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Lesson Plan: Sex Determination Systems Across Reptiles

GRADE BAND	DURATION
Introductory genetics unit, high school through college	One 45-60 minute class period

Learning objectives

- Distinguish between genetic sex determination (GSD) and temperature-dependent sex determination (TSD), using real examples from this species set.
- Explain the 2007 bearded dragon finding in which incubation temperature overrode chromosomal sex determination, and what it implies about the GSD/TSD distinction.
- Practice reasoning about experimental design using a sex-determination case study.

Materials

- Leopard Gecko and African Fat-Tailed Gecko Species Fact Sheets (TSD examples)
- Bearded Dragon Species Fact Sheet and Research Spotlight (temperature-override example)
- Mourning Gecko Species Fact Sheet (parthenogenesis - no sex determination system needed at all)
- Reptile Biology Glossary

Warm-up

Ask students: 'In humans, what determines whether a baby is born male or female?' After establishing the XY chromosomal answer, ask: 'Do you think every animal species determines sex the same way humans do?' Collect predictions before introducing TSD.

Activity outline

- **Step 1.** Introduce genetic sex determination (GSD) using the familiar human XY system as a reference point, then contrast it with the ZZ/ZW system in birds and bearded dragons.
- **Step 2.** Introduce temperature-dependent sex determination (TSD) using the leopard gecko and African fat-tailed gecko fact sheets. Ask students to identify what is absent in these species compared to GSD systems (answer: no sex chromosomes at all).
- **Step 3.** Present the bearded dragon Research Spotlight as a case that blurs the line between GSD and TSD. Have students diagram, in their own words, what happens to a genetically male (ZZ) bearded dragon embryo at high incubation temperature.
- **Step 4.** Close with the mourning gecko as a system requiring no sex determination mechanism at all, since it reproduces without males.

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Discussion questions

- Why might a species with functioning sex chromosomes (like the bearded dragon) still be vulnerable to environmental override, if that seems like it could disrupt normal reproduction?
- From an evolutionary standpoint, what might be an advantage of TSD over GSD in a species living in an environment with unpredictable or fluctuating temperatures? What might be a disadvantage, especially under climate change?
- The mourning gecko needs no sex-determination system since all individuals are female. What does this suggest about how essential 'having two sexes' really is for a species' survival, at least in the short term?

Extensions

- Have students research one more TSD species not covered here (e.g., American alligator or a sea turtle species) and compare its temperature thresholds to the leopard gecko's.
- Assign a short written response: 'Design an experiment to test whether a new, unstudied lizard species uses GSD or TSD.' Have students specify their control group, variable, and what result would support each hypothesis.