Animal Reproductive Strategies

The ultimate goal of each species is to produce the maximum number of surviving offspring using the least amount of energy. This is called the reproductive effort.

Asexual reproduction is energy efficient (low reproductive effort) as it involves only one animal. Sexual reproduction, on the other hand, is more complex and therefore needs much more energy (high reproductive effort), this is because:

- Mates have to find each other
- Competition for mates
- Reproduction has to be precisely coordinated
- Parental care is often needed for young

Unique reproductive strategies have developed to ensure maximum reproductive success.

Reproductive Strategies
A. Courtship
B. External vs Internal fertilisation
C. Ovipary, ovovivipary and vivipary
D. Precocial & altricial development
E. Amniotic egg
F. Parental care

A. Courtship
Courtship in animals is behaviour that is designed to attract another animal for mating/breeding.

1. Simple strategies
Simple strategies include chemical, visual and auditory stimuli, the purpose of these is to attract a mate. Most frogs sing (grunt, croak) during breeding season. Female moths produce pheromones to attract the male. Birds also sing, as well as have brightly-coloured plumage.

2. Complex strategies
Elaborate forms of courtship are unique to each species. Females usually favour males that are larger, have elaborate physical features and display more energy in courtship activity. This helps the female choose the male that can reinforce pair bonding and promises healthier offspring. For example, the Blue Crane has a complex courtship display that involves a long, complex series of calls as well as elaborate dances by the male.

Advantages of courtship
- It ensures that the females find suitable males, eg. The strongest male
- Sexual behaviour is timed so that the male and female are ready for mating at the same time
- The males expend the most energy, leaving the female more energy for breeding

External vs Internal fertilisation
External Fertilisation
External fertilisation takes place in water and occurs in most aquatic animals. It is not an ideal process as it is wasteful (most eggs are eaten), and fertilisation is not certain.
Advantages of external fertilisation

- Huge numbers of eggs and sperm are released into the water, increasing the probability of fertilisation
- Courtship rivals, many fish swim next to each other while releasing eggs and sperm, increasing the probability of fertilisation
- Spawning is times to occur during increased ocean movement that disperses the eggs
- Young are easily dispersed. This reduces competition with their parents for food and living space
- No special co-operative mating behaviour, which saves energy
- Larval forms get food directly from environment

Note: Reproductive energy expenditure is almost entirely due to the producing of eggs.

Internal fertilisation

Internal fertilisation occurs in insects and terrestrial vertebrates. The male gametes are released directly into the body of the female. Most birds and reptiles mate using a cloaca (an opening in the lower abdomen). During mating the male and the female line-up their cloaca for the transfer of sperm. Many insects and almost all mammals have a penis to transfer sperm during copulation.

Advantages of internal fertilisation

- Gametes are placed closer together, although there are fewer gametes
- Energy that is saved because of production of less gametes can be used for other purposes
- Some eggs have more yolk for the young to feed on
- Some eggs are enclosed within a shell before they leave the female body
- Some fertilised eggs are well protected and nourished
- Less wastage of gametes – do not need to produce them as often

Note: A disadvantage of internal fertilisation - it requires co-operative behaviour by the male & female

C. Ovipary, Ovovivipary and Vivipary

These terms describe the moment at which the future offspring separates from a parent. These strategies indicate where the embryos undergo development, and how parents nourish them.

Ovipary

In oviparous animals, the eggs are released by the female and develop outside of the parent. Most animals are oviparous, but fertilisation may occur internally or externally. Egg yolk is the only nutrition the embryos receive until they hatch from the egg.

Advantages of ovipary

Aquatic Environments

- Large amounts of eggs produced due to predation
- Self-sufficient in larval stage
- Eggs and larvae are well dispersed

Land Environments

- Invertebrates produce large numbers of eggs that hatch in larval form
- Protective shell, which prevents embryo from drying out
- Reptiles and birds produce a small number of eggs, saving energy to produce eggs with high nutrition, for protecting and incubating the eggs and parental care
Ovovivipary
In ovoviviparous animals, the eggs are fertilised internally and kept inside the female body until they hatch, thus they are born alive.

Advantages of Ovovivipary
- Mother can produce less eggs and therefore use less energy
- Much less vulnerable to cold temperatures and predation
- Young is born fully developed

Vivipary
In viviparous animals, fertilisation is internal and the eggs do not have a shell. The egg forms an embryo which develops inside the parent, and gain nutrition from the parent, usually through a placenta. Vivipary occurs in all mammals except the marsupials and monotremes, more than half of sharks and rays and some invertebrates.

Advantages of Vivipary
- Reduced number of eggs, therefore there is more energy to use to nourish and protect the embryo and foetus, as well as more energy to provide parental care.

D. Precocial and Altricial development
These terms are used to describe two basic strategies of development. These strategies, particularly seen in birds and mammals, have evolved to provide nourishment for offspring and protect them from predation.

Precocial development
Precocial species hatch or are born when they are almost fully developed. Precocial birds incubate their eggs for longer, and precocial mammals have a longer gestation period to ensure that this is possible. Energy expended for parental care is used mainly in pre-natal developments with the females being less involved after birth.

Precocial species at birth:
- Have open eyes and hair
- Have large brain relative to body size
- Immediately active and mobile, may not be very stable on their feet
- Are not usually confined to nests

Advantages of Precocial development
- Offspring can find and eat food on their own
- Offspring can look after themselves and evade predators

Altricial development
Altricial species are not well-developed when they are born or are hatched. This is because altricial birds’ eggs are much smaller and do not contain enough yolk for the young to develop fully. Animals also might be vulnerable during the latter stages of pregnancy, so the young need to be born as quickly as possible. Energy expended for parental care is used mainly in post-natal developments.
Altricial species at birth:
- Often naked, lacking hair
- Cannot walk or fly, have relatively small/ immature brains
- Often have closed eyes
- Unable to thermo-regulate, rely on parents for food and transport

Advantages of Altricial development
- Parental care means protection, brooding and feeding for young
- Offspring reach reproductive age quickly as they are in a nest and therefore easier to feed and are also fed large nutrient-rich food
- Safer from predation, as nest are inaccessible
- Brain continues to grow giving the animal more survival skills on maturity

E. Amniotic Egg
The amniotic egg is a major evolutionary innovation as it allows eggs to be laid on land. It has extra-embryonic membranes which develop after fertilisation.

Advantages of the amniotic egg
- The fluid-filled amnion surrounds and protects the embryo, it prevents dehydration.
- The allantois acts as a reservoir for nitrogenous waste
- The yolk sac holds the nutritious food
- The chorion surrounds all other membranes it allows for gaseous exchange, and forms the placenta in mammals

F. Parental Care
Parental care is any behaviour in which a parent expends energy in order to improve survival, condition and future reproductive success of the offspring. Care can be given at two stages, either pre-natal or post-natal care. Pre-natal care is care that occurs before the birth of the offspring, while post-natal-care is care that occurs once the offspring is alive.

Fish:
Fish show no parental care and no fish feed their young. Normally shed a large number of eggs in the water. Which they abandon once they are fertilised.

Amphibians:
Amphibians direct much of their parental care towards minimising the loss from predators of eggs and embryos by guarding the eggs and/or building terrestrial-breeding sites.

Reptiles:
Reptiles show virtually no parental care besides guarding eggs, incubation and attacking predators of their young.

Birds:
Birds show extensive parental care, usually by both parents. They remove eggshells from nests, build nests, incubate their eggs and feed their young.
**Mammals:**
Most mammals give **intense parental care**, as most young are helpless at birth. Mothers in precocial species lactate and protect their young. Mother in altricial species feed, keep warm, shelter and protect their young. After birth the mother licks the young for health and social reasons as it establishes a special connection. Care by the mother continues after lactation is no longer continued in some mammals.