Ask a physiologist!

How many times do you blink in an hour? Why do we blink? (Alex, age 11)

Dr Patricia de Winter of University College London replies:

This is a very good question but it does not have a simple answer because blink rate in humans varies tremendously – from 2 to 50 blinks per minute depending on the circumstances. For example, if you are concentrating very hard on reading something, such as this answer, you will probably blink less frequently than if you were sitting chatting with your friends (not to be recommended in class). There are three type of blink: spontaneous, reflexive and voluntary.

Spontaneous blinks are those that we don't notice (unless we start thinking about it) and serve to keep the eyeball clean and moist. However, it has been noted that the spontanous blink rate is more than that needed to simply prevent the eyeball from drying out – so why do we blink more than required? One answer is that spontaneous blinking is affected by a substance called dopamine in the brain which affects particular nerve cells – some studies have shown that giving drugs that affect dopamine levels changes the blink rate, although how exactly this works is yet to be explained. It is also known that people with Parkinson's disease, who have lower dopamaine levels in the brain, blink less frequently.

Reflexive blinks are a response to an unexpected event, for example, if an objects approaches your eye (such as when someone tries to put eye drops into your eye when you have an infection). Loud noises or any other startling event can also cause reflexive blinking. This type of blink lasts a fraction of a second longer than spontaneous blinks and is a protective mechanism to prevent damage to the eyeball from potential threats.

Finally, voluntary blinks are those which you do consciously (deliberately). These also last fractionally longer than spontaneous blinks.

Why do men have beards but women do not? (Lewis, age 11) **Why do we have armpit hair? (**Chris, age 14) **Why do men have facial hair? (**Oliver, age 14)

Dr Kirsten Poore, University of Southampton, replies:

Men and women do sometimes look quite different don't they? The first answer to this question is about the development of 'girls and boys' into 'women and men'. And it can be explained by what goes on around the time of puberty, in the early 'teen' years. In both boys and girls, a part of the brain called the hypothalamus sends more signals to a gland underneath the brain called the pituitary. This gland releases signals that are able to 'kick into action' the ovaries (in girls) or testes (in boys). The ovaries make the hormone oestrogen and the testes make the hormone testosterone. These hormones are what make children start to look more like adults after puberty and help us to tell adult males and females apart. The features that develop are called the secondary sex characteristics. For girls, these include the development of breasts and the appearance of hair under the arms – but not usually on the face. In boys, there is a deepening of the voice, growth in height and strength and the appearance of hair on the face, as well as on other parts of the body. Interestingly though, testosterone is also responsible for slowing and even stopping hair growth in older men, leading to baldness.

The second answer is actually another question. We could also ask why is it that males and females appear so different. Why do men have beards, for example, at all? Perhaps beards help to protect against the cold? But this can't be necessary for survival since women don't need beards. In other animals, when there are big differences in how adult males and females look, it is usually to make one of them more attractive to the other sex, or more powerful to potential rivals. Think about the manes of male lions or the tail feathers in male peacocks. This is known as 'sexual selection'. Not that many centuries ago, most men still had beards, but these days most men shave off their beards. Has our idea of what is attractive changed?

PS. Beards grow faster than any other hairs. Without shaving, a man's beard might reach 30 feet in his old age.

In most Biology text books it states that a moist surface is required for efficient gas exchange at respiratory surfaces yet I seem to remember an examiner stating that this is not the case and that diffusion would take place more rapidly without a layer of moisture. Could you, please, clarify? (Lesley Thompson, Teacher, Spalding High School)

Although we usually answer questions posed by pupils, we thought this was quite a good one, so asked Dr Glenn Baggott of Birkbeck, University of London to reply:

They are both wrong and right!

First, it depends on what is meant by efficient gas exchange. For example, if there were not a moist surface on the alveolus of the lung, by whatever definition you use the word efficient, it would be bad. The thin layer of water is needed to contain the surfactant which ensures adequate inflation and deflation of the alveolus. Without that, gas exchange will indeed be inefficient.

On the other hand, the proposition that diffusion would be perfect without the moisture depends on the gas species. The permeation of a liquid by oxygen is slower than carbon dioxide. The term permeation here refers to the rate of transfer of oxygen through the layer. This is not the same thing as diffusion, which depends on diffusion properties of the gas species, the driving force for the diffusion and the solubility of the gas species in liquid. Carbon dioxide in the liquid layer is much less of a barrier. For example, in the chicken egg the ability to lose carbon dioxide to the atmosphere is always substantially more in the early stages of development, but as the membranes inside the shell and water are removed from them by osmosis (during the first week of incubation) the ability of oxygen to permeate the shell and membranes, so reaching the circulation, increases substantially. In consequence of this, the permeability of the shell and its membranes reaches a maximum so allowing the chick embryo to grow.