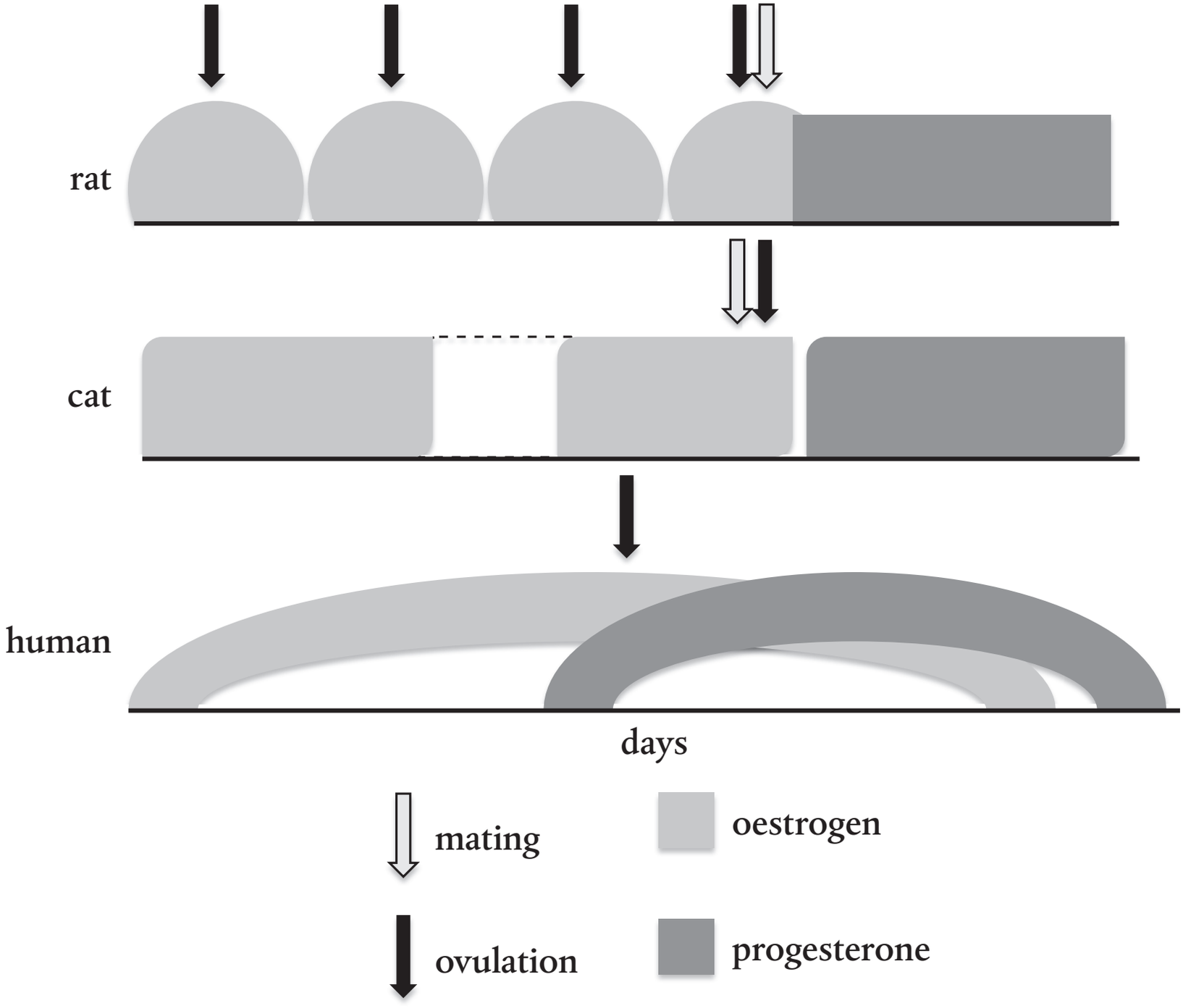


Fig. 3. Diagrams of the oestrous (reproductive) cycles of three female species. The rat has a 4–5-day oestrogen cycle, ovulates spontaneously, but only secretes much progesterone if she mates. The cat has a prolonged, and variable, period of oestrogen secretion: she only ovulates and secretes progesterone if she mates. The human female ovulates spontaneously after about 14 days of oestrogen secretion, and then has a similar period dominated by progesterone.

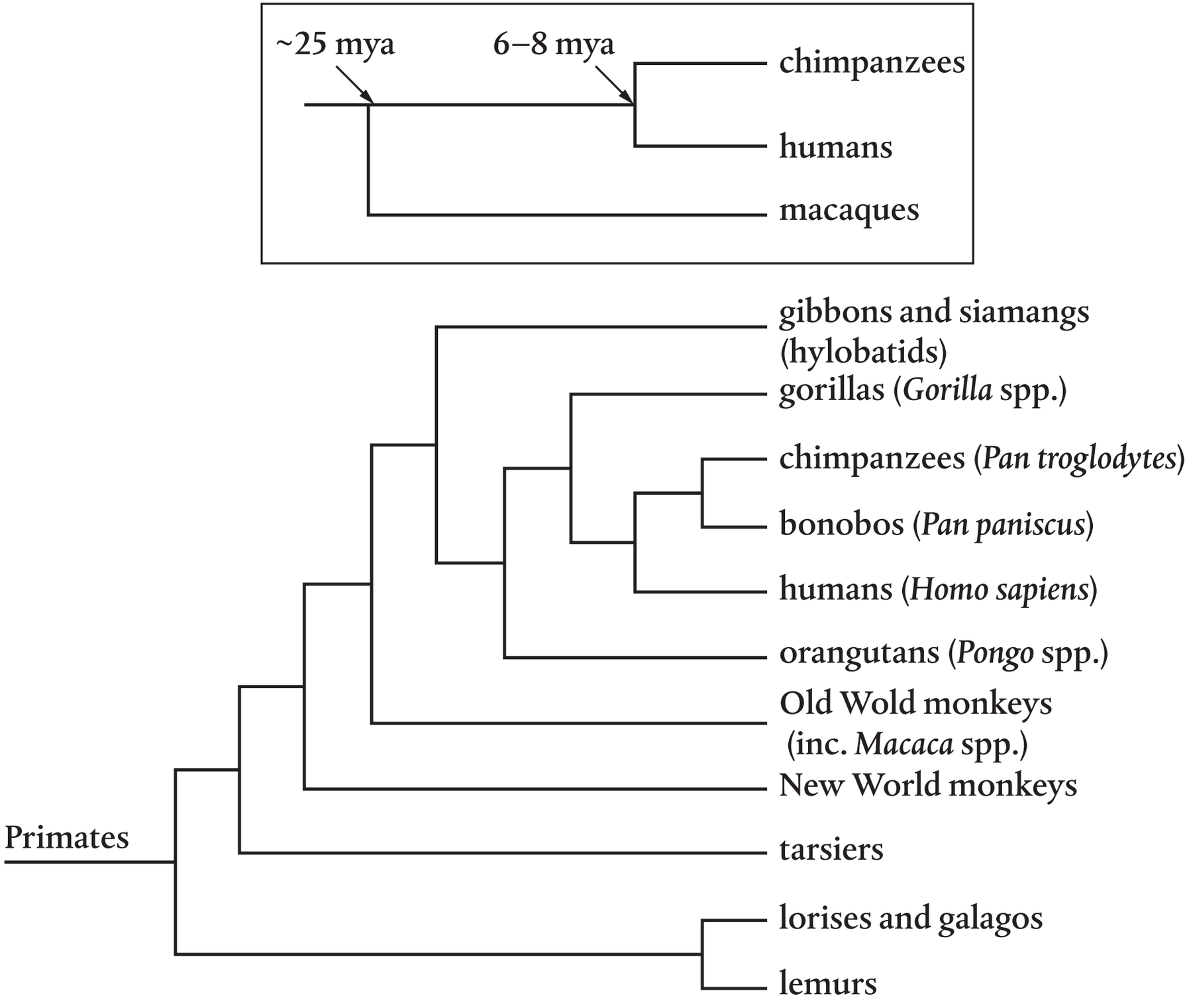


Fig. 4. The evolutionary tree of the primates. Chimpanzees are man's closest relative, but even they diverged from the human line 6–8 million years ago, and have pursued an independent evolution ever since.

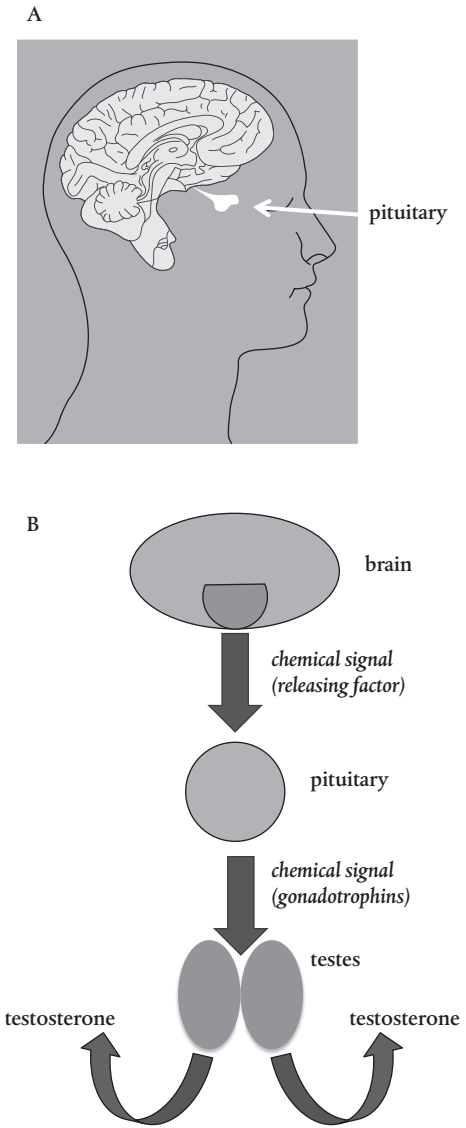


Fig. 5. (A) The pituitary, which controls the activities of the testes, lies at the base of the brain. (B) The control of testosterone secretion. Neurons in the hypothalamus (at the base of the brain) produce a chemical signal (a releasing factor) that acts on the pituitary; this, in turn, secretes large peptide hormones (gonadotrophins) that act on the testes. Gonadotrophins enable both the formation of sperm and the production and secretion of testosterone into the blood. There is thus a chain of command, starting in the brain, though this can be moderated by levels of testosterone in the blood.

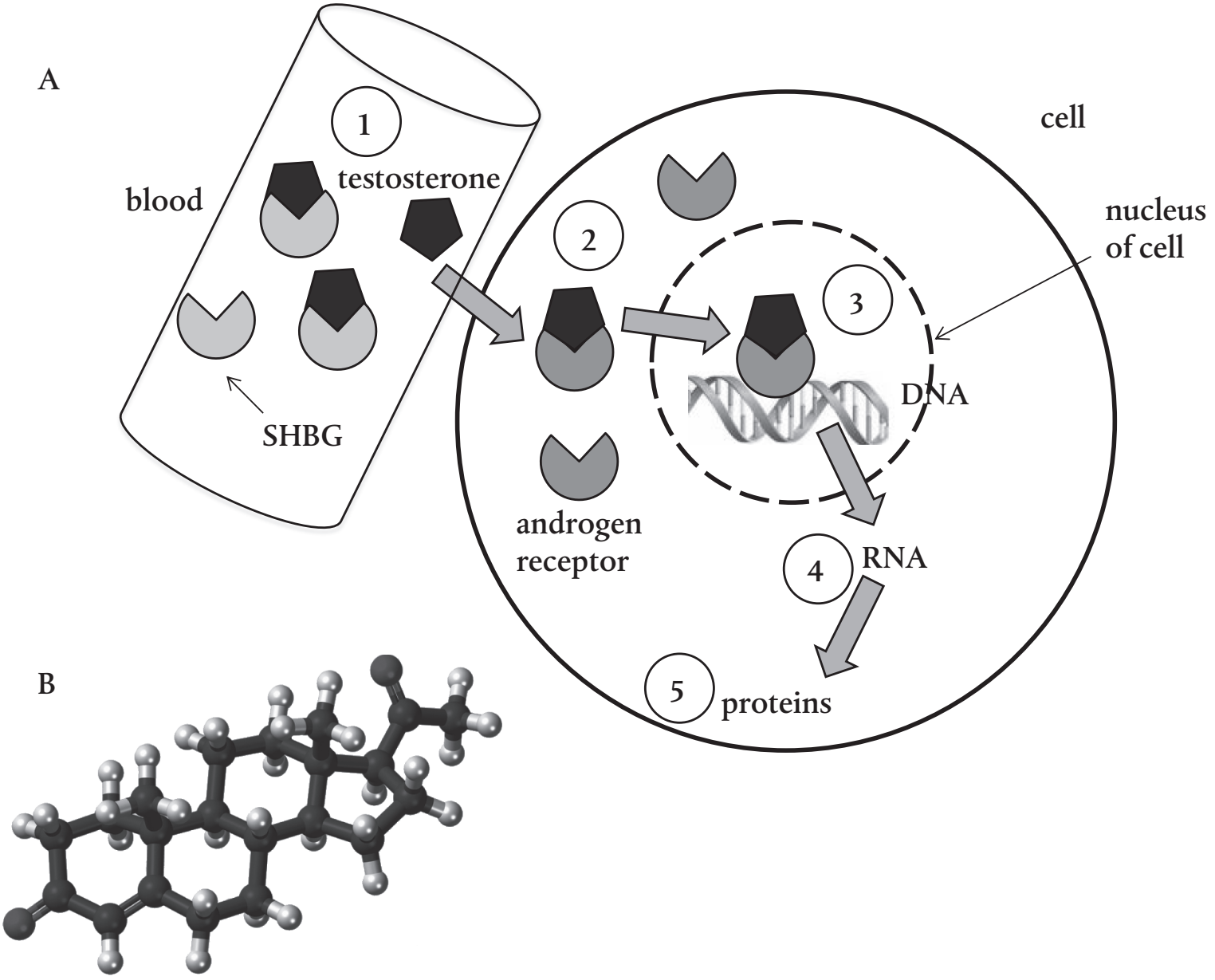


Fig. 7. (A) The process by which testosterone acts on cells. (1) Testosterone in the blood is either bound to the protein SHBG or floats free. The free fraction is able to enter the cell where (2) it binds to its receptor protein. (3) This complex then moves into the nucleus and binds to DNA. (4) DNA then makes a special set of RNA molecules that, in turn, (5) enable the formation of particular proteins. (B) The testosterone molecule. The dark spheres are carbon atoms, the pale ones are hydrogen, and the two grey ones are oxygen. Note that the backbone of testosterone is made up of four rings of carbon atoms. Three of them are formed from six interlinked carbon atoms, and the fourth (on the right in this diagram) has five. This is what constitutes a steroid.

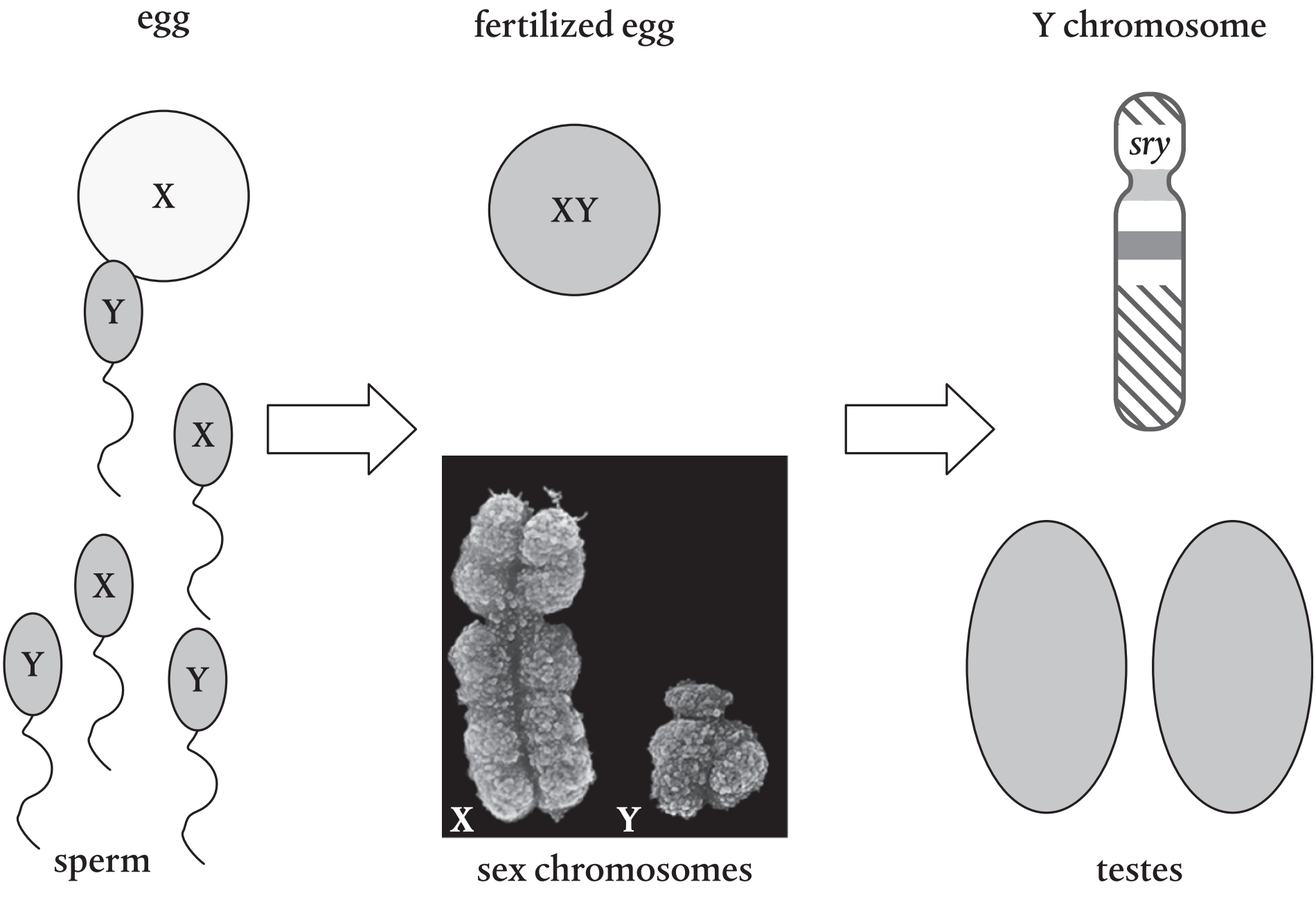


Fig. 8. How a male is made. If a Y-carrying sperm fertilizes the egg, then it forms an XY embryo. The presence of a Y chromosome (shown together with the X in the insert) and its associated *sry* gene enables the formation of the testes.

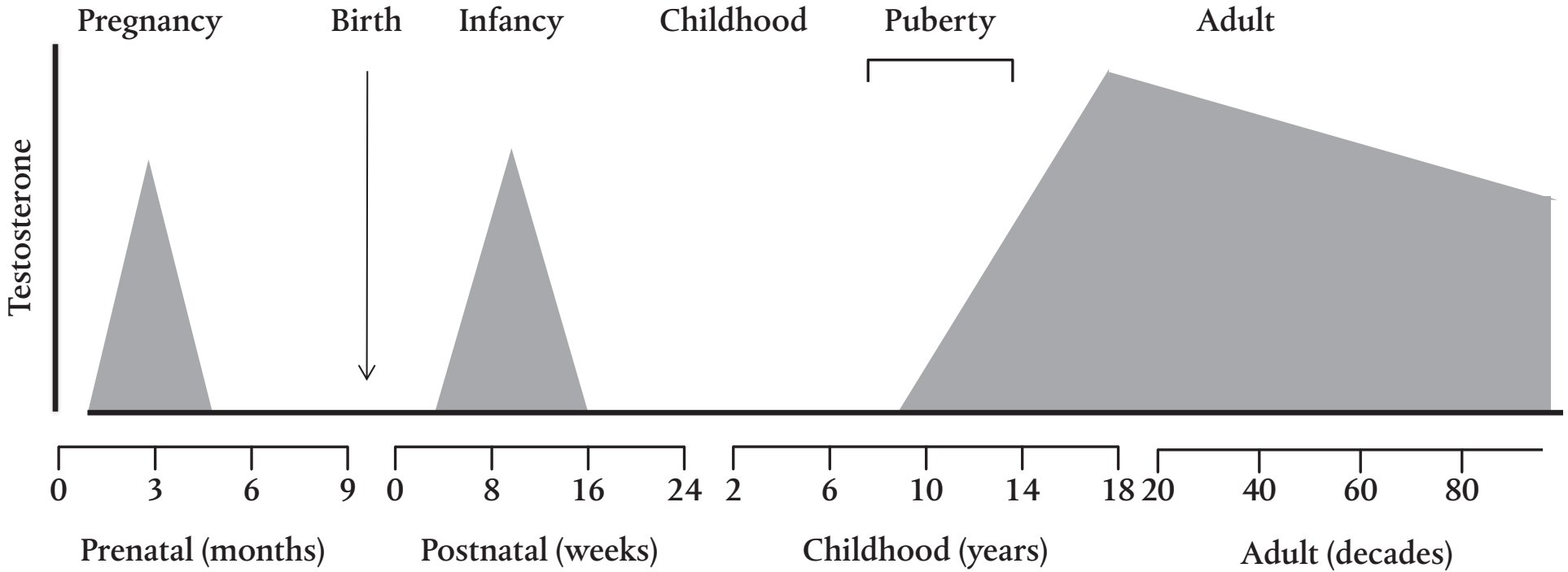


Fig. 9. The three surges of testosterone secretion during a man's life. Episodes occur during foetal life, again shortly after birth before the more sustained secretion beginning at puberty and lasting, to some degree, for the rest of a man's life.

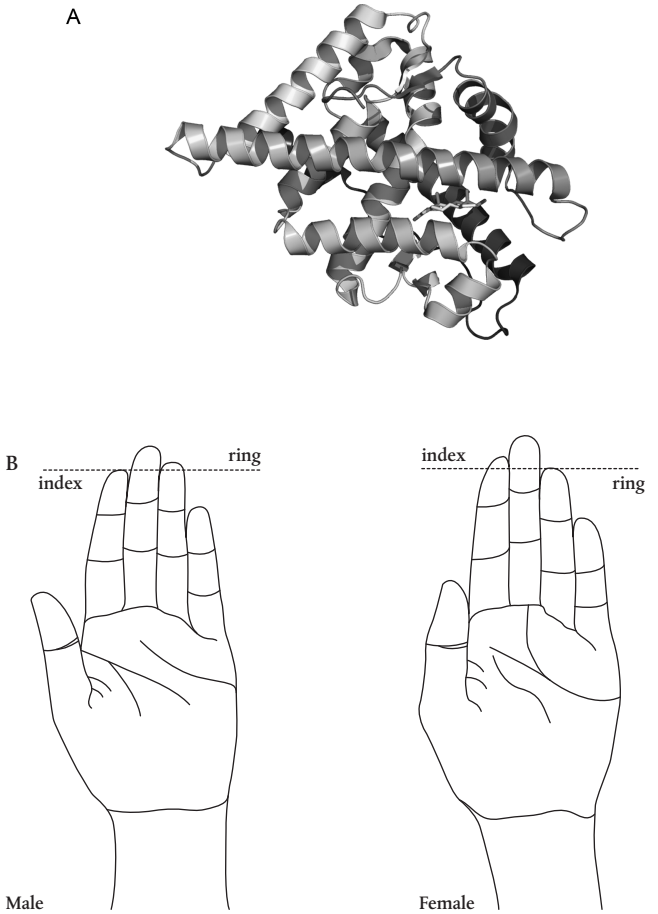


Fig. 10. (A) The complex protein that is the androgen receptor. It is made up of a long ribbon of amino acids. Testosterone attaches itself to this molecule. (B) The different ratios between the lengths of the second and fourth digits in males and females. Note that these ratios, though statistically different, overlap.

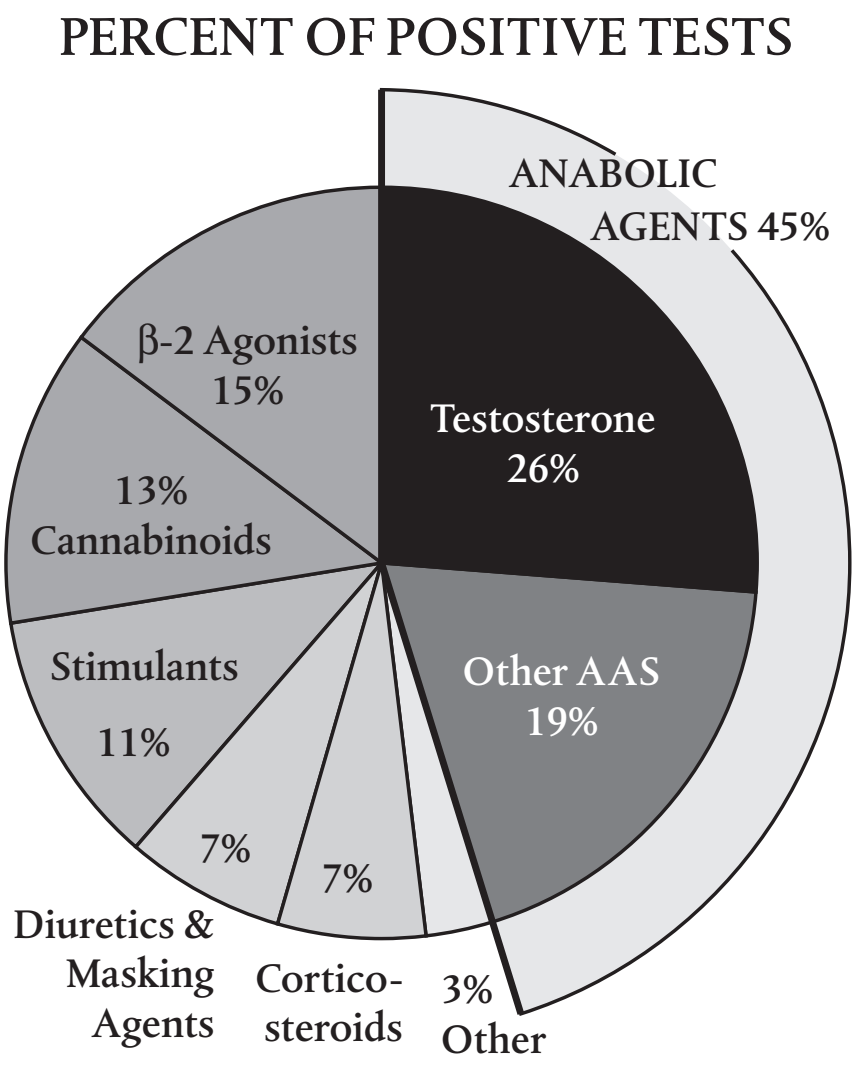


Fig. 12. Testosterone or associated steroids (AAS) are the commonest illegal drugs taken by sports athletes.

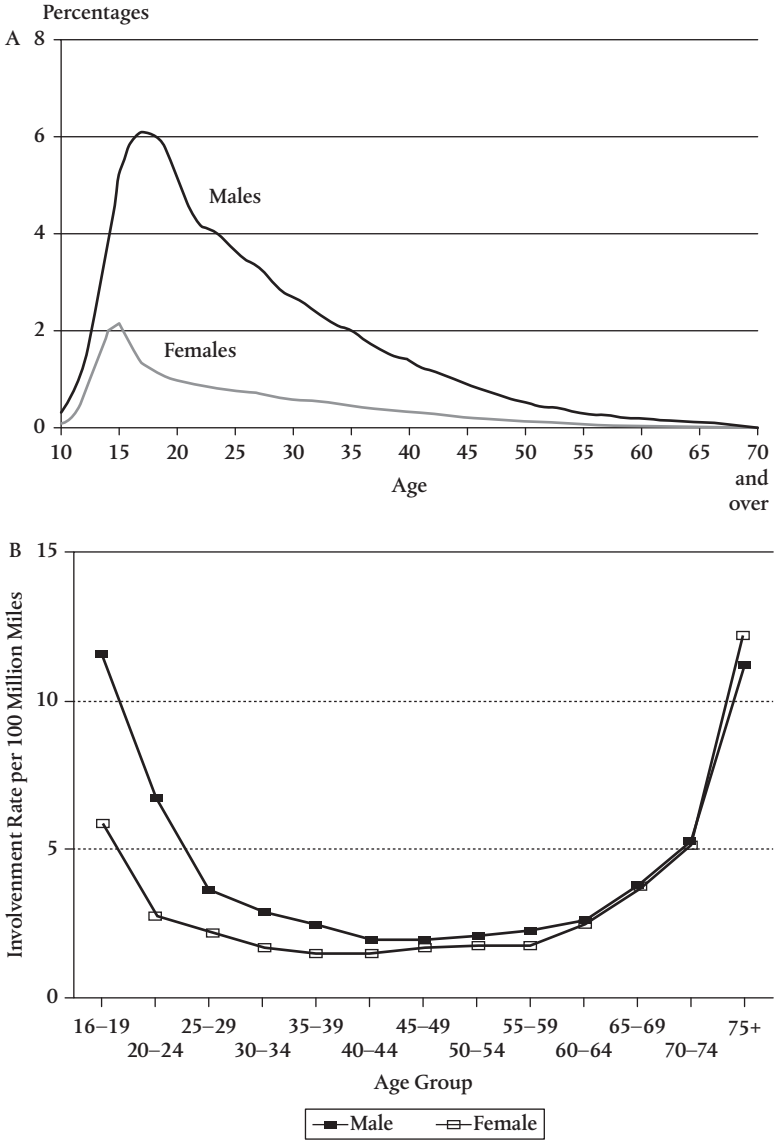


Fig. 13. (A) Criminal offenders as a percentage of the population by age and gender (Office for National Statistics, UK). Note the excess of young males, though young women are also more likely to offend than older ones. (B) Risks of a car accident by age and gender (USA). Note that while young men are more likely than young girls to have an accident, rates rise in older age in both sexes.

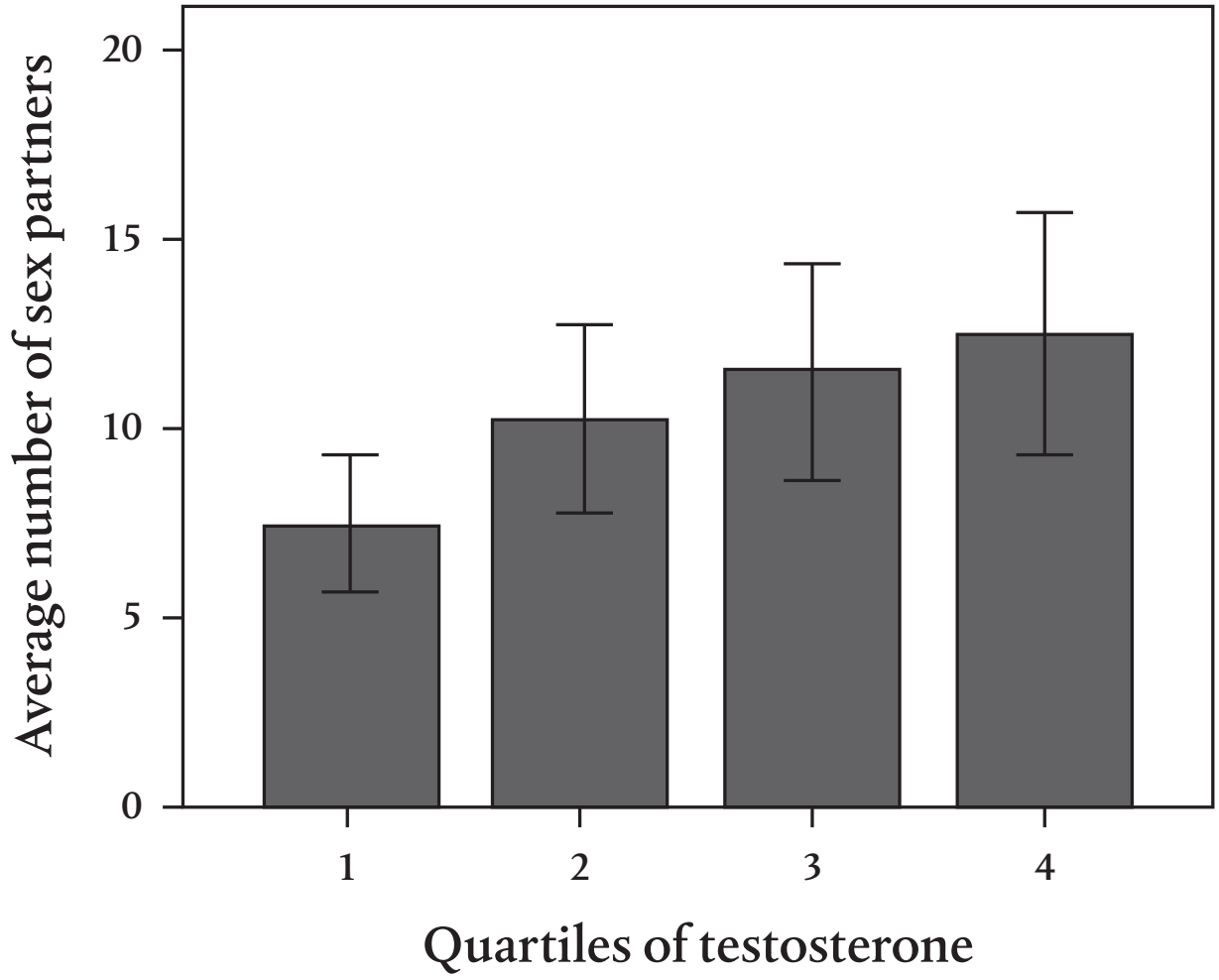


Fig. 14. There is a correlation in later life (>70 years) between testosterone levels and the number of sex partners a man has had. Each quartile represents men divided into four groups based on their increasing testosterone levels.

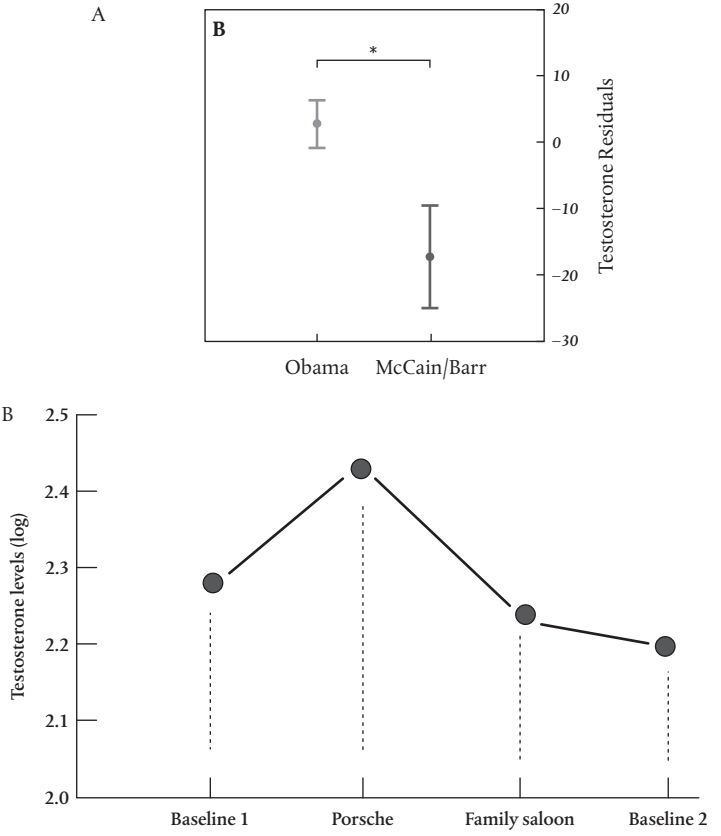
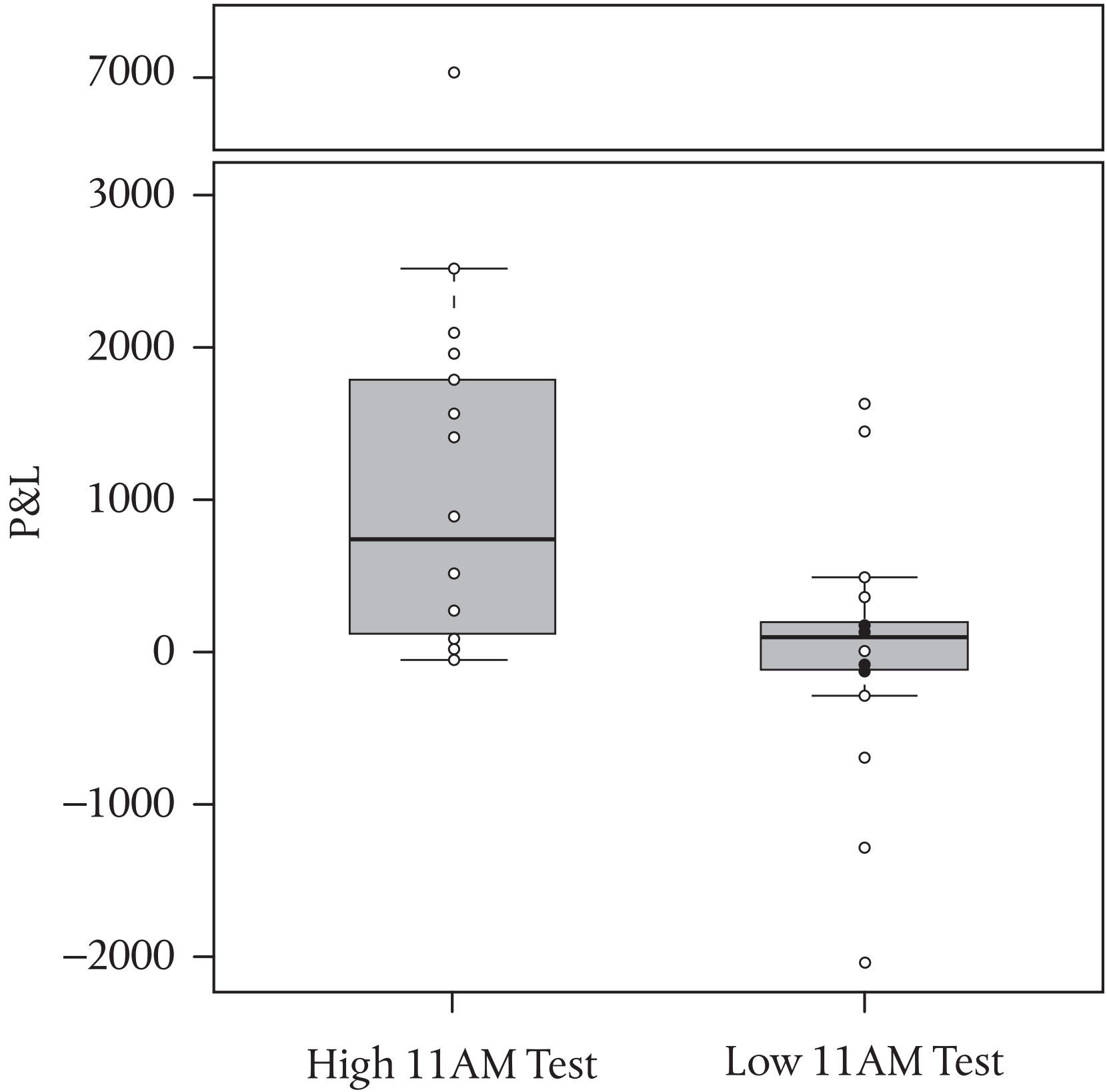


Fig. 15. The winner effect. (A) Differences between testosterone levels in Obama and McCain supporters on the night of the election 2008. (B) Driving a Porsche raises young men's testosterone, whereas driving a family car does not.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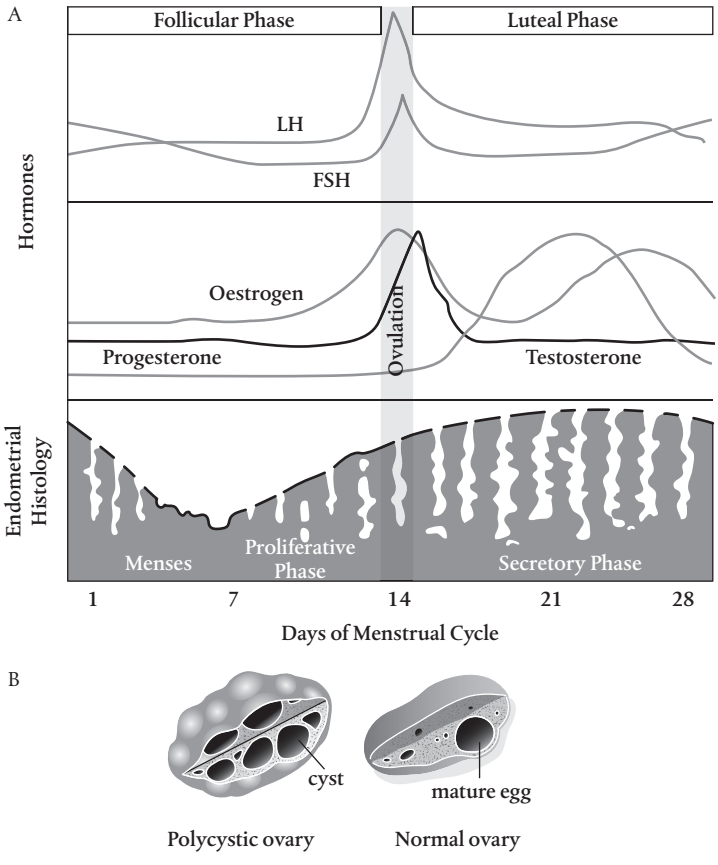

Fig. 17. (A) Variations in hormones during the menstrual cycle. Luteinizing hormone (LH) and Follicle-stimulating hormone (FSH) are the two gonadotrophins from the pituitary: they peak at mid-cycle, when ovulation occurs. LH is particularly important for ovulation. Oestrogen also peaks at mid-cycle, but progesterone is only secreted in large amounts during the second half of the cycle. Testosterone tends to peak at mid-cycle as well though some researchers have not confirmed this (there is probably considerable individual variation). The changes that occur in the lining of the uterus are shown at the bottom. (B) Normal and polycystic ovaries. The latter tend to secrete large amounts of testosterone.

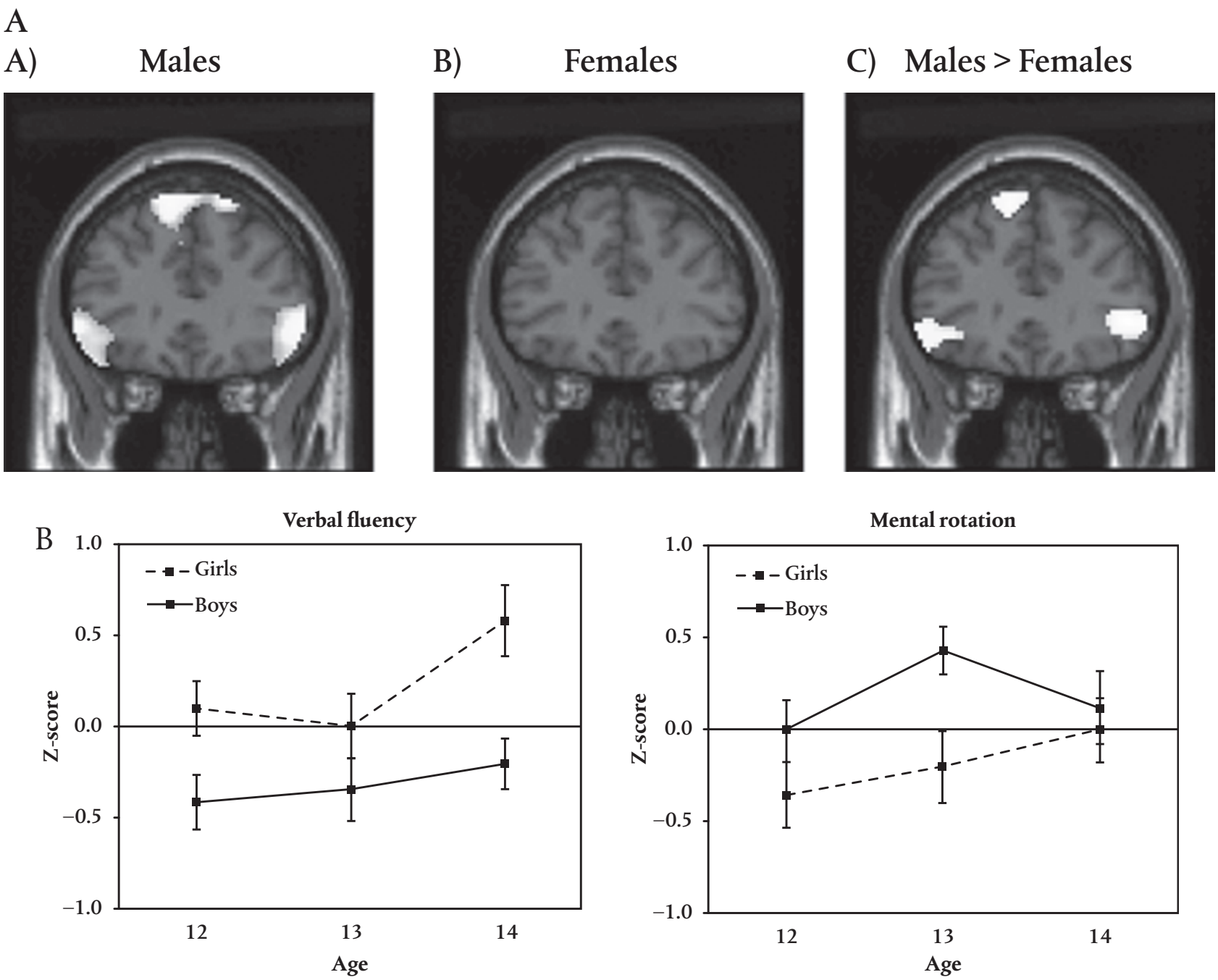

Fig. 18. (A) Sex differences in activation of the brain (fMRI) after subjects were asked to rate faces as socially approachable. Males showed greater activation than females in areas of the frontal cortex, though whether this indicates greater caution or increased distrust is not clear (see Chapter 10 for more discussion of this part of the brain). (B) Sex differences in verbal fluency (better in girls) and mental rotation (better in boys). These differences are present before puberty and do not change during it, suggesting that different hormone levels during adulthood are not implicated. The possible contribution of prenatal testosterone is discussed in the text.

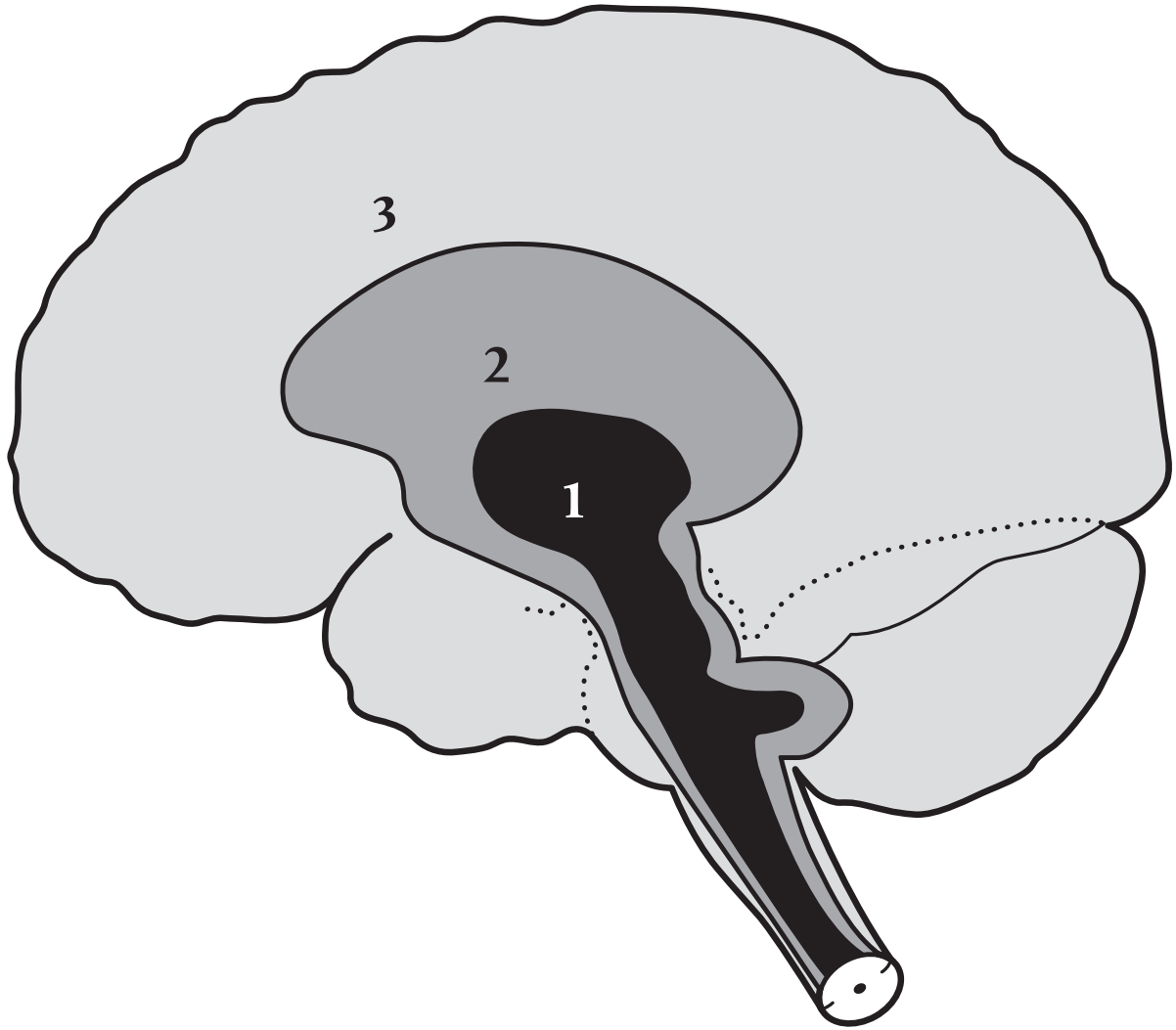

Fig. 19. Paul MacLean's 'triune' brain: (1) reptilian (reflex); (2) paleo (old)-mammalian (emotion); (3) neo (new)-mammalian (cognition).

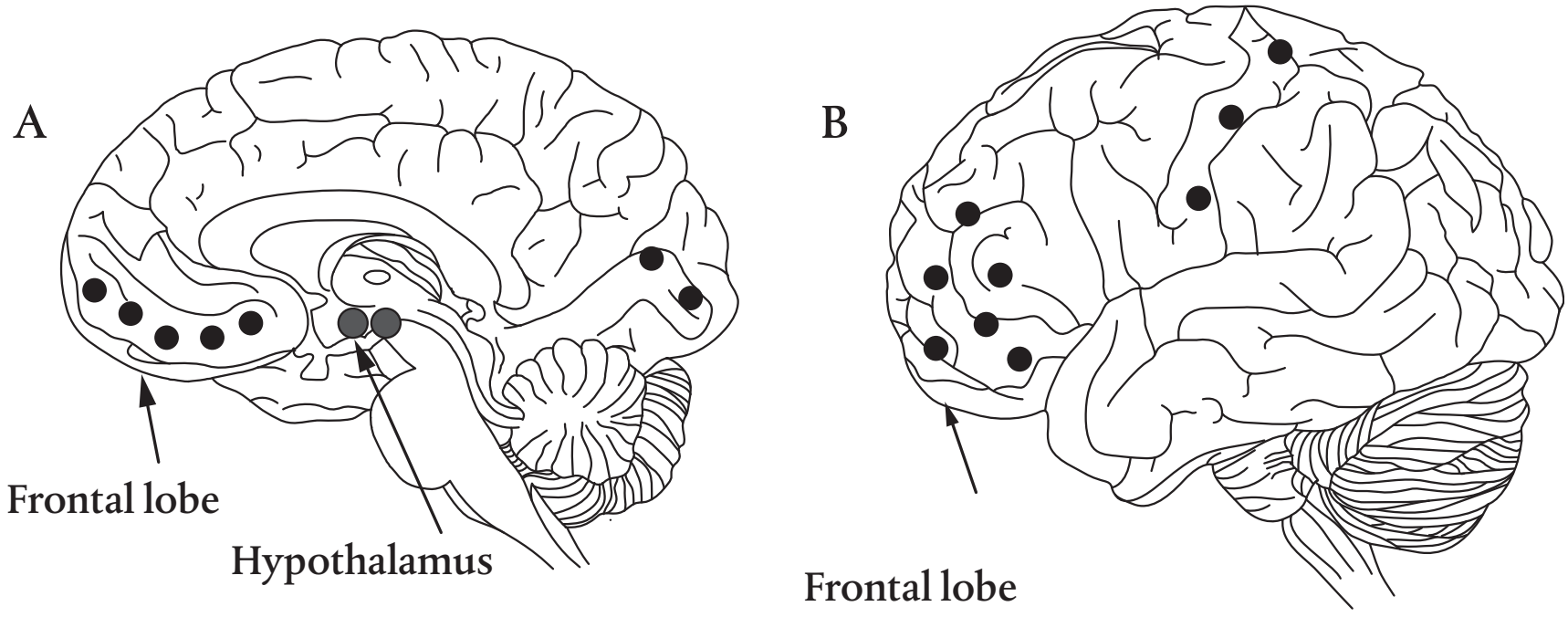

Fig. 20. The parts of the human brain that contain androgen receptors (dark spots). (A) View of one half of the brain from the inside. In the cortex, receptors are concentrated in the lower part of the frontal lobe: the functions of this area are described in the text. There are a few at the back of the brain, a region that is concerned with vision. There are large concentrations in the hypothalamus. (B) The brain from the outside: receptors cluster in the frontal lobe, but there are a few in an area concerned with movement.

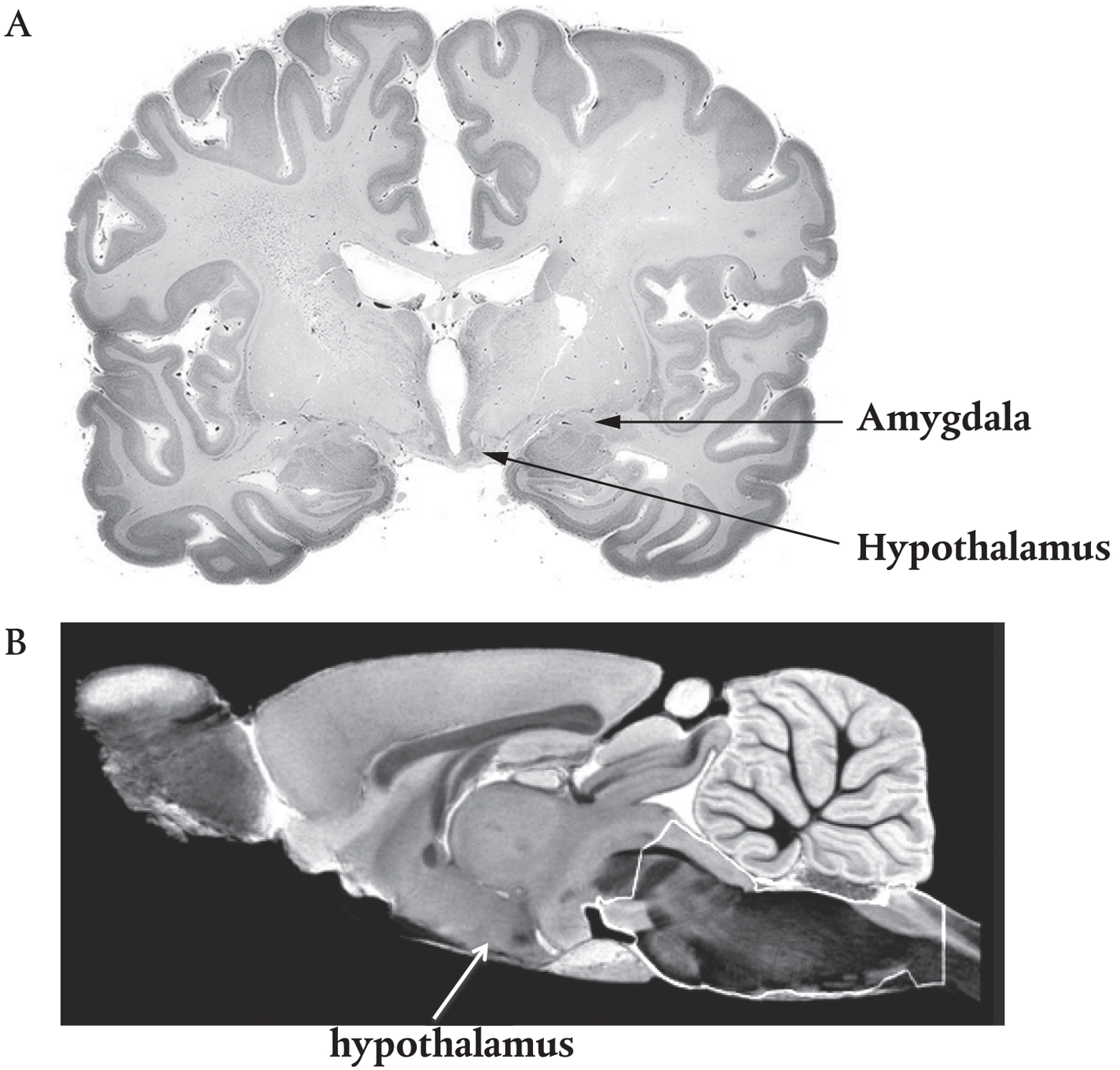

Fig. 21. (A) A section through the human brain: many receptors are present in the hypothalamus and amygdala, parts of the limbic system. (B) Longitudinal section through the rat's brain: the large protuberance at the front (left) is the olfactory bulb, emphasizing the importance of smell for rodents (in humans it's about the size of a small pea). The distribution of androgen receptors is very similar to that in the human brain.

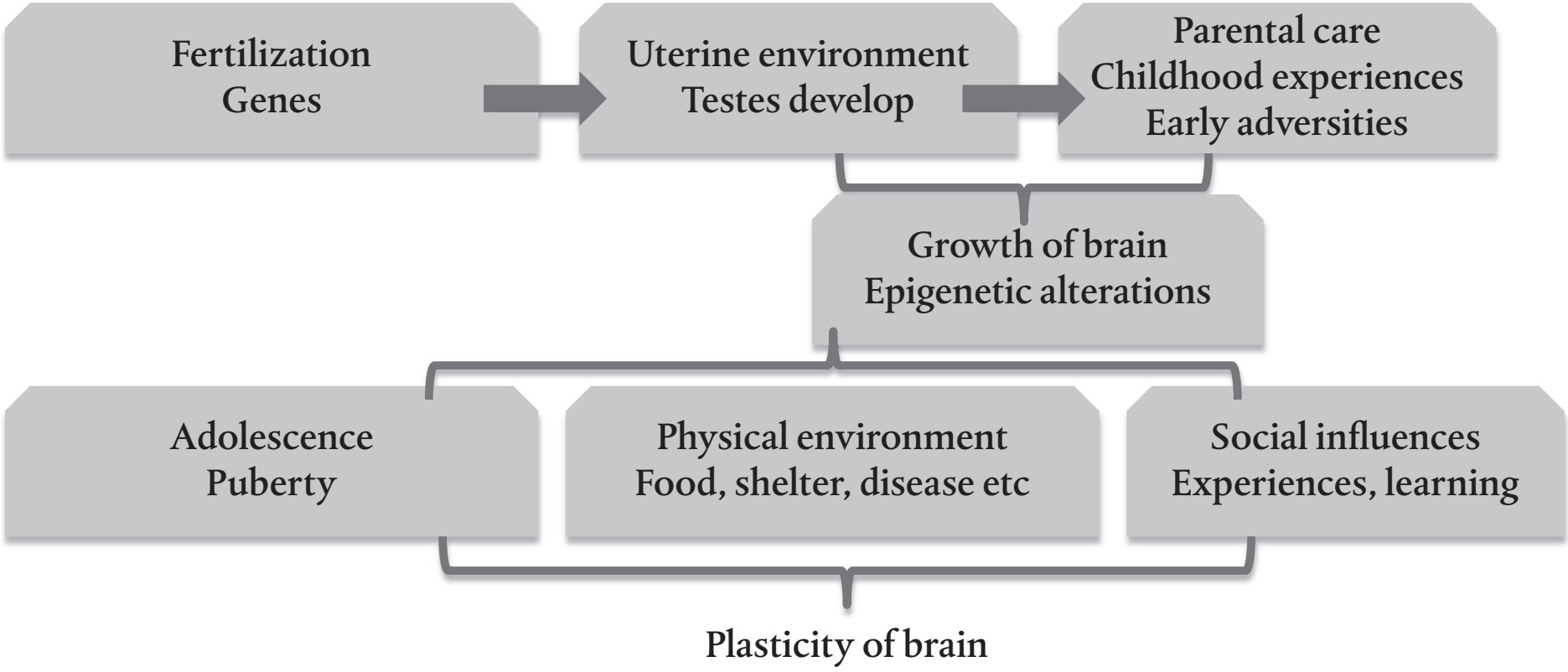

Fig. 22. There are manifold influences on the brain during life, from the earliest moment of fertilization, during embryonic life, childhood, and the slings and arrows of adulthood. Testosterone is only one of them. Occasionally, this process results in a genius. What distinguishes geniuses from the rest of us is not their testosterone but their brains. But contemporary neuroscience is not at a stage that allows it to tell us what the essential difference might be.