THE GENERAL ADAPTATION SYNDROME

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It will show you how ahead of their time these two great pioneers were – and are – in their thinking.

The training of athletes for strenuous physical activity today is much an art and less a science. We lack too many basic facts about the effects of muscular exercise on the human organism even for the most modern training regimes to be called scientific. Personal judgement, opinion, authority and sheer enthusiasm continue to play nearly as important a part in PRODUCING the champion as in the earliest days of modern competitive running when Walter George of England as far back as 1886, ran the mile in 4 minutes 12.75 seconds.

The modern textbook on coaching methods tells next to nothing of a scientific nature of how to train the body – functions for speed and endurance. Those solid facts are there to enable us to do little more than guess why one athlete makes his record time whilst another, working to exactly the same training program, may fail to perform even near his best. As Professor A.V. Hill says (1) in his article in the Encyclopaedia Britannica, “There is very little physiological knowledge about the changes which come over the body in physical training”.

The guiding lights for many coaches have been the methods used by the reigning champions and the most successful trainers. Occasionally, with imitation, real progress seems to have been made. For instance, it is now generally accepted that for maximum possible performance, an athlete must train for hours rather than minutes a day and the FAST-SLOW training principle first used by the Swedish runners in the 1930’s is now widely and successfully practised in many sports. But whether the improvement in standards is due to new methods or greater worldwide interest and participation, one can do little more than guess. Methods of training have not yet been evaluated scientifically.

It is not difficult to find the reason for the lack of knowledge about training, for the human body is a complex organism with what seems countless known physiological, psychological and social factors acting and interacting. It is difficult and time-consuming to make well-controlled experiments, holding enough variable factors constant, in order to come to many definite conclusions. Since modern civilised society holds the opinion that to strive for athletic honours is a worthy goal for some of its members, there is good reason for the scientists being curious about the basic principles governing strenuous physical performances. There will have to be observation and experiment with the whole athlete directly in his particular specialised sphere of physical performance, if there is going to be real progress in solving the problem of how to train an athlete to perform his best.

While he should be aware of our general lack of insight into training mechanisms, he will make a poor coach who has no basic philosophy to guide his teaching. The purpose of this paper is to propose the acceptance of the General Adaptation Syndrome theory of Hans Seyle as a scientific basic philosophy to guide his teaching. Whether he believes that the more training the athlete does the better the eventual performance will be, or that it is not so much a question of how much, but how the training is done, the present author suspects that the Seyle STRESS concept will provide the framework of a sound theory for future scientific observation and research in training.

The author suggests that a more general understanding of the stress and Adaptation energy concept will prevent the waste of much athletic talent and hence add in some measure to the sum total of human happiness.

The Seyle hypothesis of the General Adaptation Syndrome has important implications in the field of Medicine, but it would appear to the present author that a knowledge of the G.A.S. and its implications will result in the gain of considerable insight to the coach who stresses his charges with physical exercise.

Hans Seyle has shown that such stressing agents as infections, poisons, trauma from burns or mechanical damage, heat, cold, starvation and muscular fatigue as well as having their own quite definite specific actions on parts of the organism, have invariably generalised and stereotyped non-specific effects on the body, superimposed upon all the specific effects.
The outstanding effects of prolonged stress that Seyle reported (5, 6 and 7) are...

1. Enlargement of the adrenal cortex and cellular changes there indicate or increased glandular activity.
2. General atrophy of the lymph glands with concomitant changes in the blood cell count, particularly in resect of eosinophils and lymphocytes.
3. Erosions and ulcers in the gastro-intestinal tract.

These changes and others are characteristic of what Seyle names the **General Adaptation Syndrome** (the G.A.S).

Under the influence of various stressing agents, including muscular exertion, which can be an important stressor, the body changes in such a way as to adapt itself. According to Seyle, this adaptation can be differentiated into three states...

1. The Alarm Reaction
2. The State of Resistance
3. The State of Exhaustion

The Alarm Reaction is sub-divided into two stages ... shock and counter-shock. Shock represents the organism's initial response to a sudden exposure to stimuli to which the organism is neither quantitatively or qualitatively not adapted.

For example: an animal may be in a state of training for muscular exercise. Running on a treadmill for five minutes may cause a very mild G.A.S., whilst the untrained litter-mate may show a marked response on stopping. But provided the stress is severe enough even if trained to withstand it, the animal will show some alarm reaction changes.

The changes of shock include diminished blood pressure, loss of muscle tone, a sustained very high heart rate and gastro-intestinal ulceration if the stress is very severe. However, with mild stresses (and exercise usually only acts as mild stress) the main signs are merely transient high heart rate and some chemical and cellular changes in the constitution of the blood.

As Seyle pointed out, muscular exercise as a stress gives, a minimum of shock and a maximum of counter-shock. Exercise causing very little tissue damage precipitated an almost pure G.A.S. response.

In the stage of counter-shock the physiological changes of shock become generally reversed ... e.g. blood pressure rises above normal ... and soon it seems that the adaptive mechanisms in the body are proceeding at a greater rate than the destructive processes. Adaptation may be defined as being a state of the organism characterised by an increased resistance to stress through previous exposure to stress.

During the increased rate of adaptive processes of counter-shock the organism becomes active, shows evidence of increased psychic stimulation and there are noticed activities indicating a sense of wellbeing. Physiological changes including lymph gland atrophy and a lowered eosinophil cell blood count occur.

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In the stage of resistance the organism will continue resist the original stressing agent but the animal becomes more vulnerable to other stresses, which in addition to the original stress if severe enough, may each be capable of producing Alarm Reaction superimposed physiologically on the Resistance reaction. The final stage of the G.A.S. is the Stage of Exhaustion, which represents the non-specific reactions resulting from prolonged over-exposure to which adaptation has been developed but
can no longer be maintained. During the Exhaustion Stage resistance to all stressing agents is lowered and any stress will precipitate a violent reaction of prolonged shock and death.

The passage of the animal from one stage into another is usually a gradual one and it is not always easy when specific effects of a particular stressing agent are evident, to recognise the stage. There seems little doubt, both experimentally and in practice that resistance to all stresses decreases gradually as the Exhaustion stage is approached.

Seyle pointed out many times in his papers that we know practically nothing about the physiological changes occurring as the animal progresses from a state of resistance towards exhaustion. We know even less about human responses.

By way of general illustration of the G.A.S. response to cold as a stressing agent, it may be of interest to re-tell Seyle’s story (7) of what happened to mice when taken from mild room temperature and placed in a freezing chamber. When taken from the room at about 700°F and placed in an environment at close to freezing point the mice at first became prostrated with shock. They then started to run about and carry on their normal activities and at first appeared over-active (the counter-shock phase) and then apparently passing into the State of Resistance, when it was difficult to tell the difference be between them and mice living under normal conditions.

After some hours one by one the mice began to succumb, becoming sluggish in their activity and finally dying in shock.

Those who have observed athletes during training will by now be able to discern that the Seyle CAP fits in many places. The present author suggests that the athlete when trained hard also invariably shows many responses of the G.A.S.

Seyle postulated that the animal organism (including man) has finite, limited adaptation energy. But as Seyle points out, this concept is an abstraction insofar as we do not yet how the exact nature of Adaptation Energy. All we can say at present is that the body responds as though it has such a limited supply. The facts advanced by Hans Seyle, and the author’s own observations on himself and other athletes who have been in severe training, support the concept that stress effects are summated to draw on the limited adaptation energy.

When everything seems to be nearly equal, some individuals can always be observed to be able to stand distinctly more training than others and continue to show improvement.

Whatever may be the reason for this – whether it is because of hereditary constitutional differences in the store of adaptation energy – the fact remains that only the naive coach would dispense a rigid system of written training instructions. Bitter experience has shown many times that what is one athlete’s training MEAT might well be another’s poison. An individual’s adaptation energy must be one of the first considerations.

References:
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- Seyle H. The Story of Stress, Acta Inc. Medical Publishers, Montreal, Canada