

58 Energy metabolism and the action of adrenaline

At the start of physical exercise, signals from the central nervous system (brain), in particular the hypothalamus, as well as from the muscles used, activate the hormone system. This means that the pituitary gland releases **ACTH** (adrenocorticotrophic hormone), **STH** (growth hormone) and **ADH** (anti-diuretic hormone) or the adrenal medulla releases the catecholamines **adrenaline** and **noradrenaline** by activating the sympathetic nervous system.

These signal hormones either have a direct effect or regulate the release of secondary hormones via a feedback loop. The intensity of the hormonal response to physical stimuli varies in individuals, and depends on their health status, diet, the menstrual cycle phase in women and, not least, on general fitness. During shorter training periods at a constant level, hormonal reactions are usually diminished. By contrast, endurance training can intensify the activity of some hormones.

Adrenaline is one example of this intensified effect. It is released in larger amounts in highly fit

athletes during peak physical exertion. Adrenaline suppresses insulin secretion and enhances glucagon synthesis while keeping the blood sugar level sufficiently high during periods of exertion. Depending on the intensity of physical activity, the fat burned in the muscle increases because of the lipolytic effect of adrenaline, which is supported by glucagon and glucocorticoids, making high plasma levels of fatty acids available.

The benefit of adrenaline on energy metabolism is further enhanced by its central stimulating effect and its ability to improve the contractility of the heart and skeletal muscles. The latter, in particular, affects actual athletic performance as well as conferring long-term benefits. Adrenaline levels at rest reduce with increasing age. Therefore, endurance training stimulates repeatedly higher secretion of adrenaline, providing relative protection for the muscles from early ageing.