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Superhuman Alphas

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Abstract
This Paper looks at the instigators to the fight-or-flight response and how it relates to the character Bill from the 'Alphas' TV Programme. Bill stimulates the fight-or-flight response on command in order to increase strength. The biological aspects are examined in this paper and how they relate to the Alpha, Bill.

Introduction
Alphas is a TV programme about a group of gifted people who have a series of heightened natural responses which makes them almost superhuman. This article looks at the pathway that is excited by Bill to illicit his increase in strength, possible hypotheses to how it could be done and the dangers behind this effect when it is prolonged.

Alphas - Bill
Bill is able to increase his strength on command, it would seem even if he is not presented with a life-threatening situation. There are a series of images that appear in the first episode which are meant to correspond to the pathway by which Bill becomes stronger than a normal human.

The screenshots show images of a neural pathway that sets off the response; blood is then shown to be pumping to the heart and then the heart increasing in speed. The effect seen is an increase in sweat production and strength, which is associated with the fight-or-flight response.

The Biological Response
The perception of a threat starts a signal in the hypothalamus. This signal is then transmitted to the pituitary gland causing a chemical messenger, ACTH, to be released into the bloodstream, as well as a nerve signal. Both will be received by the adrenal gland [1].

Heart contractions change in strength when the cardiac muscles containing long action potentials are modulated by the concentration of Ca^{2+}. The heart uses the boost in Ca^{2+} concentration to increase the force in the contraction [2].

The nerve impulse and chemical messenger then activate the release of epinephrine (adrenaline) and norepinephine from the adrenal medulla into the bloodstream; this activates β-adrenergic receptors on the heart. In turn, this results in the activation of adenylate cyclase; it increases cyclic AMP, promoting the cAMP-dependent phosphorylation of a number of different proteins within cardiac muscle cells [2].

The phosphorylation of these proteins increases the concentration of Ca^{2+} in the sarcoplasmic reticulum [SR] within muscle cells. Phosphorylation of the calcium channels results in more calcium ions entering the cell, increasing the capacity for calcium ions. The SR can then release a higher calcium concentration during the next action potential which in turn activates a higher number of actin-myosin interactions, contributing to a stronger contraction. As the SR then tries to accumulate the calcium ions again, the contraction is shortened [2].

If there is an increase in intracellular Ca^{2+} for a short period of time that causes an increase in cardiac muscle contraction, it is in response to sympathetic stimulation. When the force of contraction is increased, the rate of relaxation also heightens, and the stimulation increases the frequency of the heart contraction. This results in a stronger, shorter and more frequent heart beat, as shown in figure 1. It occurs during times when an individual is excited or frightened because of an external stimulus [2].

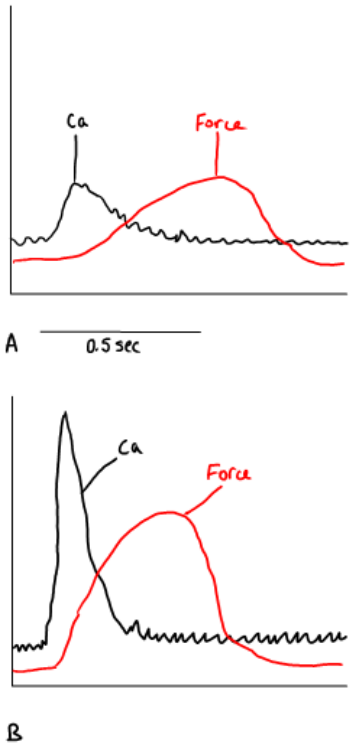

Figure 1A Control mechanism. 1B Stimulated mechanism [2].

The Physical Response

The response to the reaction in the body is from a number of hormones that are released into the body. They cause the increase in heart rate, as shown above, and nonessential systems shut down so that energy can be redirected to other parts of the body. All of which help individuals to survive in dangerous situations [3].

In Context

When Bill induces his fight-or-flight response we see that the biological pathway mentioned above is started. The ACTH could have a similar chemical effect as can be seen in Cushing's disease; a functional pituitary adenoma causes hypersecretion of the adrenal which may be caused by an ACTH-secreting nonpituitary tumour. Something similar could be causing an increase in ACTH levels without much provocation. However, this causes weight loss, skinny limbs and muscles as a result of the muscle wasting away. So the process would need to be short-lived in this Alpha.

Dangers

Having a prolonged fight-or-flight response the individual will pass through the final of three stages: alarm, adaptation and finally exhaustion, as shown in figure 2 [4].

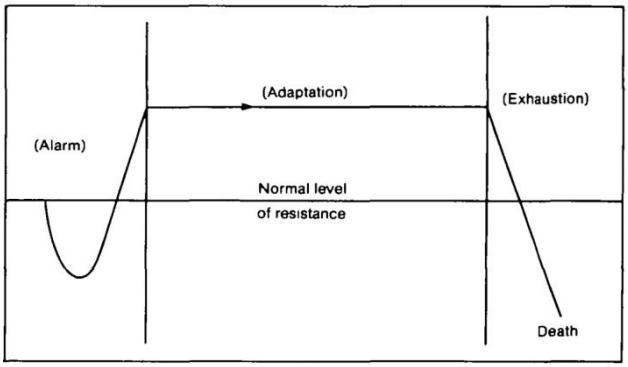

Figure 2 Three stages of the fight-or-flight response [4].

Even as the body prepares for survival, it interferes with other key bodily functions such as: digestion, reproduction, growth and tissue repair [5]. Energy that is normally used by these systems is redirected to the fight-or-flight response [3]. If Bill really were to prolong his response for a lengthy period of time then the rest of his functions would no longer be supported and, as figure 2 shows, this would no doubt end in death.

Conclusion

One possible theory is that the Alpha mentioned in this paper could have a similar ACTH-releasing tumour but the release could not be continuous due to the health issues related with them. If Bill were a normal human then he would not be able to stand the prolonged exposure to the conditions within the body during the fight-or-flight response. However, if his body was in some way adapted to the increase in ACTH concentration, his body may be better suited to induce the response in comparison with a normal human that is affected by the higher concentrations.

References

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