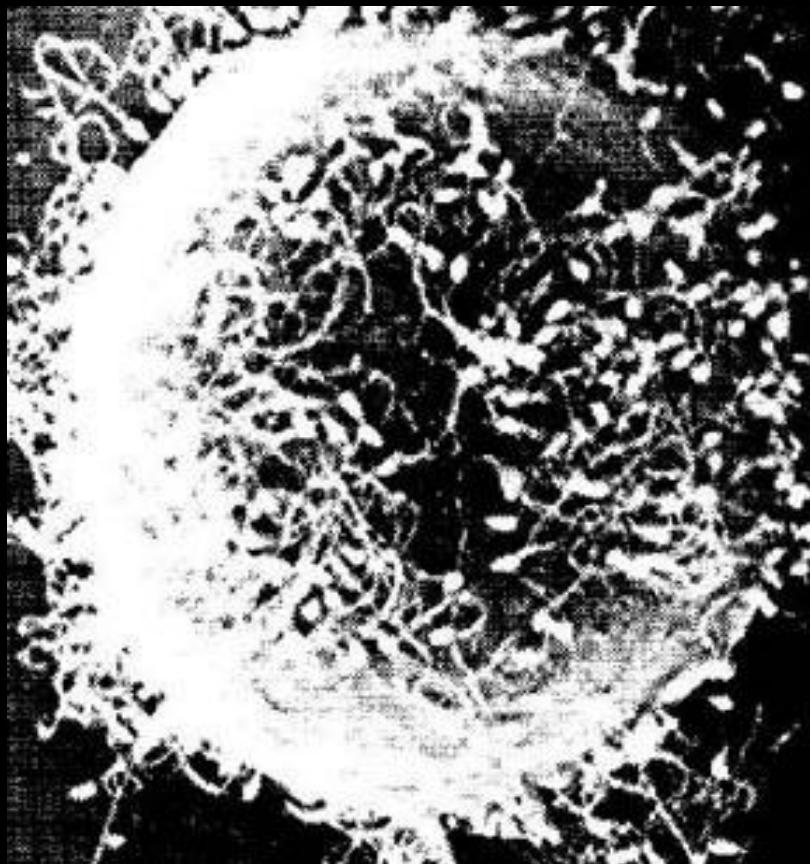


- Quite common in secondary sexual characters.
- And usually:
  - males are more elaborate
  - traits are costly
  - traits are associated with breeding.

# Natural Selection versus Sexual Selection

- *Natural Selection*: favors those phenotypes with greater survival ability.
- *Sexual Selection*: favors those phenotypes with greater reproductive success due to greater ability to acquire mates.

# Sexual Differences in Reproductive Strategy



- Females invest more time and energy per gamete/ offspring.
- Female reproductive success is influenced by mate quality and they are *coy* in their choice; increased mating success does not translate into increased reproductive success.
- Males increase reproductive success by increasing the numbers of females they mate; males are undiscriminating with whom they will mate.

# Mechanisms of Sexual Selection

- *Male Competition*: Males compete directly for access to females.
- *Female Choice*: Males advertise for females and females choose their mates.
- *Competition & Choice*: Mechanisms can interact, males can compete for resources that influence a female's choice.
- *Role Reversal*: In some polyandrous mating system (e.g. pipefish, jacanas) role of sexes are reversed.

# Male Competition



- In many species males evolve organs used for combat, such as antlers in red deer.

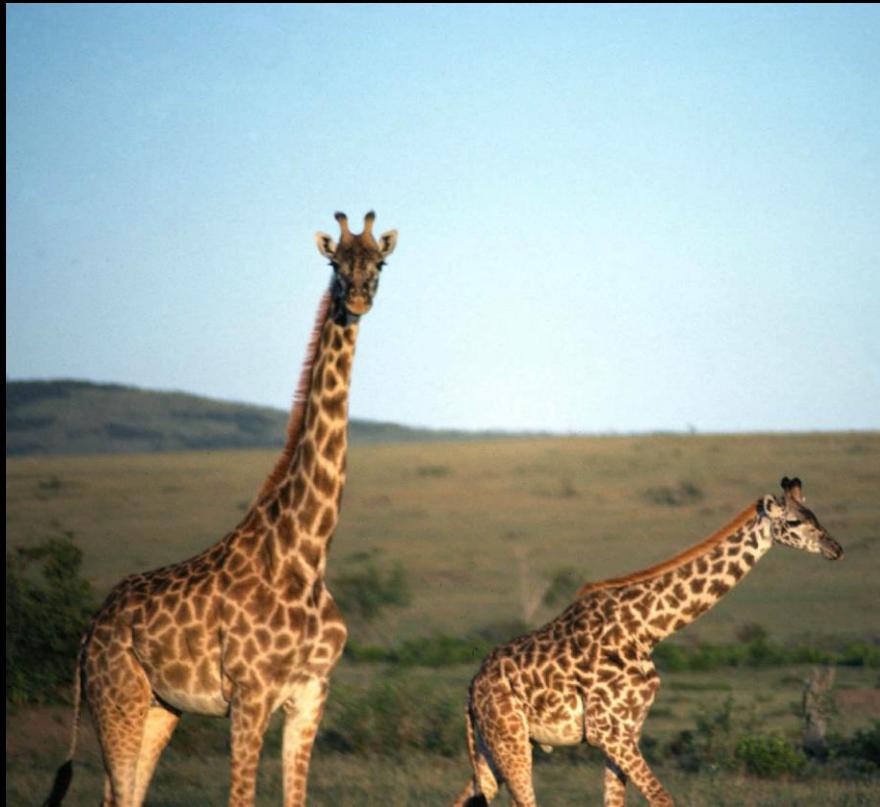
# Male Competition



- In frogs, males often have more muscular forearms than females to aid them in avoiding displacement from the females by other males (*Bufo cognatus*).



# Male Competition?



- Long neck of giraffe is usually considered an adaptation for foraging. But . . .
- They spend a lot of time bent over feeding.
- Males fight by clubbing each other on the top of the head.
- Males have thicker skulls than females.

# Sperm Competition



IT WAS A RACE TO BE FIRST

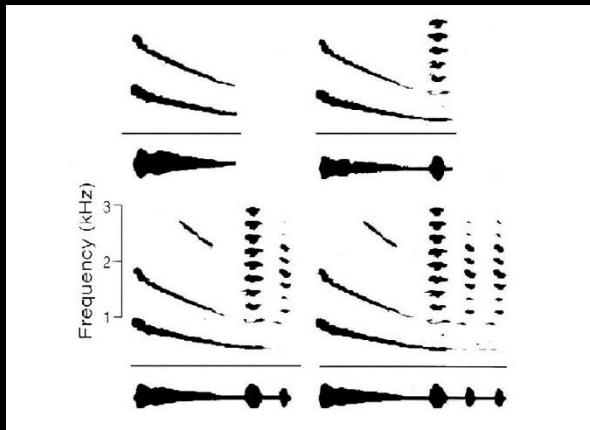
- Males can also compete inside the females if females are multiply inseminated.  
By . . .
  - Increase quantity of sperm.
  - Produce sperm toxins.
  - Erect mating plugs.
  - Have kamikaze sperm.

# **Sexual Selection by Female Choice**

- Darwin proposed that in many species females chose males based on aesthetic preferences.
- Although sexual selection by male competition was readily accepted, female choice was an idea that was rejected and lay dormant for 100 years.
- Might have been rejected because of Victorian society and had a resurgence coincident with the feminist movement.



# Sexual Selection for Complex Calls in Túngara Frogs: Female Choice



- Males produce a call with two components, a whine and a chuck.
- In isolation, males produce only a whine.
- In a chorus or in response to tapes of calls, males add chucks.

**Sound for PC**

Double click here

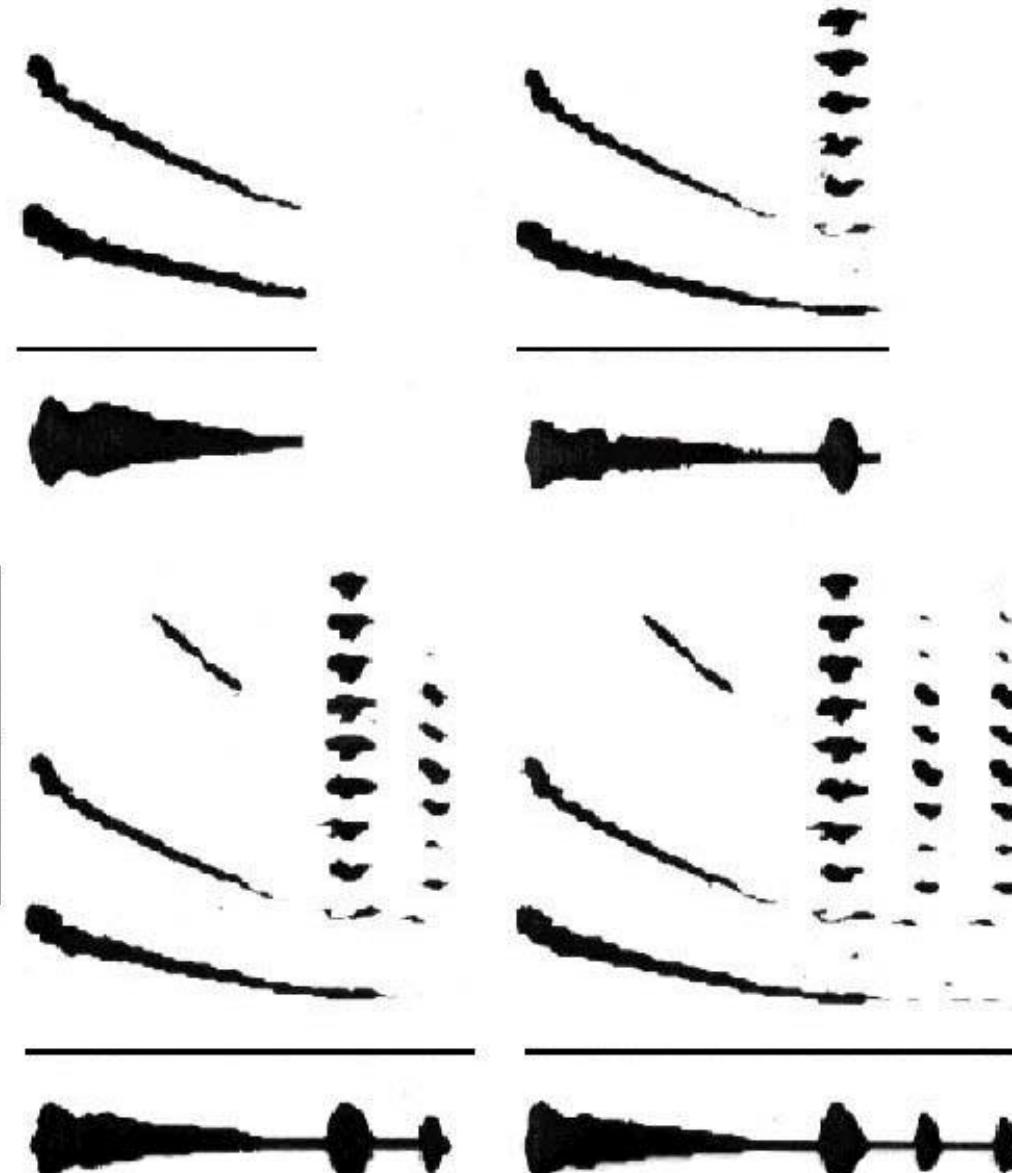
A warning may come  
up about viruses.  
Just click OK.

Frequency (kHz)

3

2

1



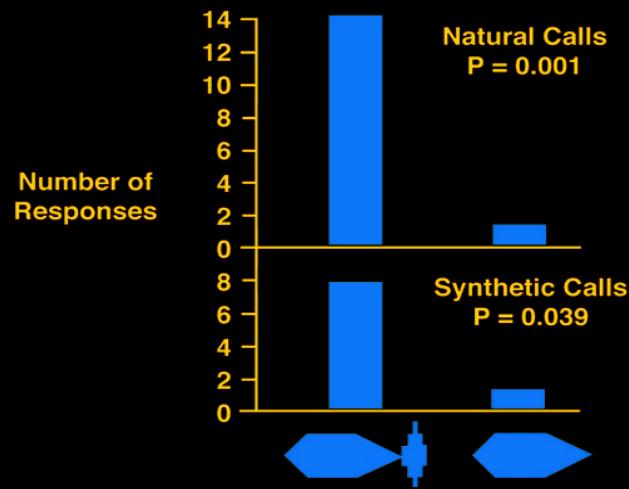
**Sound for PC**

Double click here

The sound files do not play in adobe acrobat: **15\_1whine.wav**, **15\_2whine.wav**, **15\_3whine.wav**, **15\_4whine.wav**  
can be found in the image directory.



### *Physalaemus pustulosus*





# **Sexual Selection for Complex Calls in Túngara Frogs: Predation Costs**

**Movie for Mac:** click once with cursor on image

- Frog-eating bats are attracted to whines.
- When given a choice bats prefer whines with chucks to whines without chucks.
- Natural selection favors simple calls, sexual selection favors complex calls

**Movie for PC:** Double click here

A warning may come up about viruses.  
Just click OK.

# The Evolution of Female Choice

- *Direct Benefits*: A female's choice increases her immediate fecundity and thus evolves as the target of selection.
- *Good Genes*: Female choice increased the genetic quality of its offspring for survival.
- *Runaway Sexual Selection*: The preference increases in frequency because it becomes linked to 'sexy son' traits.
- *Sensory Exploitation*: Some aspect of the female preference is a *pleiotropic* effect, and a preexisting bias for certain male traits.

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# Resources



- Male scorpionflies present females with a nuptial gift prior to mating.

# Resources



- Male katydids package sperm in a nutritious ejaculate which the females eat after mating.

# Resources



- Male hornbills plaster females into a nest and deliver food through a small opening while the female incubated the eggs.



I



WHR

**0.7 (U7)**

**0.8 (U8)**

**0.9 (U9)**

**1.0 (U10)**

II



WHR

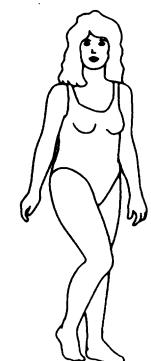
**0.7 (N7)**

**0.8 (N8)**

**0.9 (N9)**

**1.0 (N10)**

III



WHR

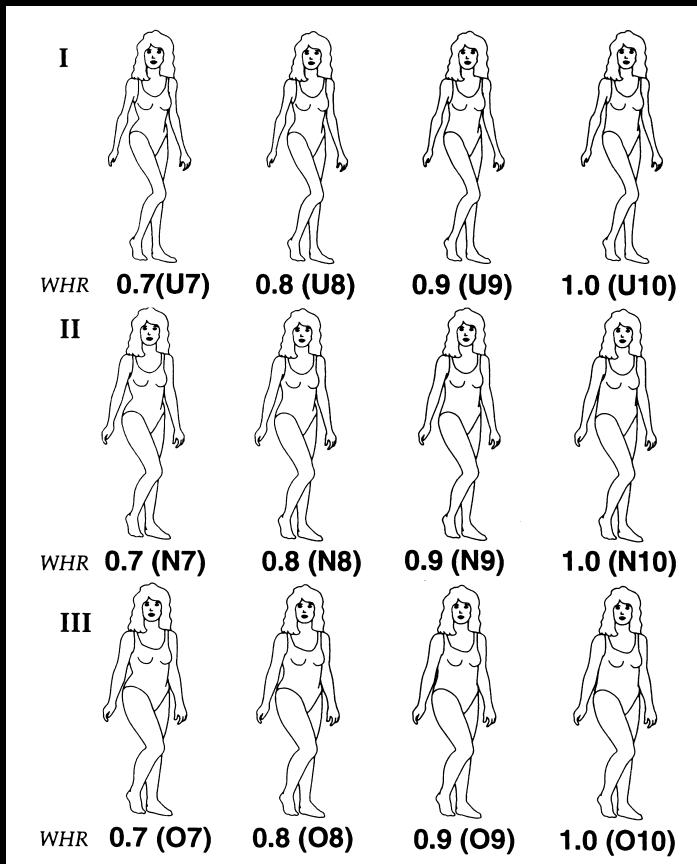
**0.7 (O7)**

**0.8 (O8)**

**0.9 (O9)**

**1.0 (O10)**

# Preference for Waist: Hip Ratio



- Holding body mass constant, men prefer line drawings of women in which the waist measurement is 70% that of the hip (waist:hip = 0.70).
- Some suggestion that women with this ratio might be more healthy and fecund.

# Barbie's Ratio



- If Barbie was a person her measurements would be: 39:23:33
- and . . . “she would have to walk on all fours”
- her waist to hip ratio is 0.70.



# The Paradox of the Lek



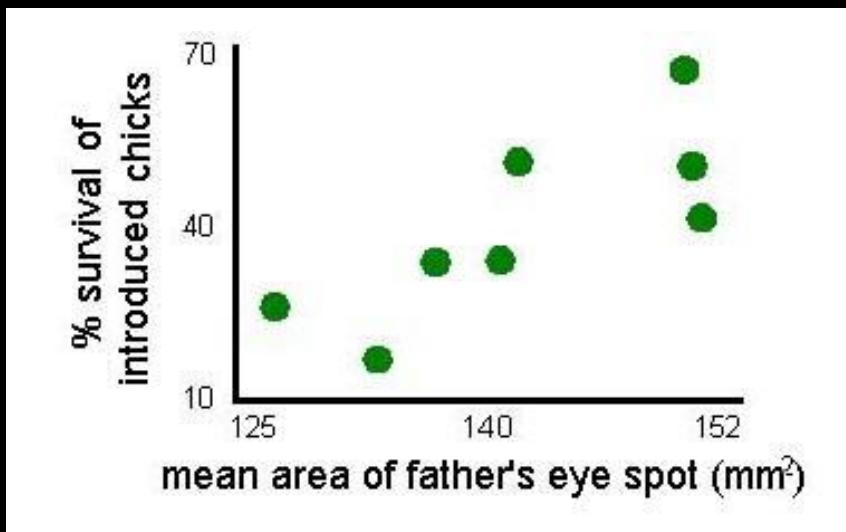
- In many species (birds, frogs, fish, insects) males gather at leks to advertise for females.
- Females choose males but receive only sperm from males.
- If all males can fertilize eggs, why choose?

# The Evolution of Female Choice

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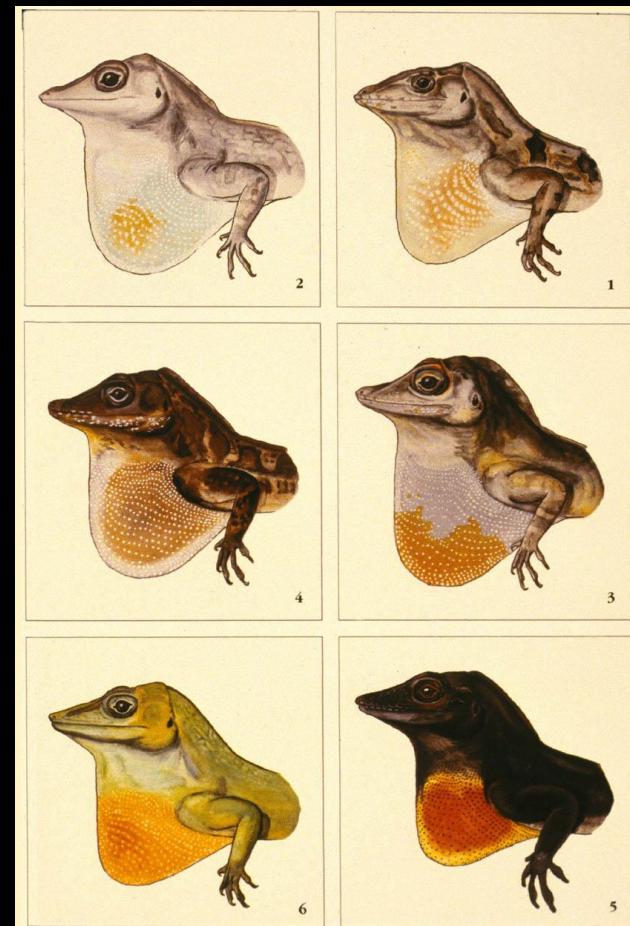
# Good Genes in Peacocks

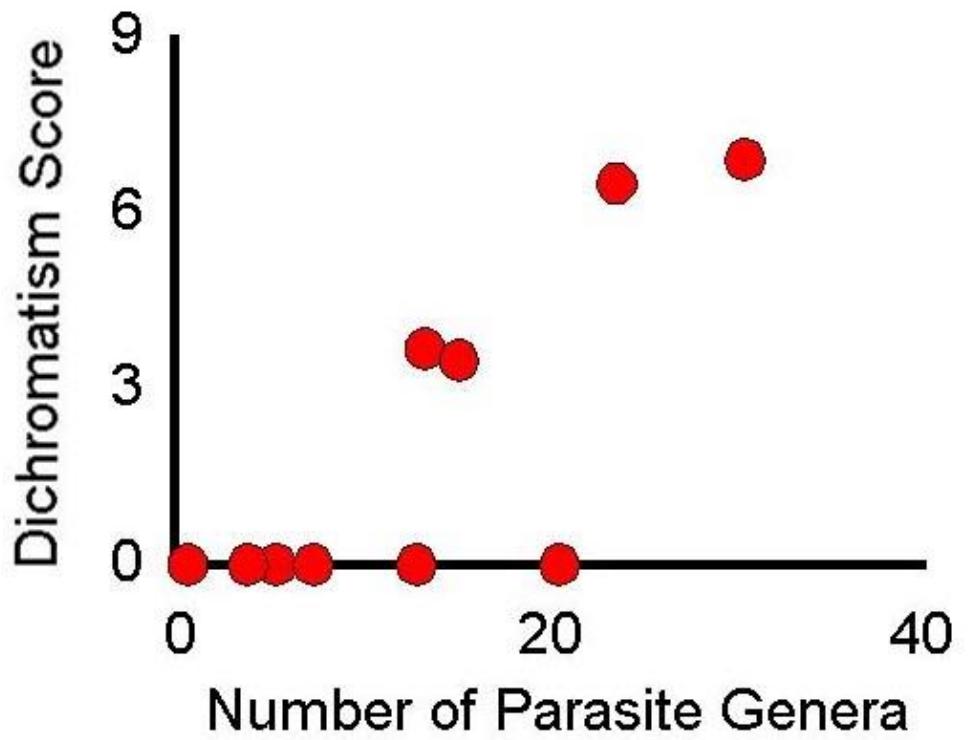


- Females prefer males with larger eye spots.
- Females are paired randomly with males.
- Researchers raise, incubate eggs and raise offspring.
- Young are released into wildlife park.
- Survivorship is measured.



# Parasites and Bright Color





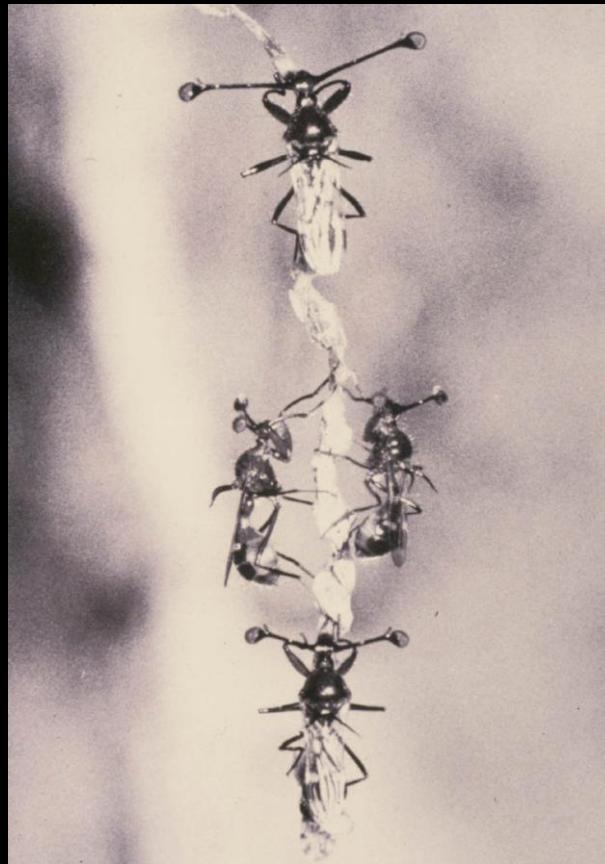
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# The Sexy Son Hypothesis

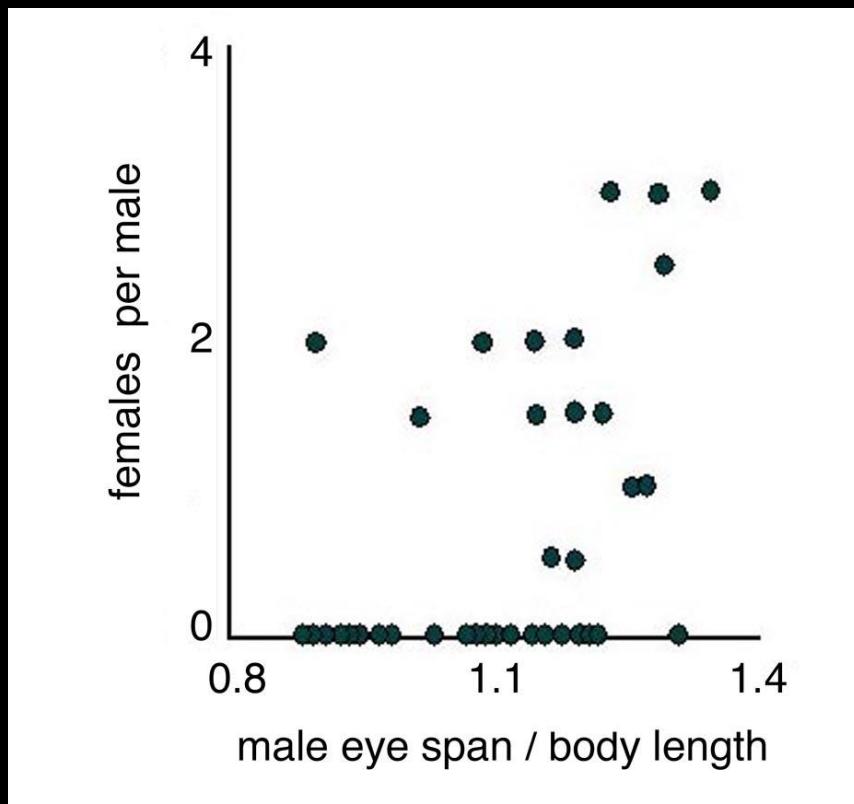
- There is genetic variation for male trait and female preference.
- Both sexes possess both genes but only express the one relevant to their sex.
- Trait alleles increase in the population because they are preferred.
- Preference alleles increase because they are linked with trait genes and ‘hitchhike’.

# Stalk Eyed Flies

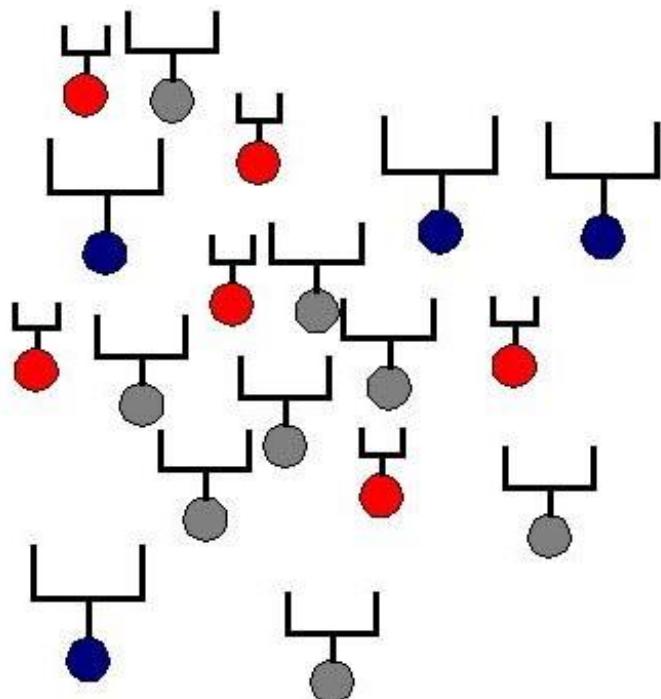


- Males have greater eye spans than females.
- Males defend root hairs, and the harem of females that collect on them.

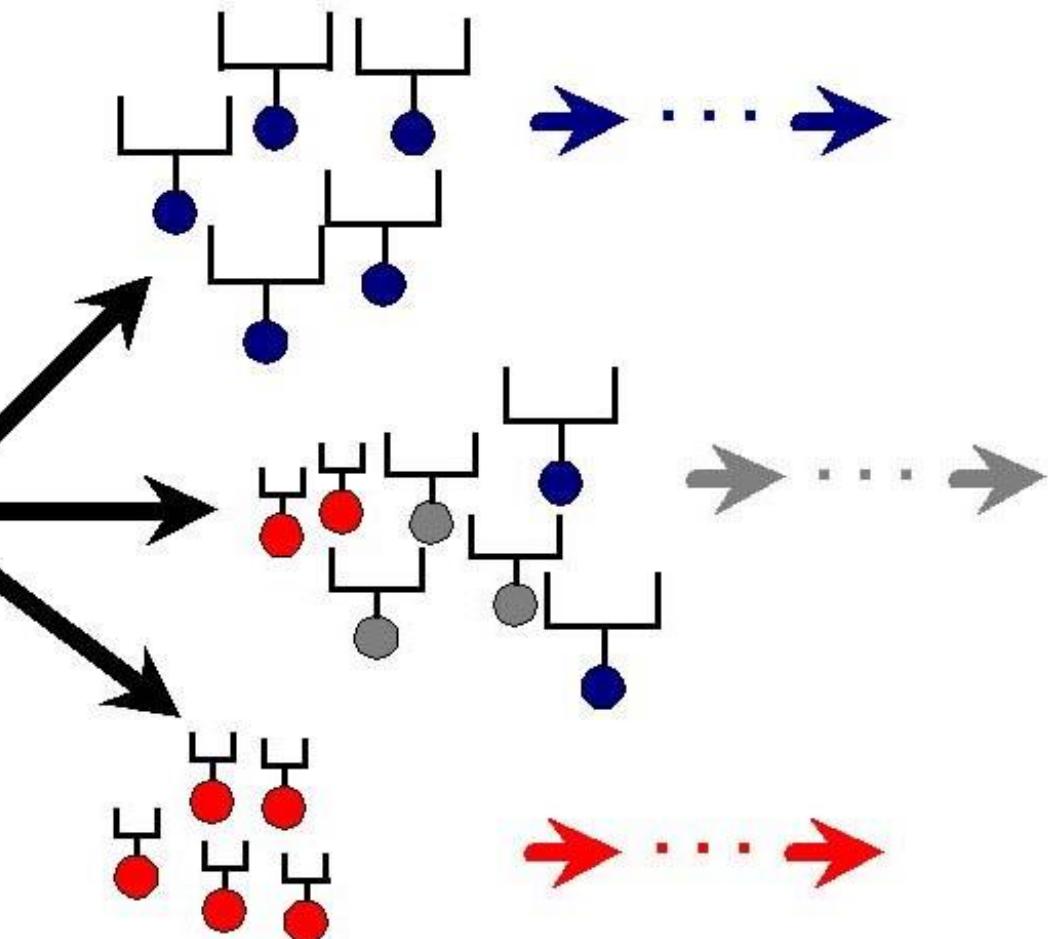
# Eye Span and Mating Success



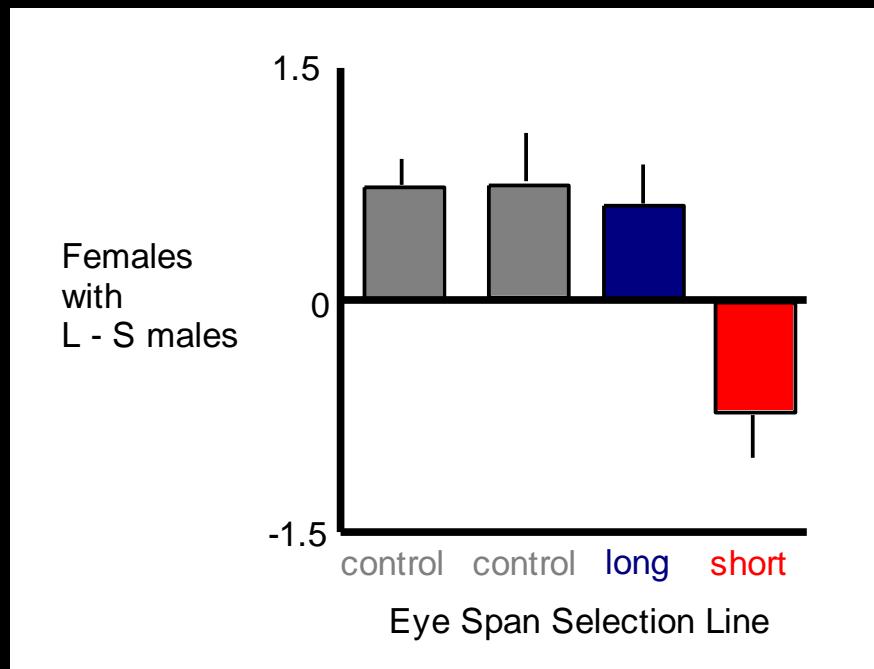
## Initial Generation



## Males Selected for 2nd Generation



# Correlated Response in Artificial Selection Experiments



- Experimenter artificially selects lines for small eye span, large eye span, and no selection (control).
- Female preference in selected lines is then measured.
- Females evolve preference for smaller eye span in that line, preference for larger eye span appears at a maximum.

# The Evolution of Female Choice

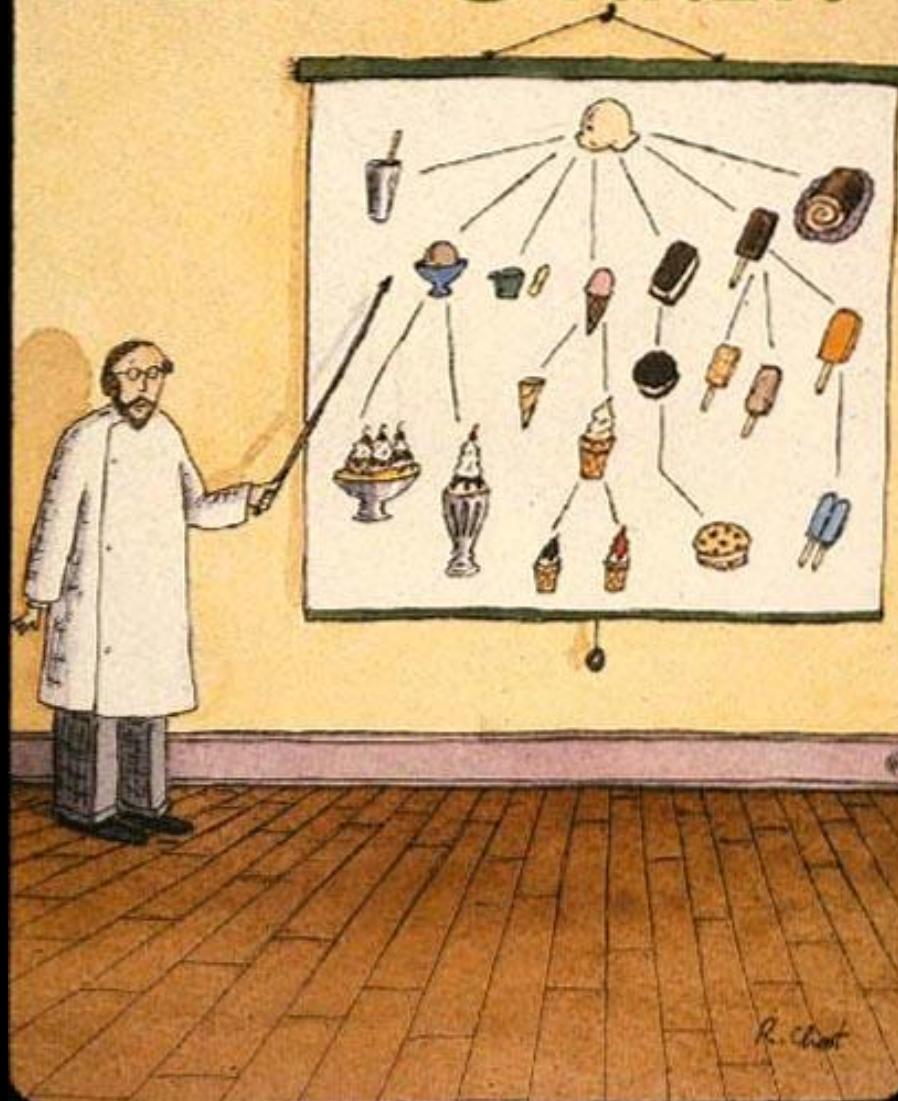
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Aug. 4, 1986

THE

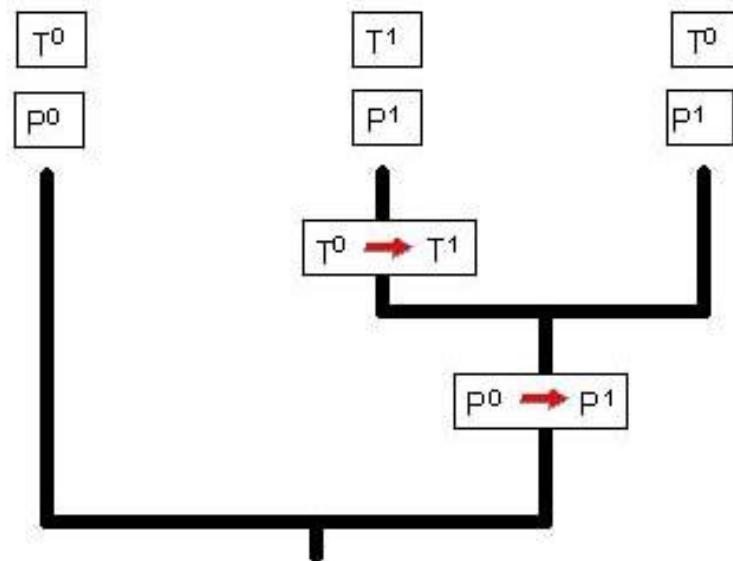
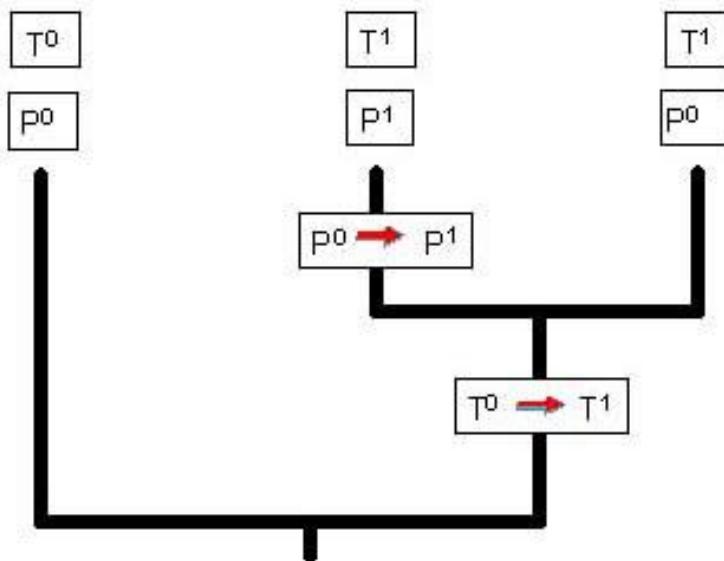
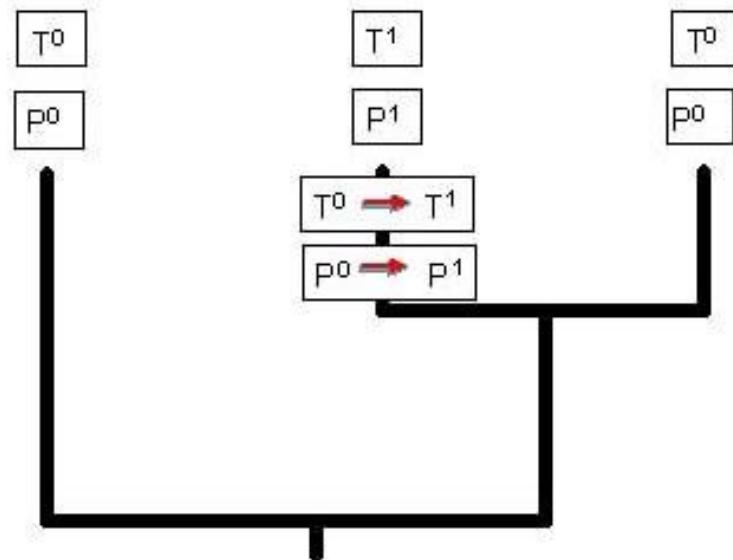
Price \$1.50

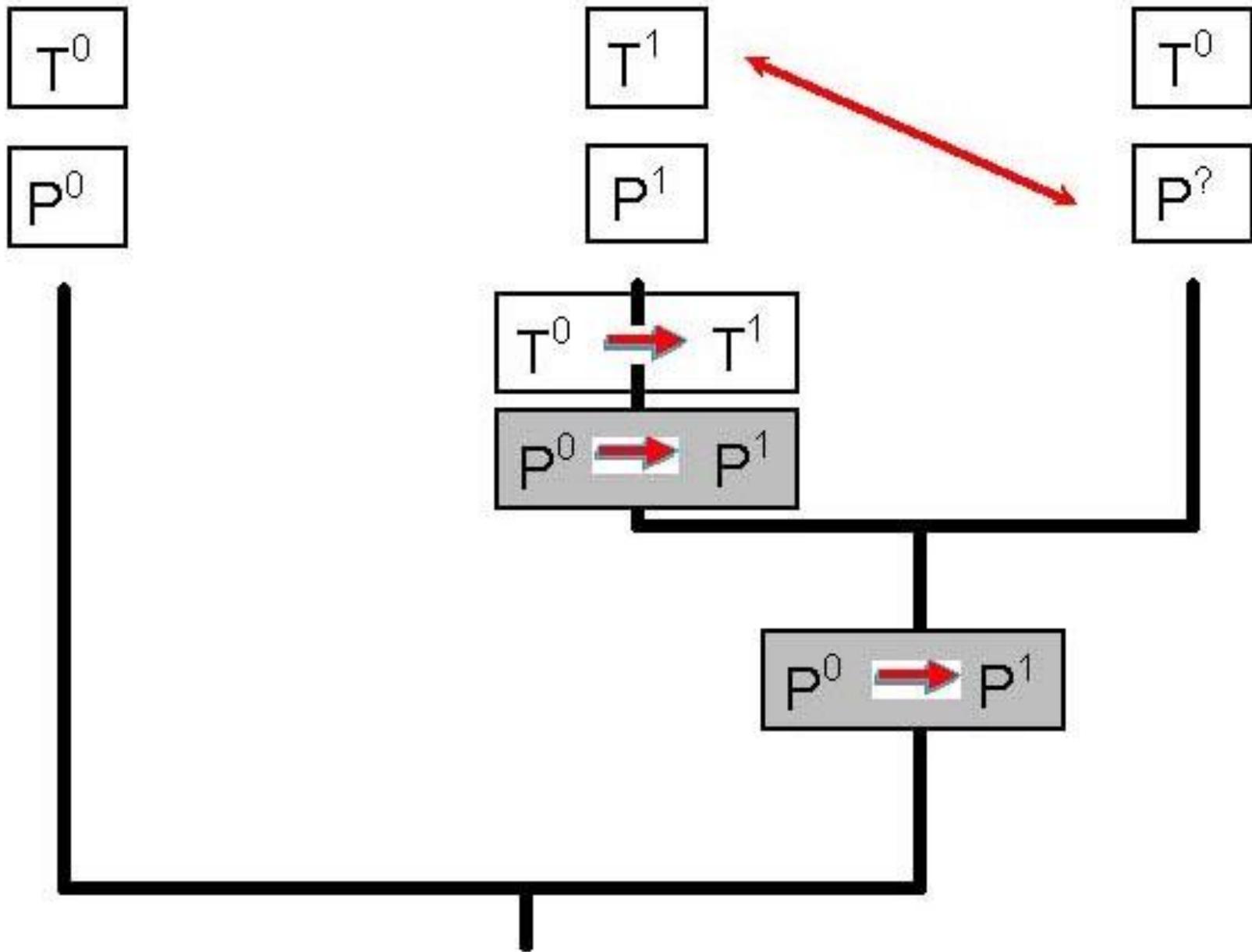
# THE NEW YORKER



R. Crumb

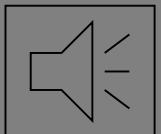
# Patterns of Trait-Preference Evolution





Sound for Mac: click once with cursor on speaker

Sound for PC: Double click here



*P. ephippifer*



*P. pustulosus*



*P. 'roraima'*



*P. petersi*



*P. enesefae*



*P. pustulatus*

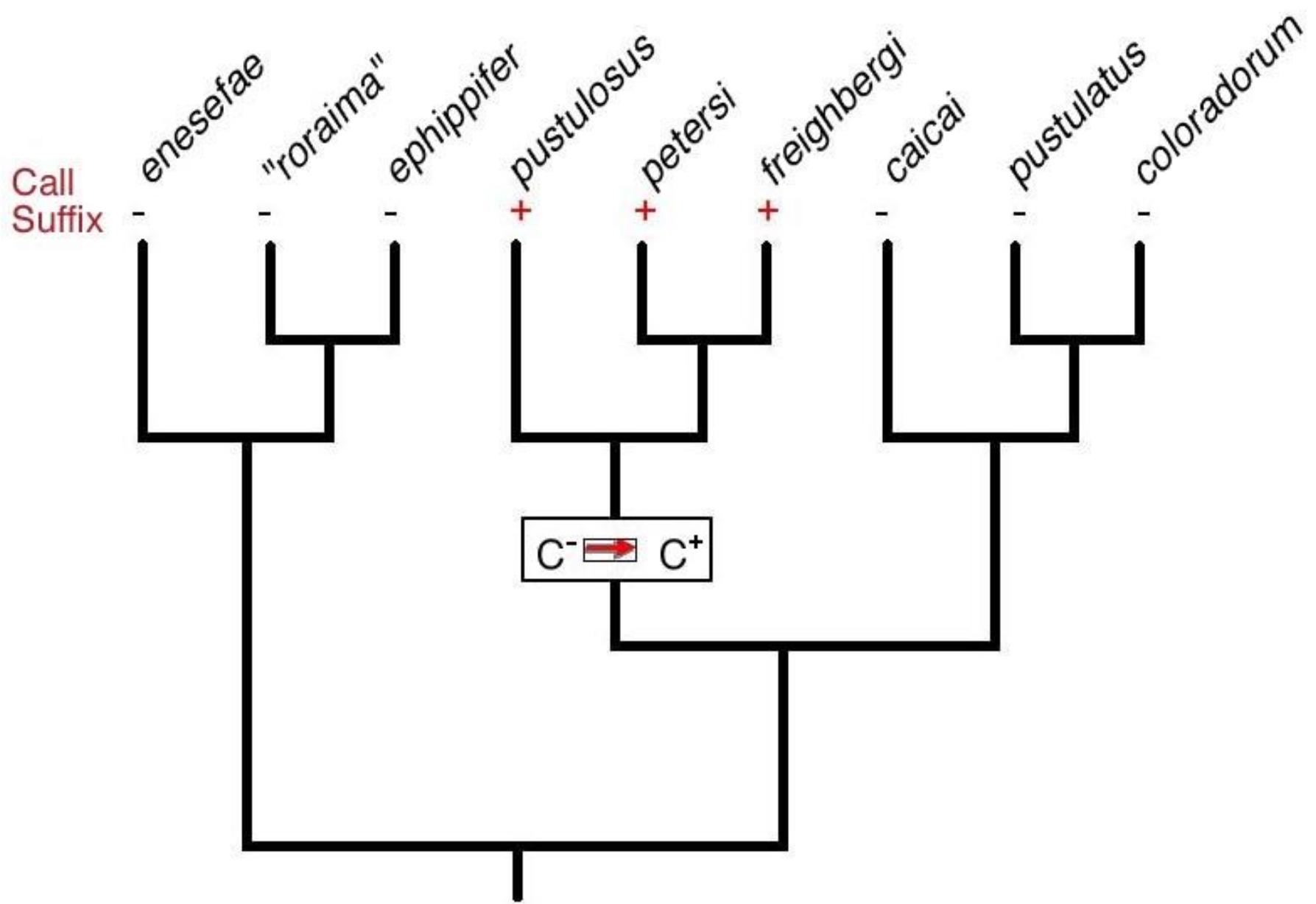


*P. coloradorum*

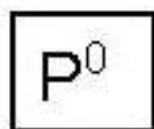
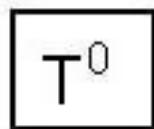


*P. caicai*

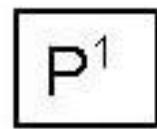
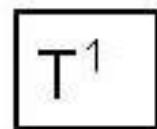
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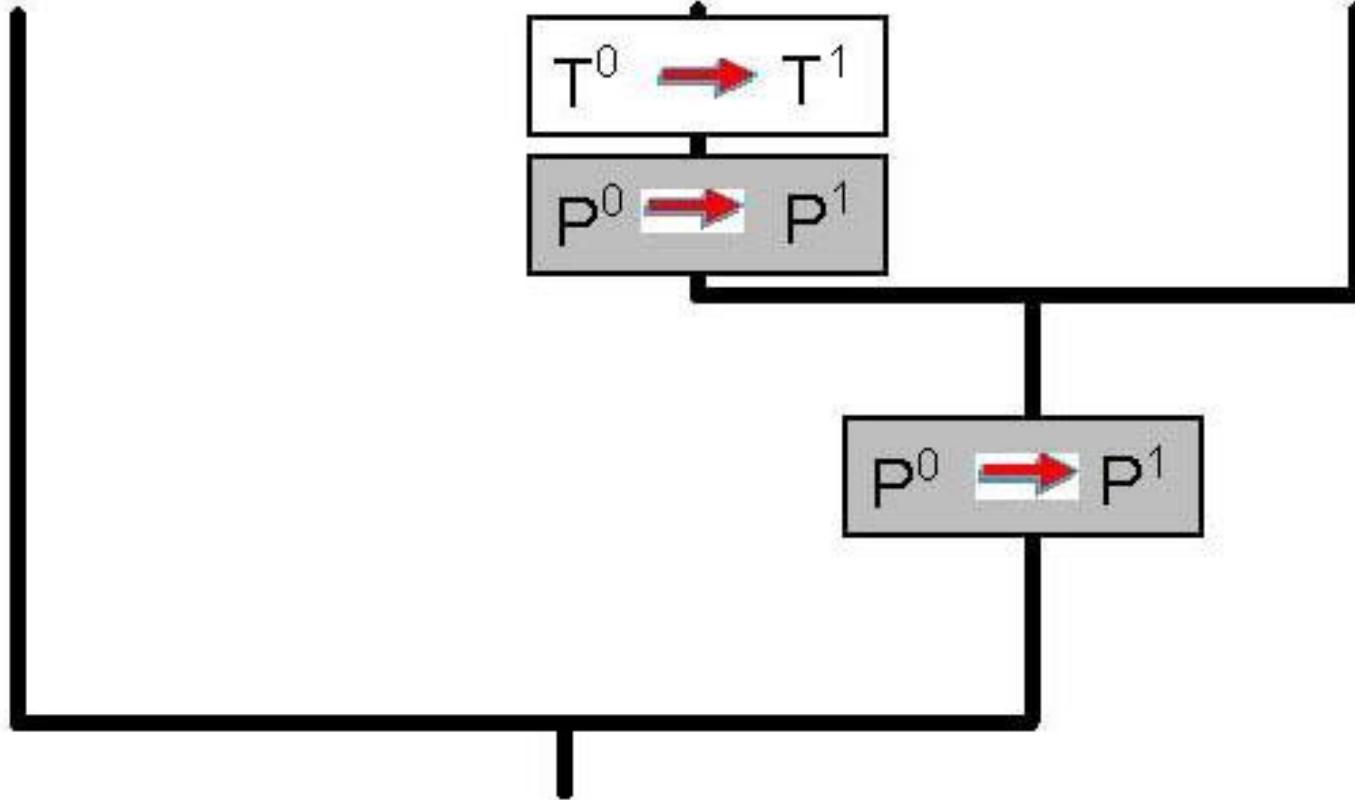
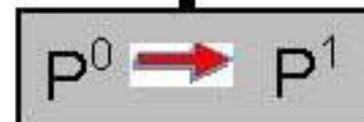
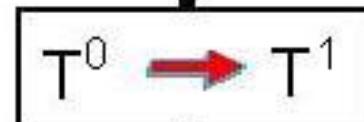
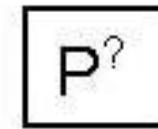
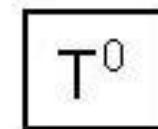
Outgroup



Amazon

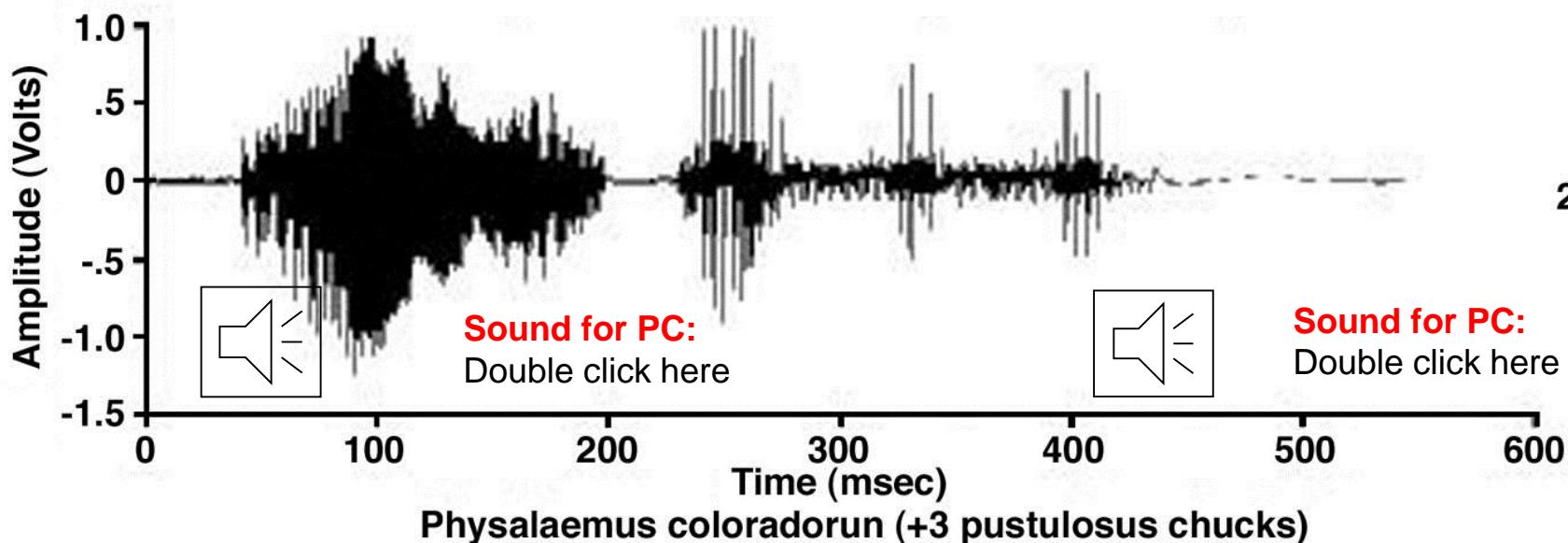
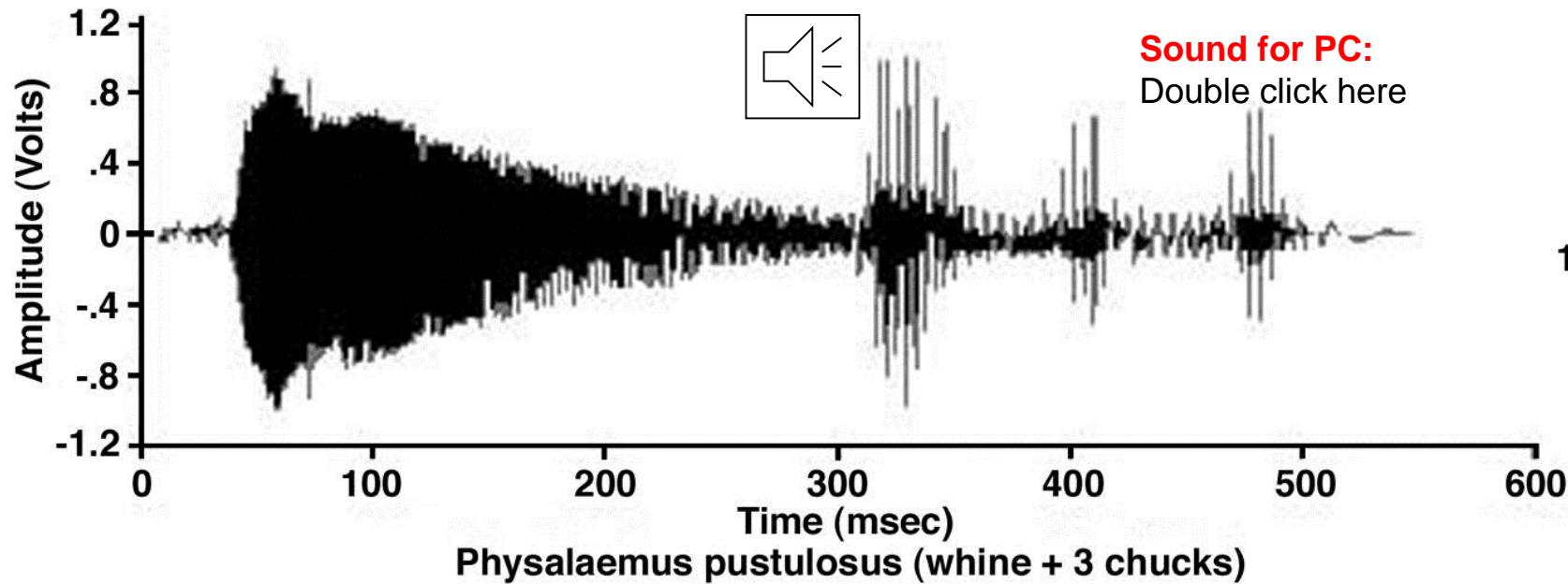


West Andes



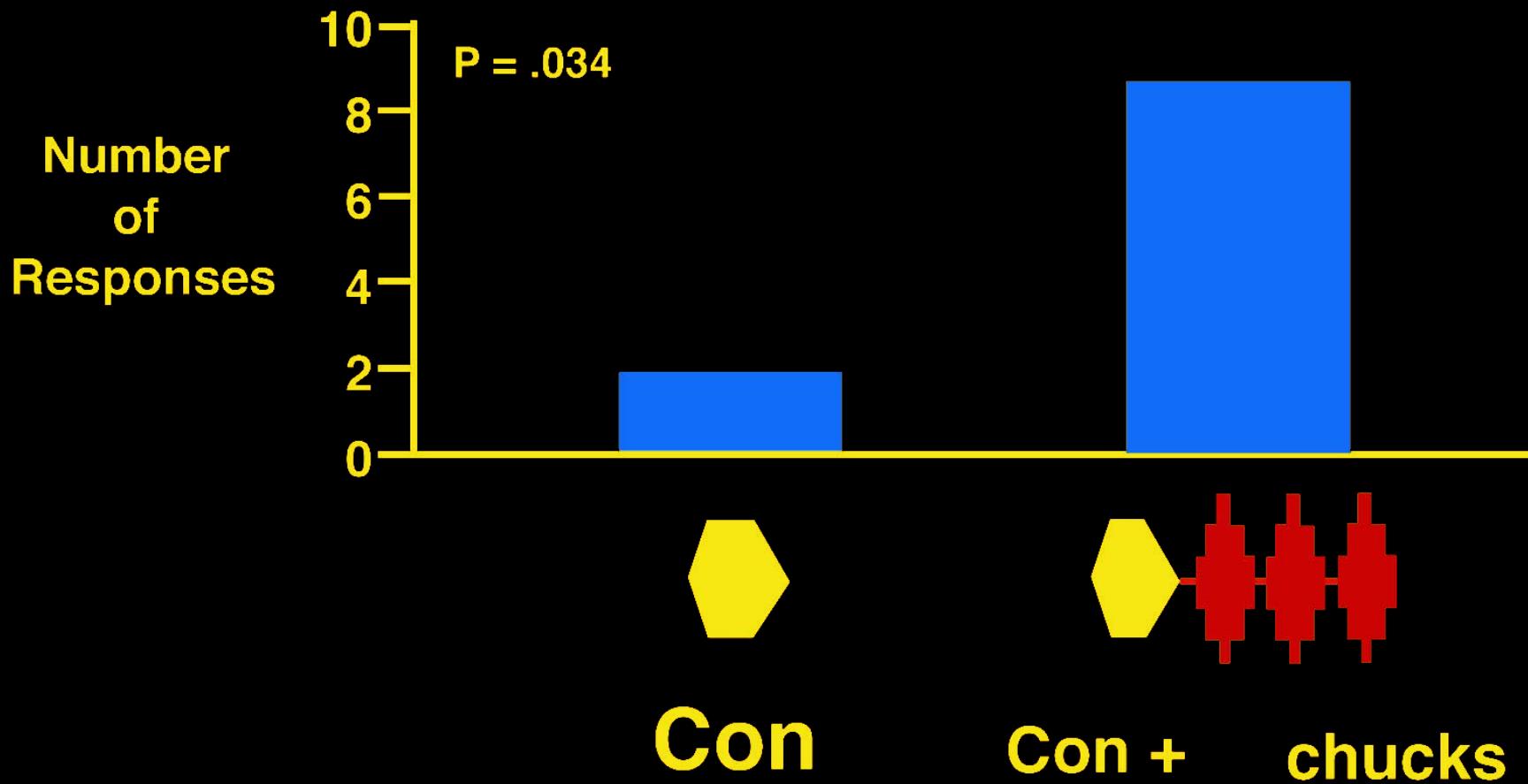


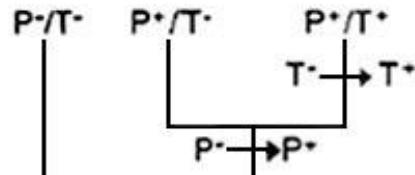
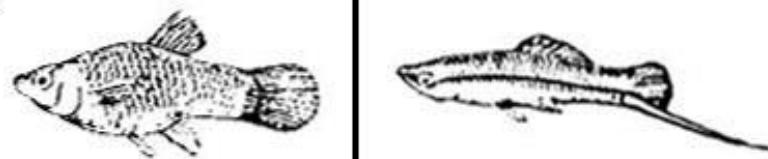
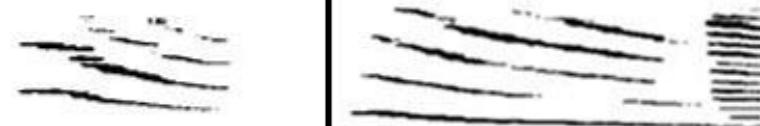
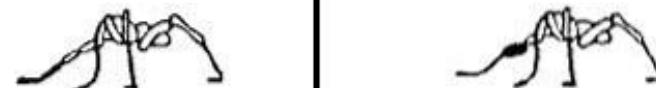
Sound for Mac: click once with cursor on each speaker



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*Physalaemus coloradorum*



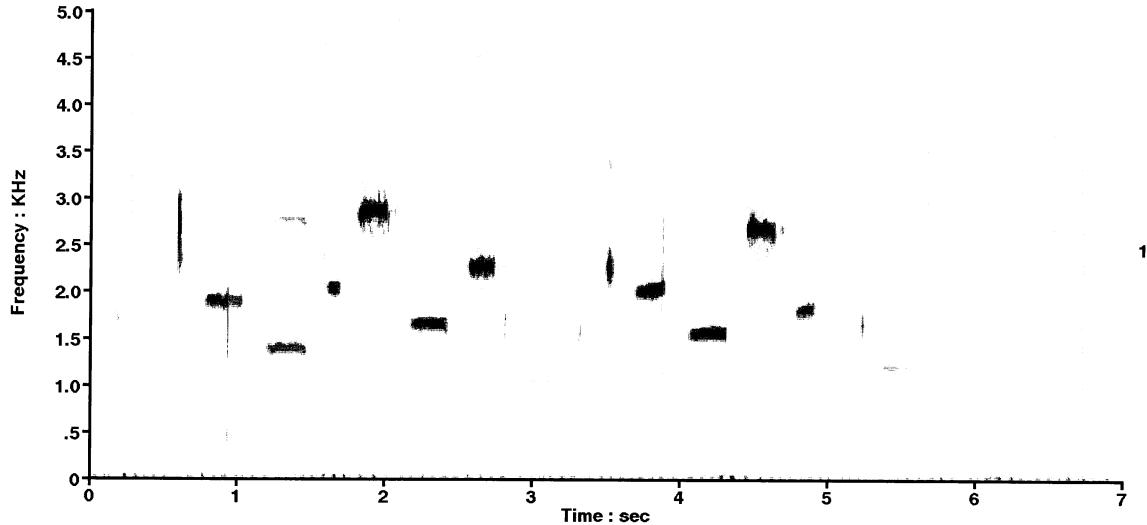
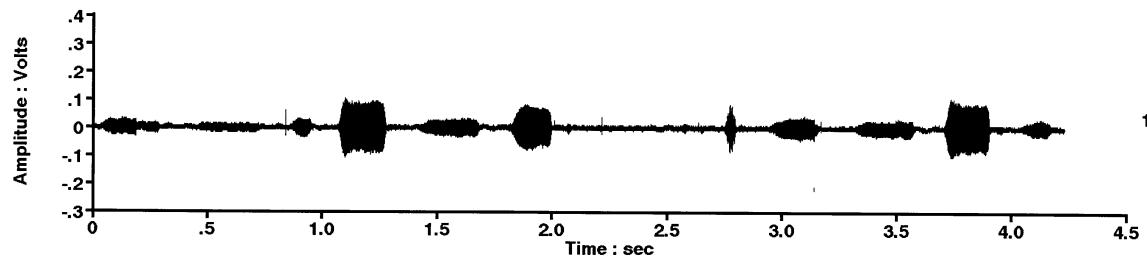
**A****B****C****D****E**



Sound for Mac: click once with cursor on the speaker



Sound for PC:  
Double click here



DF: 49 Hz DT: 20.5 ms T-Inc: 14.0 ms FFT:1024 Wind:HANN  
Hi-Filt: OFF Lo:-40 db Hi: -6 db

Musician Wren

The sound file does not play in adobe acrobat: **52song.wav** can be found in the image directory

# Dancing baby

**Movie for Mac:** click once with cursor on image

**Movie for PC:**

Double click here

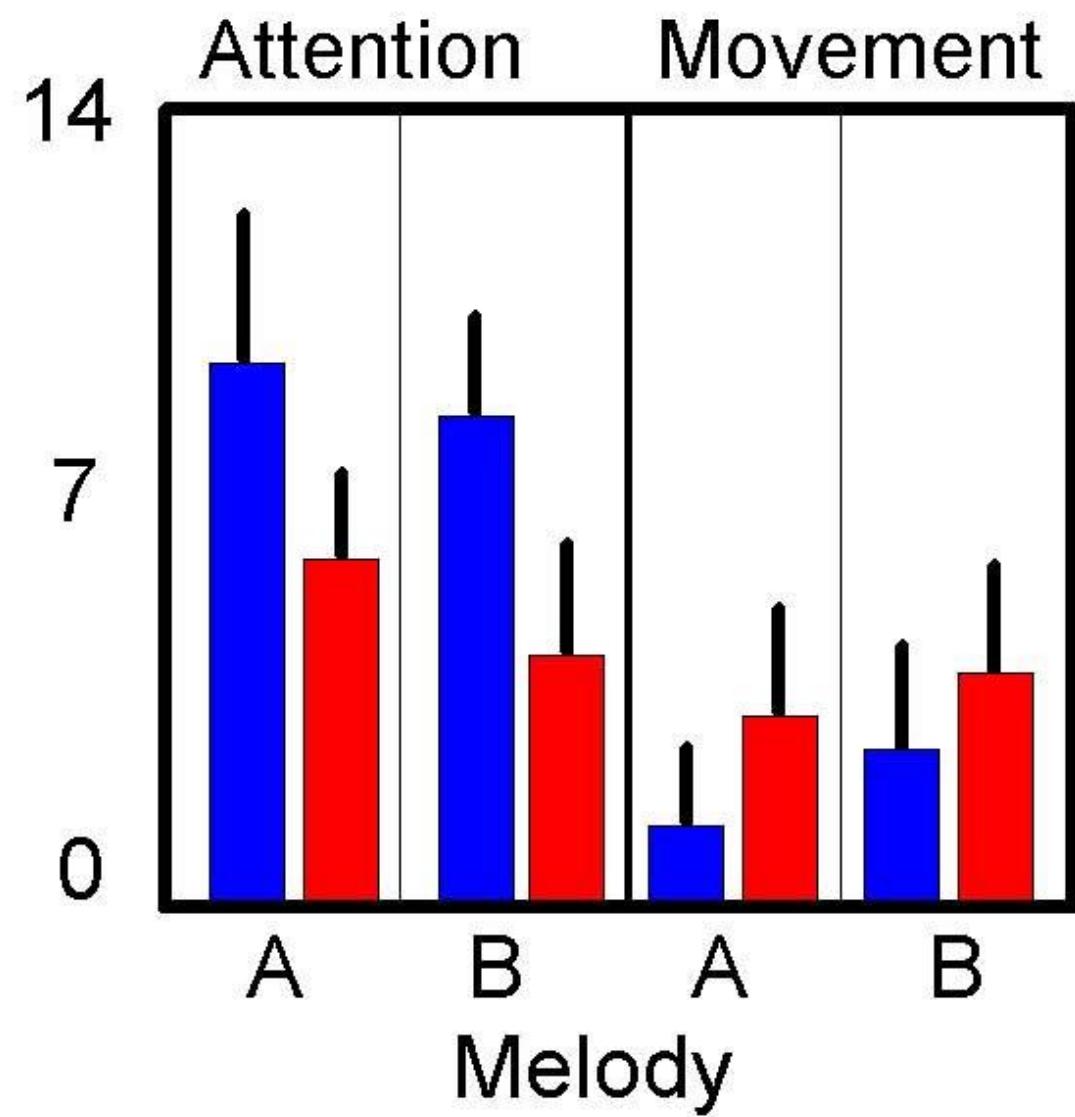
A warning may come  
up about viruses.

Just click OK.

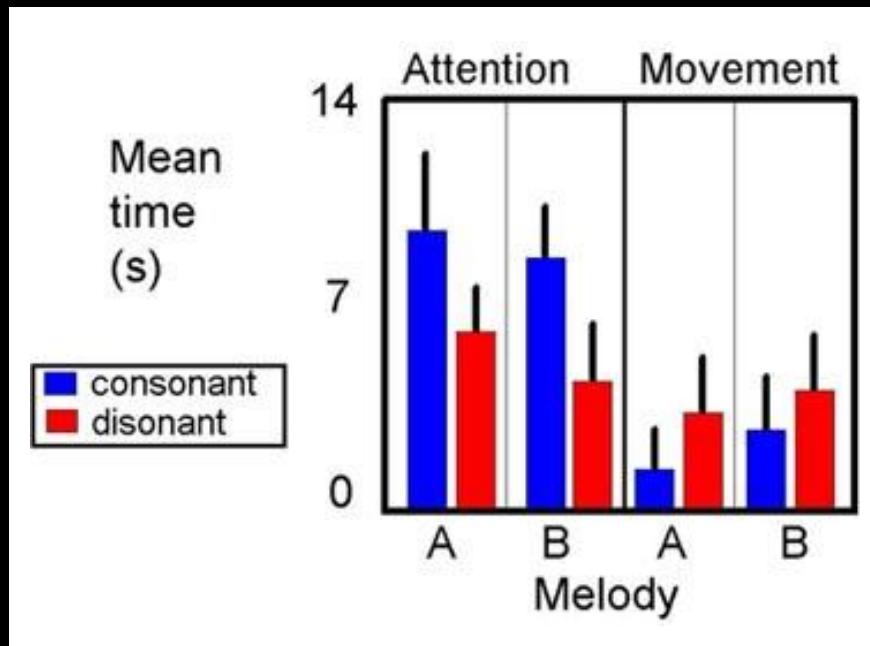
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Mean  
time  
(s)

consonant  
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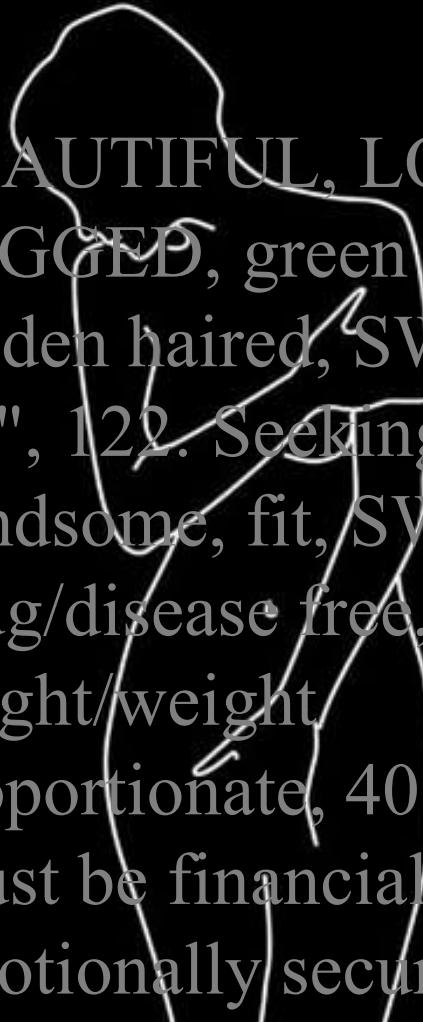


# Sensory Biases for Music?

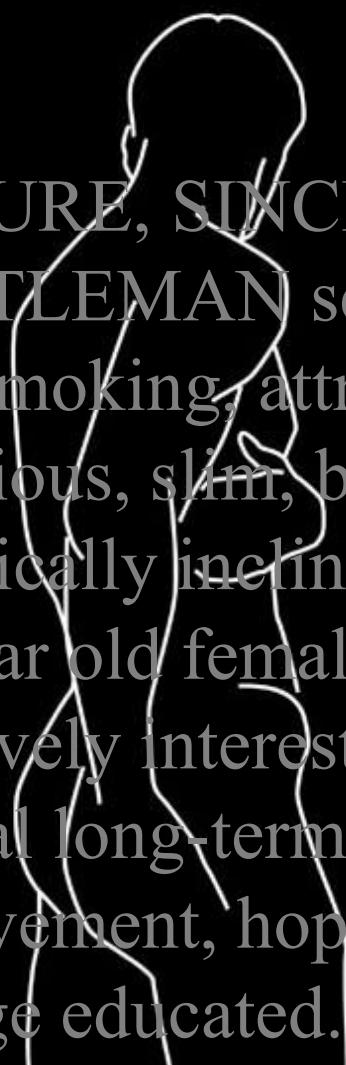


- “Naïve” infants show preferences for consonant sounds versus dissonant sounds.
- This might be due to inherent properties of auditory system structure rather than cultural effects.





**BEAUTIFUL, LONG LEGGED**, green eyed, golden haired, SWF, 5'7", 122. Seeking tall handsome, fit, SWM, drug/disease free, height/weight proportionate, 40-52. Must be financially and emotionally secure



**MATURE, SINCERE GENTLEMAN** seeks non-smoking, attractive, vivacious, slim, busty, athletically inclined, 27-42 year old female positively interested in mutual long-term involvement, hopefully college educated.

# Dr. Michael Ryan



Michael Ryan, the Clark Hubbs Regents Professor of Zoology, began his career at The University of Texas at Austin in 1984. He came to UT from a post-doctoral Miller Fellowship at the University of California at Berkeley and received his Ph.D. in Neurobiology and Behavior from Cornell University. Since that time, Dr. Ryan has established himself as a leading expert in the evolution and mechanisms of animal behavior, with particular emphasis on communication and sexual selection. To date, he has written a book on communication in tungara frogs, is the editor of two more books on frog communication, and has over 140 publications in journals including Science, Nature, and the Proceedings of the National Academy of Sciences. Dr. Ryan is very actively involved with the Zoology/Ecology, Evolution, and Behavior graduate program, having served as its faculty advisor from 1993 to 1998 Courses he has taught range from graduate seminars in Human Language and Animal Communication to a non-major course in Ecology, Evolution and Society. Dr. Ryan has been invited to deliver guest lectures worldwide on the topics of animal behavior.