Gomendio & Roldan 1991 found this in a comparative study of rodents and primates.

Larger size not always adaptation for speed higher EPC rate selects for larger sperm storage tubules: a.

Briskie 1997 in birds. Positive correlation with sperm length. Not adaptation for speed as females store sperm in tubules then release when laving egg

ii.Sperm dimorphisms to block up female

- 1. Pitnick et al 1995. Sperm evolving large size to block up female storage tubules in drosophila. Aperene and euprene sperm
- 2 Cook and Weddell 1995. Females delayed remating if full because have stretch receptors in storage organs in lepidoptera

iii.Accessory fluids

- 1. nutrients for sperm
- 2. Chapman 1995- Drosophila toxins incapacitate other male sperm
- 3. Fowler and Partridge 1989- females have lower survival as result of mating
- 4. Antagonistic coevolution because female can evolve resistance. Drosphilia: holland and Rice 1999

iv.Lumley 2016: evidence that females improve offspring fitness by mating with multiple males but found no evidence that gamete-specific interactions (sperm competition) allow offspring fitness benefits when

polyandrous fertilization conditions provide opportunities for sperm competition and cryptic female choice v.Male morphology

- 1. testis bigger in multiple mating species
- 2. penis shape
- 3. plugs and chastity belts
- 4. Parental Certainty Tactics
- Sperm Removal

 Parker suggested internal fertilisation evolved as tactic to increase certainty dimensioned opulation
 Prolonged copulation
 The brimstone butterfly remains in copula for A MUSTICE. Protonged copulation
The brimstone butterfly remains in copula for A WEEK The mile attras a 'plug'
Repeated copulation
lions 100 times a day for a week
Mate guarding
Forced copulation

.Damage to film are mating with is stra 😰 to io vhy damage the female going to bear your offspring? Adaptive to male if, reducing the female's chances of surviving and mating in the future, she invests more in her current (YOUR) brood

i.In a hermaphrodite marine flatworm, sperm injected directly into the body cavity (where the eggs are). Can cause infection, so better to take male role and fertilise other individuals first before taking female role and accepting sperm. Bean weevil has spines on penis that damage female

ii.Extra: sexually antagonistic coevolution, Drosophila interest of males in females is short term, favouring investment in his offspring at expense of females future fitness, if mating polyandrously- HIGH CONFLICT LINE f. Plugs and chastity belts

.Sealing genital tract common in rabbits, bats, snakes, insects etc

Bose 2016: Effort spent on raising unrelated offspring can be costly and wasteful, and parents are g. expected to reduce their level of investment when they have low or uncertain relatedness to the young under their care. Explored what cues plainfin midshipman males (toadfish) use to assess their paternity. Nest takeover: male displaces another male from a nest, is a reliable indirect cue of paternity causes drop in offspring survival. When presented in isolation, direct cues of reduced offspring relatedness do not result in a decline in offspring survival in midshipman

- 5. Female Perspective
- **Multiple Mating**

.Fertility insurance

i.Extra Care

1. Dunnocks: each male want full paternity but female mate with beta male so will care also

- Fisher: Equilibrium. If population = no advantage to deviating from ESS. If not at ESS: can females exploit LSR by producing rarer sex
- .Woodchuck: females removed. More daughters (rarer) produced
- i.Trivers Social Evolution: Humans. WW1, WW2 male biased mortality, after war, male biased sex ratio
  - 3. maternal condition
  - Trivers and Willard 1973 (Trivers-Willard theory)
- .mothers base sex ratio based on condition and ability to invest in offspring

i.mothers in good condition in polygynous and dimorphic species are predicted to produce an excess of sons, whereas mothers in poor condition should do the opposite.

ii.Assumptions:

- 1. Silver spoon effect: life long reproductive advantage for an individual that had access to abundant resources during early part of life.
- 2. Condition of young after investment depends on condition of mother
- 3. ^ influences adult reproductive success
- 4. Males gain more from improved condition
- big male > big female. small male < small female 1
- 2. Good condition have son, poor have female
- 1. Red deer: Dominant female: better condition. breed earlier and have higher LRS becurse live longer. Stronger effect of ramon of Subordinates htvrmor daughters
  - dominant females ore daughters because rank is passed

dominant females better at ng daughters from harassment from males: have more dominant daughters: produce more daughters

- ii.Season Preview from 10 page 10 1. Seal: sexually dimorphic species, breed early pups have longer to suckle so more sons earlier
  - Kestrel: male bias early in season, female bias late. Probability of breeding as yearling: female constant but male decrease with age. Surprising because females larger than males so should be born first but males born first because have higher probability of breeding as yearling.
  - may have more experience: late reproduction 1. benefit in LHT: lower juvenile mortality and higher fecundity

iii.Red deer: polygynous males be big

Factors affecting condition a. .Size i.Dominance

iii.Age

b. Testing the theory

.tested using mammal data

i.Problems with using natural variation is that could be different effects of other factors ii.Host size: parasitic wasps: one egg per host.

- 1. Host size determine adult size, female gain more if large than male
- 2. gave wasps choice of host sizes and fitted step function of male/female divide
- 3. Prediction: host size is important in sex ratio

- 2. Link between FA and fitness
- 3. FA can tell you about good genes models of selection: Moller

. Individual asymmetry indicator of stress level experienced. Asymmetry = lot so indicates quality of genes individual has

a. Can tell us whether secondary sexual characters signal genetic quality?

.Are secondary sexual ornaments sensitive indicators?

i.Moller 1992: Swallows male tails (secondary sexual ornaments) affected by stress, female not

- also looked at wing feathers: not sexually selected and FA not affected so secondary sexual ornaments indicator of stress because males affected by trait that was sexually selected and not across whole body
- 2. Magnitude of FA in secondary sexual characteristics: 10%, and 1% in normal morphological traits

## b. Is symmetry itself assessed?

Moller 1992: manipulated swallow tail length

- 1. control I: captured and released
- 2. Control II: captures, tail cut and reglued
- 3. Manipulated FA on either side
- . males with long and symmetric tails took shortest time to pair up
- a. Also fledged more young

ii.Swaddle and Cuthill 1994

iii.Female attractivenes

- b. Females put in more effort
- c. Swaddle and Cuthill 1994: But flight is probably affected

i.Zebra finches find particular leg colour bands attractive (Burley 1985)

- 1. Preferences in free chamber orreate with free mating pattern
  - 2. Manipulate Colliana asymmetry whilst hold

female spen more time looking at male with synnexical rings

- study using morphing to be symmetrical or not
  - to assess effects on human facial attractiveness
- 2. Symmetrical faces LESS attractive
- . Attractive faces made less attractive by symmetry
- a. Unattractive faces made more attractive by symmetry
  - 3. Reasonable to think highly asymmetric faces signal a developmental problem. But most are fairly symmetrical so could symmetry be used as cue to finding best mate?
  - . But hard to judge symmetry when face isnt head on
    - 4. Is symmetry preference a by-product of how we learn categories?
- . Johnstone 1994: neural networks prefer some patterns, avoid others
- a. Patterns in left bigger and right bigger forms
- b. Prefer symmetrical patterns because average of all patterns is symmetrical

from

13. Publication Bias

. Need a larger sample size to detect smaller effects as at small sample sizes the estimate of the effect (strength of relationship between 2 variables of interest) will be noisy. As sample size increases, effect of random variation reduces and so estimated effect homes in on true value.