Does mate quality influence the differential allocation of resources to developing eggs of female zebra finches?

Zebra finches are a **socially monogamous species with biparental care**, meaning the fitness of the female is closely linked to that of the male (Griffith and Buchanan, 2010).

Resources can be passively allocated to developing eggs to maximize fitness returns in response to environmental cues such as **mate attractiveness** (Gilbert et. al., 2006) and **quality of parental care** (Navara et. al., 2006).

Differential Allocation Hypothesis

Females will invest more resources into developing eggs when copulation occurs with an **attractive male** (Kathryn et. al., 2016).

- Attractive males can provide more protection and food provisioning (because they are naturally more dominant and have higher mass than unattractive males (Gilbert et. al., 2006).
- Females will allocate more resources to offspring because future environmental conditions are perceived to be safer (Gilbert et. al., 2006).

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Compensatory Investment Hypothesis

Maternal egg provisioning levels will increase when copulation occurs with a **less attractive male** (Bolund et. al., 2009).

- Less attractive males provide more parental care to compensate for their external features (Kathryn et. al., 2016).
- Parental care includes food provisioning to the female during the nesting period and to offspring post-hatching (Kathryn et. al., 2016).
- If the female is in better condition, she can withstand the costs of increased egg provisioning (Kathryn et. al., 2016).

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Can zebra finch maternal effects be explained by a single hypothesis?

Maternal effect patterns are dependent upon **mate quality**, the likelihood of **extra-pair copulations**, and perceived **environmental conditions** that may affect future reproductive potential (Griffith and Buchanan, 2010).

Because allocation strategies are flexible within species and individuals, maternal effects will differ depending on environmental conditions and partner quality (Navara et. al., 2006). Therefor, zebra finch reproductive strategies may involve both differential allocation **AND** compensatory investment.

Hormonal influences on egg provisioning levels

Yolk androgens have an overall positive effect on the growth and survival of offspring (Navara et. al., 2006) but can cause impaired T cell immunity and oxidative stress at high concentrations (Pariser et. al., 2012). They also have been shown to bias the sex ratio to favor males (Rutkowska et. al., 2007).

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Yolk antioxidants are critical for embryonic development as they protect growing tissues from oxidative damage (Pariser et. al., 2012).

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Yolk androgen to antioxidant ratio: antioxidants have been shown to mitigate the negative effects of maternally deposited androgens (Pariser et. al., 2012).

Females in better condition can allocate higher ratios of antioxidant to androgen to eggs than those in poor condition (Pariser et. al., 2012).

High ratios of antioxidant to androgen are more beneficial to developing offspring, but costly to the mother (Pariser et. al., 2012).

Carotenoids are pigments that can be chemically modified and deposited into developing eggs to aid in development of plumage colour (Bolund et. al., 2009).

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Maternal effect patterns in response to differing mate quality

1. Females invested more carotenoids into eggs reared by a male of lower attractiveness (Bolund et. al., 2009).
2. Females invested more testosterone into eggs reared by males of high attractiveness but low parental quality (Bolund et. al., 2009).

Conclusion: The general findings suggest that allocated resources are used to **compensate** for poor conditions (Griffith and Buchanan, 2010).

Females are more likely to use **compensatory investment** of carotenoids when mated to a male of low attractiveness (Griffith and Buchanan, 2010).

Carotenoid deposition can be used to compensate for phenotypic shortcomings because they aid in the development of body colour (Bolund et. al., 2009).

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Females that copulate with an attractive male will tend **differentially allocate** androgens to offspring to compensate for low parental expenditure (Griffith and Buchanan, 2010).

Increasing mate attractiveness has been shown to correlate with increased bigotry and decreased parental effort (Burley, 1988).

It has been shown that increasing androgen content in developing eggs leads to increased begging duration, which may act as a strategy to increase parental contribution (Griffith and Buchanan, 2010).

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