

Do attractive male guppies produce more grandchildren? Testing crucial hypotheses of sexual selection

What makes a potential sexual partner attractive, and why? These questions lie at the heart of a whole field of biology devoted to studying the often astonishing range of sexual reproduction tactics we see in the natural world: tactics ranging from the peacock's tail, to the antlers of deer or the flowers of plants. How does evolution produce and maintain such traits, especially as they often cost a lot of energy to grow and carry, or make it harder to hide or escape from predators? Biologists specialising in evolution have been interested in this topic since Darwin's time, but the field remains alive and vigorous, with plenty of unanswered questions. Among those questions is that asked in the opening line: what makes a potential sexual partner attractive, and why? In most species, this is a question more important for females than males, as females usually have more to lose – mate with a bad male, and she could lose a whole reproductive cycle, whereas a male can more easily seek additional reproductive opportunities elsewhere (interesting cases where the roles are reversed are rare but do exist – seahorses, for example). When males help rear the young, or provide females with something tangible – food, or a nest site – it is easy to see what might be attractive and how a female might benefit from choosing among males, and thus how evolution might promote the trait of interest. However, the males of many species contribute nothing to the next generation except their genes, yet it is often the case that females of these species still practise some sort of choice. What is more, the females often 'agree' on the locally 'best' male – a classic example being peahens and peacocks. How are these females choosing, and why? The 'how' is often obvious – the males exhibit a secondary sexual trait (e.g. colourful plumage, elaborate song), and the females respond to some kind of cue in this trait. The 'why' is harder, and surprisingly complex and contentious and this is the subject of my study.

One idea is that attractive males sire 'sexy sons' that should be desired by choosy females and produce more children than their less sexy rivals. Another idea is a 'good genes' model which predicts overall good quality of the children of both sexes. Children of attractive fathers in the latter model should be for example less vulnerable to pathogens, mature faster and less likely to die before they reproduce. Thus in this pathway both sons and daughters of attractive fathers will in consequence have more children (that survive to maturity) than sons and daughters of less attractive fathers.

In this project I will test these models using guppies – popular aquarium species, and the subject of many evolutionary studies on account of its extreme variation in colouration. To do so, I will use three consecutive generations from breeding experiment. I will assess which males will have the highest number of grandchildren using DNA fingerprinting and photographs of the males to analyse phenotypic traits such as colour pattern and morphometric features (e.g. body size, intromittent organ length). What is more, I will test female mating preferences using a specially designed aquarium in which females are able to choose candidate partner. This with respect to the photographs will allow me to determine the attractive traits and their contribution in the to the number of grandchildren. This experiment will make an important contribution to understanding how sexual reproduction exists in its many and variable forms.