43.1C: Sex Determination

Learning Objectives

- Differentiate among the various ways animals determine the sex of offspring

Mammalian sex is determined genetically by the presence of X and Y chromosomes. Individuals homozygous for X (XX) are female, while heterozygous individuals (XY) are male. The presence of a Y chromosome causes the development of male characteristics, while its absence results in female characteristics. The XY system is also found in some insects and plants.
Sex determination in mammals is influenced by the presence of X and Y chromosomes. Males are heterozygous (XY), while females are homozygous (XX). In birds, Z and W chromosomes determine sex, with females being heterozygous (ZW) and males homozygous (ZZ). The W chromosome appears essential in sex determination, similar to the Y chromosome in mammals.

Avian sex determination depends on the presence of Z and W chromosomes. Homozygous (ZZ) results in a male, while heterozygous (ZW) results in a female. The W chromosome is essential in determining the sex of the individual, similar to the Y chromosome in mammals. Some fish, crustaceans, insects (such as butterflies and moths), and reptiles use this system.

The sex of some species is not determined by genetics but by an aspect of the environment. In some crocodiles and turtles, for example, sex determination is dependent on the temperature during critical periods of egg development. This is referred to as environmental sex determination or, more specifically, as temperature-dependent sex determination. In many turtles, cooler temperatures during egg incubation produce males, while warm temperatures produce females. In some crocodiles, moderate temperatures produce males, while both warm and cool temperatures lead to females.
produce females. In some species, sex is both genetic- and temperature-dependent.

Individuals of some species change their sex during their lives, alternating between male and female. If the individual is female first, it is termed protogyny or “first female;” if it is male first, it is termed protandry or “first male.” Oysters, for example, are born male, grow, become female, and lay eggs; some oyster species change sex multiple times.

Key Points

- Mammals, birds, and some other animal species depend on heterozygous or homozygous chromosome combinations for sex determination.
- Cool or warm temperatures affect sex determination in species such as crocodiles and turtles.
- Some species, such as oysters, have the capability of alternating their sex several times within their life span.

Key Terms

- **protandry**: the condition in which an organism begins life as a male and then changes into a female
- **protogyny**: the condition in which an organism begins life as a female and then changes into a male
- **homozygous**: of an organism in which both copies of a given gene have the same allele
- **heterozygous**: of an organism which has two different alleles of a given gene

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