

Chapter 1

1. Using the list below, decide which of the feeding strategies best describes that used by each of the following species. For each one, point to one feature of its behaviour or anatomy that indicates its adaptation to that way of life:

Lion, Cheetah, Hyena, Leopard, African Hunting Dog

Feeding strategies:

Stalking hunter

Cooperative hunter

Scavenger

Chasing hunter

Answer

Firstly note that these are all predators of the African savannah – a habitat and way of life that gave rise to our genus.

Lion (*Panthera leo*)– large cooperative hunter – female members of the pride work collectively to bring down a large prey, though one female is often able to make the kill of even very large prey. Typically defend a territory as a pride.

Cheetah (*Acinonyx jubatus*)– chasing hunter – the lightly built and athletic body is built for speed and to bring down prey roughly the same size as itself, which it often hunts alone.

Hyena (Family Hyaenidae)– usually a scavenger that works as a pack to scare of other scavengers or occasionally to kill as a cooperative hunter.

Leopard (*Panthera pardus*) – stalking hunter – uses the camouflage of its coat so that it can get close to a prey and avoid a long chase. Hunts alone.

African Hunting Dog (*Lycaon pictus*)– hunts in large packs. Free-roaming. Although relatively small they are able to bring down very large prey by working together in large numbers. Will, like hyenas also drive off other scavengers.

2. What are the most obvious changes in the jaw-lines of hominid skulls shown in Fig. 1.4? Suggest why natural selection might favour the finer lines of more recent species.

Answer

The skulls become less *prognathous* in more recent species – that is, the lower part of the face does not project out from the lower part of the face. The jaws also become much reduced in *Homo*, and the teeth become much smaller with the shift to meat-eating.

If large teeth and the large grinding capacity of massive jaws is no longer needed, the costs of growing these can be reduced...and selection will favour those who demand fewer resources.

3. Why can natural selection not work to fit a species to a perfect design?
Why is no species perfectly adapted to its environment?

Answer

The differences in genotypes between individuals, which, through their phenotypes, are subject to selection, are the result of chance events – the chance combination of different

genes at fertilization, or by rare mutation events, which are largely random and not a response to environmental pressures. Neither 'anticipate' an endpoint and offer no mechanism that can work to any sort of design.

Change is a feature of all environments, although some, such as deep ocean environments are remarkably persistent and consistent. A perfectly adapted species would not only perfectly match the prevailing environmental conditions but also anticipate all possible scales of change. It is true that some of the most ancient and unchanging living species can be found in deep oceanic waters, but few would survive a major volcanic eruption.

4. Classify each of the following as either a cost (risk) or benefit of sexual reproduction. Indicate who benefits and who bears the cost

- Development from a single cell
- Combining genes with another individual
- Variability amongst offspring
- Change in genotype between parent and offspring
- Large number of potential partners
- Finding a partner

Answers

- Development from a single cell – *considerable risk to offspring, cost to one or more of the parents in supporting this development*
- Combining genes with another individual – *cost to both male and female, but especially to female in supporting (foreign) genes supplied by male*
- Variability amongst offspring – *benefit to those offspring favoured*
- Change in genotype between parent and offspring – *benefit to offspring favoured*
- Large number of potential partners – *benefit to offspring and the genes seeking to be passed on*
- Finding a partner – *cost to both partners, but often male is selected by female and so has a larger cost*

5. Why is "fitness" relative?

Answer

The fitness of an individual is measured as the proportion of individuals showing the same genotype in the next generation. A fit individual will contribute more genes to the next generation than a less fit individual. Alleles (different forms of the same gene) can be described as competing with each other – one increases its proportion as the expense of all the other forms. The same is true of competition between individual organisms for any limited resource, so success in evolutionary terms is always relative.