

GECKODAILY CLASSROOM RESOURCES · RESEARCH SPOTLIGHT

Research Spotlight: When Temperature Overrides Genetics

Can an animal's chromosomes say 'male' while its body develops as female?

Bearded dragons normally determine sex the way birds do: females carry one Z and one W chromosome (ZW), while males carry two Z chromosomes (ZZ). This is a fully genetic system, and for most of the incubation temperature range bearded dragons experience in the wild, it behaves exactly as you'd predict from the chromosomes alone.

In 2007, a research team led by Alexander Quinn published a study in the journal *Nature* reporting something unexpected: at sufficiently high but still naturally-occurring incubation temperatures, genetically male (ZZ) bearded dragon embryos developed as females anyway - complete with functional ovaries and the ability to reproduce. The chromosomes still said male. The body, and the reproductive system, said female.

This is a case of temperature overriding a genetic sex-determination system, and it was one of the first well-documented examples in a species with proper sex chromosomes (as opposed to species like the leopard gecko, which never had sex chromosomes to begin with). It suggested that the line between 'genetic sex determination' and 'temperature-dependent sex determination' is less absolute than textbooks often imply - some species can sit on a spectrum between the two systems.

Follow-up research has looked at whether temperature-overridden (sex-reversed) females behave and reproduce differently from chromosomally normal (ZW) females. Some studies have found sex-reversed females can lay more eggs, raising further questions about why a fully genetic system would remain vulnerable to temperature override at all, evolutionarily speaking, if the override doesn't clearly reduce fitness.

Why it matters in class

This case study is a genuinely useful teaching bridge between 'genetics determines sex' and 'environment determines sex' - showing students that many biological rules have exceptions worth investigating rather than memorising as absolute.

Discuss

If a chromosomally male (ZZ) bearded dragon develops as a fertile female, what would you predict about the sex chromosomes of that individual's own offspring? What experiment could test your prediction?

Sources: Quinn, A.E. et al. (2007), 'Temperature sex reversal implies sex gene dosage in a reptile,' *Nature* 447; IUCN Red List; Wikipedia (Central bearded dragon).