Student activities

Tutors, examiners, researchers and textbook writers all tell us how important it is to be active in our learning. Lance Workman gives some useful activities which will consolidate and enhance your understanding of the article you have just read.

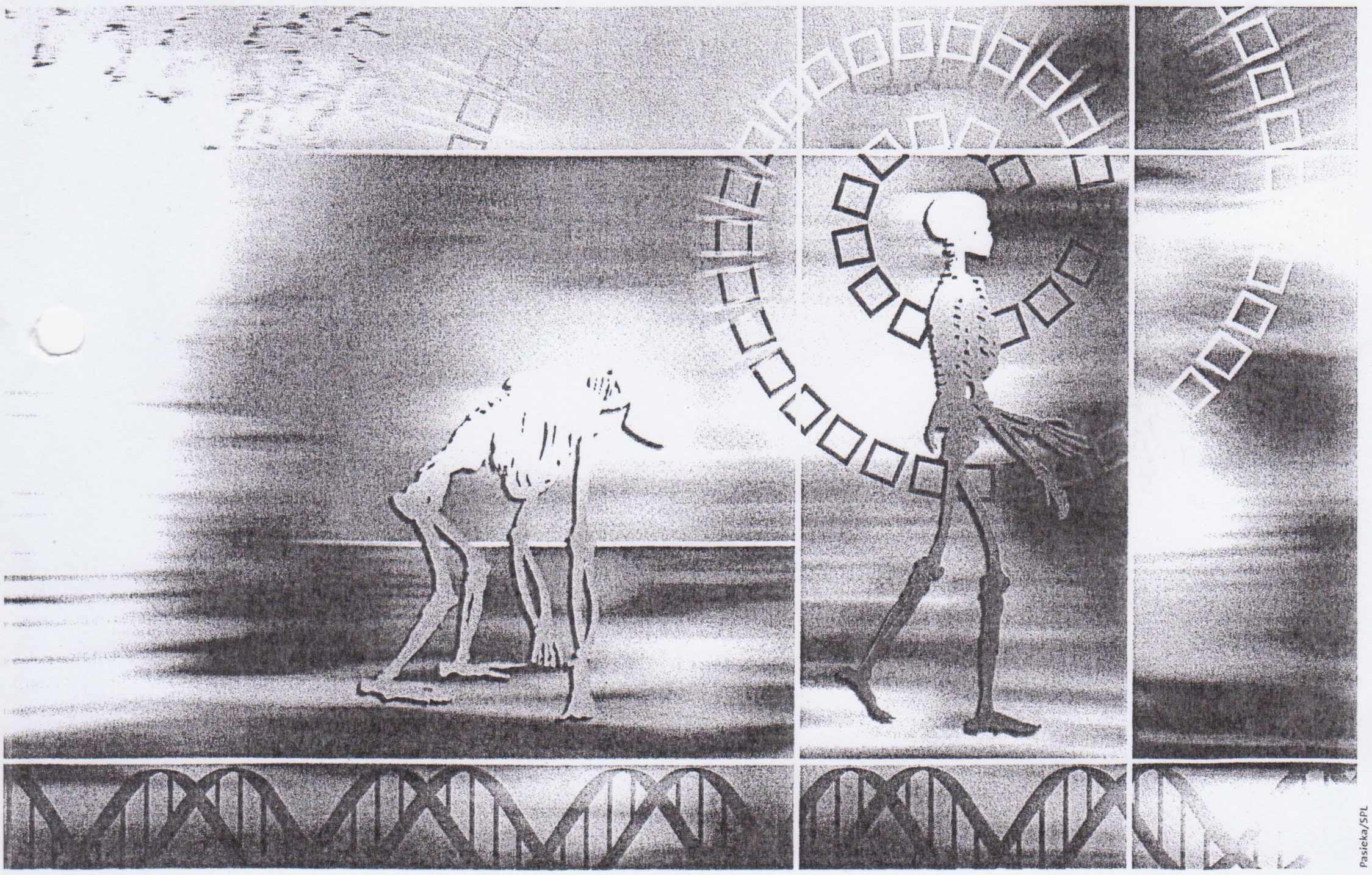
Male and female brains

Our article on 'Male and female brains' probably raises more questions than it answers and, when teaching evolutionary psychology, we often find that such areas lead to a great deal of debate among students. In this column I will outline first how evolution is considered to work via natural selection and then suggest some discussion questions for you to consider with your teacher in class.

Darwin first outlined his theory of natural selection in detail in *On the Origin of Species* in 1859. Today, virtually all serious scientists accept this as the main mechanism for evolutionary change. But what does natural selection mean? Natural selection is one of the simplest ideas known to science and means any heritable characteristic that helps an individual to survive and reproduce is likely to be passed on when in competition with other less successful heritable characteristics.

Today, we understand that heritable means that it is 'coded for' in the genes (genes were unknown to Darwin, of course). Darwin took a gradualist view of natural selection; that is, small accumulated changes slowly leading to large changes over many years. This means that we will see changes in a species over long periods of time, as advantages occur randomly through mutation and recombination (random changes in genes and the mixing-up of genes that occurs during sexual reproduction).

In order to illustrate this process, let us consider bipedal locomotion in our species and how it might have evolved. Six million years ago, we shared a common knuckle-walking ape ancestor with the chimpanzee, but today we walk upright on two legs. We can envisage an ancient ape-like ancestor that split from the chimpanzee ancestor 6 million years ago (supported by the fossil record). The split may have occurred because a sub-population became isolated geographically. Within that sub-population, some individuals developed a slightly better ability to walk on their hind legs for extended periods of time (modern-day chimpanzees do so for brief periods) due to random mutations. Those individuals with this mutation were then able to use their hands more often to carry objects, and standing upright more frequently meant their eyes were on a higher plane and hence better able to scan for predators and food sources. These two advantages meant that they were able to survive longer and to produce more surviving offspring with the same features. In a sense, they were 'fitter'



Pasieka/SPL

than the rest of the population (natural selection was often referred to as 'survival of the fittest' in later editions of *On the Origin of Species*).

Hence the gene(s) for this improved ability would spread throughout the population in a number of generations, outcompeting those with different gene combinations. Over many generations, other mutations would arise randomly that helped to support this original gene and they would also be selected, as they would improve further the benefits of bipedalism. Such mutations would, for example, have led to a lengthening of the leg bones and a shortening of the arms and they would also have altered the biomechanics of the spinal column. Hence, many generations of gradually accumulated changes led to the upright posture that we see in modern humans.

Discussion questions

1 In our article, we suggest that if a feature (either anatomical or behavioural) is present at the time of birth, then this strengthens the argument that it is more likely to be a product of biological/evolutionary processes rather than social/cultural.

- Explain this line of reasoning. Can you think of any counter-arguments/limitations to this argument?

2 We suggest that modern-day male and female brains may differ due to the different pressures that our male and female ancestors faced. In particular, we suggest that females may have evolved superior 'empathising' skills because they stayed near the tribal base and looked after their offspring. Males, in contrast, may have evolved superior visuospatial skills as a result of the time they spent hunting away from home.

- Consider the strengths and the weaknesses of this argument.

3 Some people are unhappy with suggestions that there may be evolved differences between the sexes.

- Suggest three reasons why some people may not be happy with this suggestion.

4 The article states that the variation within the sexes is greater than the variation between the sexes.

- What does this mean?

5 As a thought experiment, many students do not find it difficult to suggest plausible (and sometimes imaginative) scenarios to explain how natural selection slowly alters physical features (see above example). But the same students often find it more difficult to apply natural selection to understanding how behaviour might have evolved.

- Using your understanding of natural selection, try to explain how behaviour might evolve. If you are struggling with this question, you could consult *Evolutionary Psychology: A Primer*, which is available online from the University of California, Santa Barbara, or read chapters 2 and 3 of *Evolutionary Psychology* by Workman and Reader (2004).

In the article, we discuss areas of the brain that are believed to differ between males and females as a result of differing evolutionary pressures. These include the frontal cortex, the parietal cortex, the limbic system and the hypothalamus. For further information on the relationship between the brain and evolution, try this web site at McGill University: **www.thebrain.mcgill.ca**

Reference

Workman, L. and Reader, W. (2004) *Evolutionary Psychology: An Introduction*, CUP.