

Maintain high standards and try to be straight forward and clear in your expectations – the responsibility you have accepted is searching for truth clarity and to provide (simply put) - a better way

# Consequences of Maintaining High Standards (assuming they are realistic)

High Standards come with expectations:

1. Everyone will not like it – you will be criticized as “hard to deal with”

2. Everyone (probably most) will not reach the standards

3. Some will

4. Some will excel

Pay attention to these people – their photographs are on slide 26 and they are not Waldo

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To Answer the Fundamental Questions Posed – do we need new (relatively) paradigms: consider a somewhat different approach

approach

new (relatively) paradigms: consider a somewhat different

# Change the Way We Educate Coaches

## ❖ Recent research and review indicate:

- Coaches education rarely contains a formal (degree) aspect dealing with training methodology, physiological and biomechanical concepts - consequently:
- Coaching Knowledge, including S & C coaches: primarily informal, self-directed learning sources - subsequently approach new information in an inefficient fashion (Hornsby et al. 2017; Stoszkowski et al. 2015; Fullagar et al. 2019)
- Examination of coaches' perceptions and practices: typically deals with what, rather than why and how they do it (Hornsby et al. 2017; Stoszkowski et al. 2015; Bailey et al. 2018) .
- Commonly coaches presume that practical experience is more relevant than scientific concepts and paradigms. So, methodologies used by successful coaches are typically perpetuated and rarely questioned. This may in part explain the prevalence and acceptance of pseudoscience and guruism in practice (Balagué et al. 2019; Stoszowski et al. 2020; Stoszowski et al. 2022).
- Sound theoretical and “academic” insights, in contrast, are frequently ignored, disparaged and discounted - Athletes realize the consequences.

## ❖ Result:

- self inflicted limitations on coaches development of open-mindedness, self-reflection, and critical thinking skills.
- coaching intransigence – often reinforced by Athletic Department
- willingness of the sport scientist/S&C to compromise (often as a result of job security fears) - limits both sport science application and development

Balagué et al. 2019; Stoszowski et al. 2020; Stoszowski et al. 2022

# ❖ So, in sport (training and competitive outcomes) we need to re-evaluate and update:

1. Formal coaches education – currently in USA it is focused on sports management aspects, psychological/sociological paradigms - not in physiology or biomechanics, certainly not in evidence based training methodology - reframing of coach education is needed
2. Scientific assumptions and premises– underpin critical thinking - re-evaluation of your, mental process, methods, data etc. should be on-going process:

Objectivism and Determinism (cause and effect)- Scientists assume that the world is a lawful place where events occur as a result of other events that present in the environment.

Empiricism - The act of objective observation of the phenomena of interest

Experimentation – objective observation and examination of the world

Replication - only after repeated replication can the findings of the experiment be added to the collection of scientific knowledge of a field.

Replication is the primary method used to confirm the reliability of a scientific finding.

Parsimony - the most simple and logical explanation of a phenomena should be considered before any highly contrived explanations examined.

Philosophic Doubt -Science assumes the existence and applicability of the laws of logic. Scientists borrow from philosophy and use the laws of logic, including : the law of non-contradiction, the law of identity, the law of excluded middle to discuss experimental observations, inferences, and conclusions about what is true of the world. Thus, ideas evolve as additional objective information becomes available.

3. The development and promotion of solid science and critical thinking for both scientists and coaches. This can be accomplished by considering the athlete as a complex ever developing unit, understanding basic biological concepts and paradigms and understanding the construct of evolutionary pressures.

Sport Science is still in its infancy: For those engaged in advancing athlete well-being and performance: should undertake a responsibility to challenge existing paradigms.

Can we make sport science pioneering work more applicable to the end user?

### Currently:

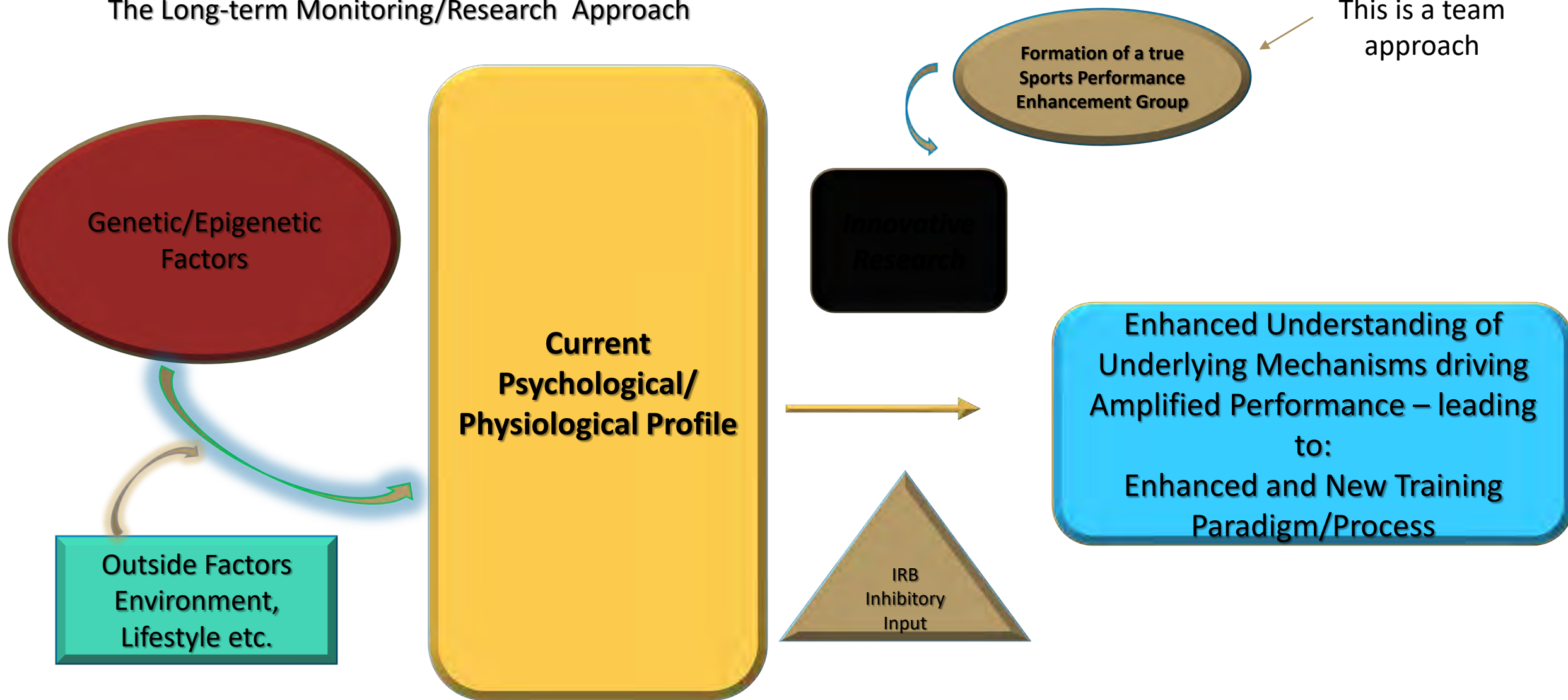
- Often lacks:  
historical/contextual/evolutionary knowledge
- Poor coaching education
- Too little focus on long-term developmental aspects of athletes – too much focus on the here and now
- Ulterior motives and political agendas
- Focus on learning/acquiring skills and some level of fitness
- Limited Impact

### Future:

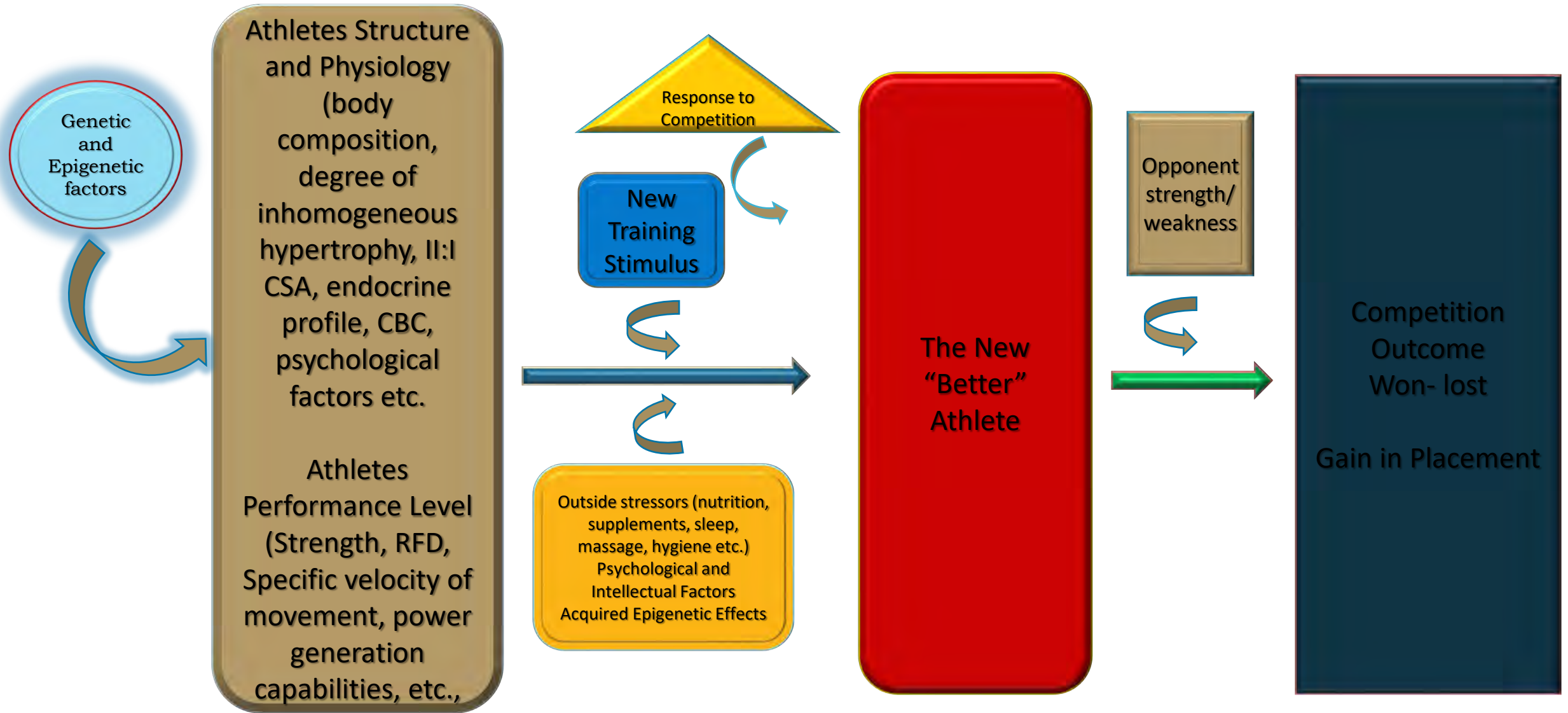
- Greater focus on the “need” for sport
- Update coaching education
- Focus on the complexity of sport, holistic athlete development and the achievement of preparedness- a long-term monitoring approach
- Obviating political agendas
- Courage
- Greater impact

- Hornsby G. et al., 2017.
- Stoszkowski J. et al. 2020.
- Stoszkowski, J. et al. 2022.
- Hornsby, G. et al., 2021.

## The Long-term Monitoring/Research Approach



# The Long-term Monitoring Approach (Sports Performance Enhancement Group)



Sixth: Sport Science because you want to know – because you like what you are doing – at least some of it – emotion (have some) – never give up

CRISPR (Cas-9 protein)- Prime Editing

AI-Human integration

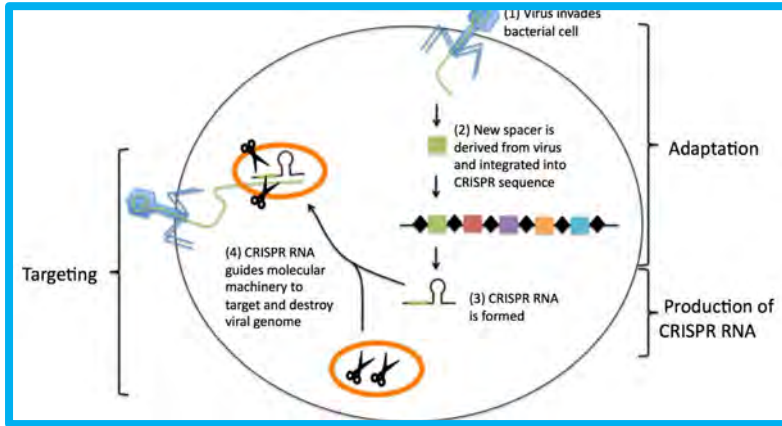
The Singularity

I-Robot the athlete

Await

# CRISPR (Cas-9 protein)

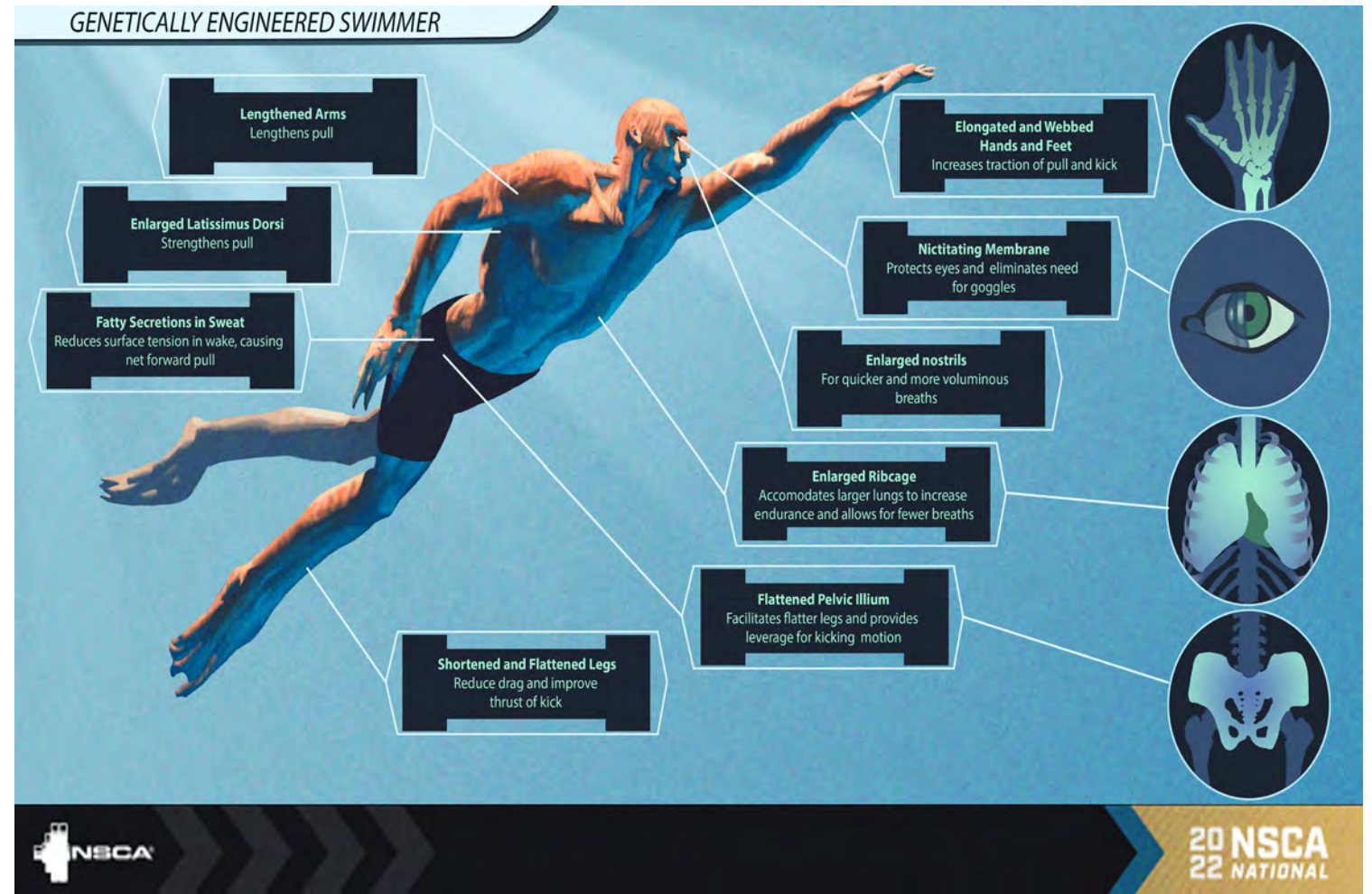
## Clustered Regularly Interspaced Short Palindromic Repeats,



**Prime Editing:** writes new genetic information into a specified DNA site using a catalytically impaired Cas9 endonuclease fused to an engineered reverse transcriptase, programmed with a prime editing guide RNA (pegRNA) that both specifies the target site and encodes the desired edit.

Slate

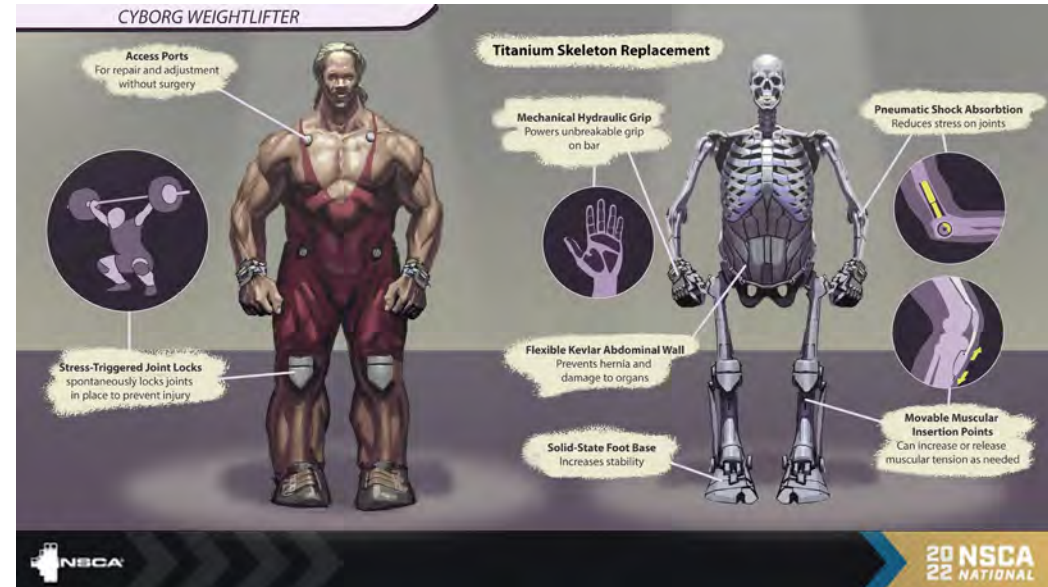
Johnson w. et al. We Are Not Ready to Deal With Gene-Edited Athletes. Soon, countries or parents might try to tinker with people before birth to make them sports superstars. DEC 10, 2019



Dr. Bashir: DS9

AI/Human Interface:  
Cyborg - Hypothetical  
person whose  
physical abilities are  
extended beyond  
normal human  
limitations by  
mechanical elements  
built into the body.

1989, Second season TNG episode "Q Who."



Elon Musk launches Neuralink (2019), a medical research company aiming to integrate human brains with intelligent computers

Neural Lace: an ultra-thin mesh with a collection of electrodes capable of monitoring brain function and facilitating direct computing capabilities from thought.

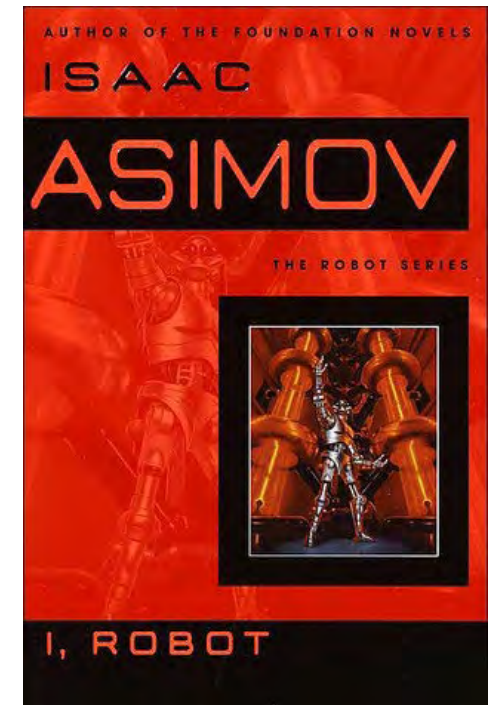
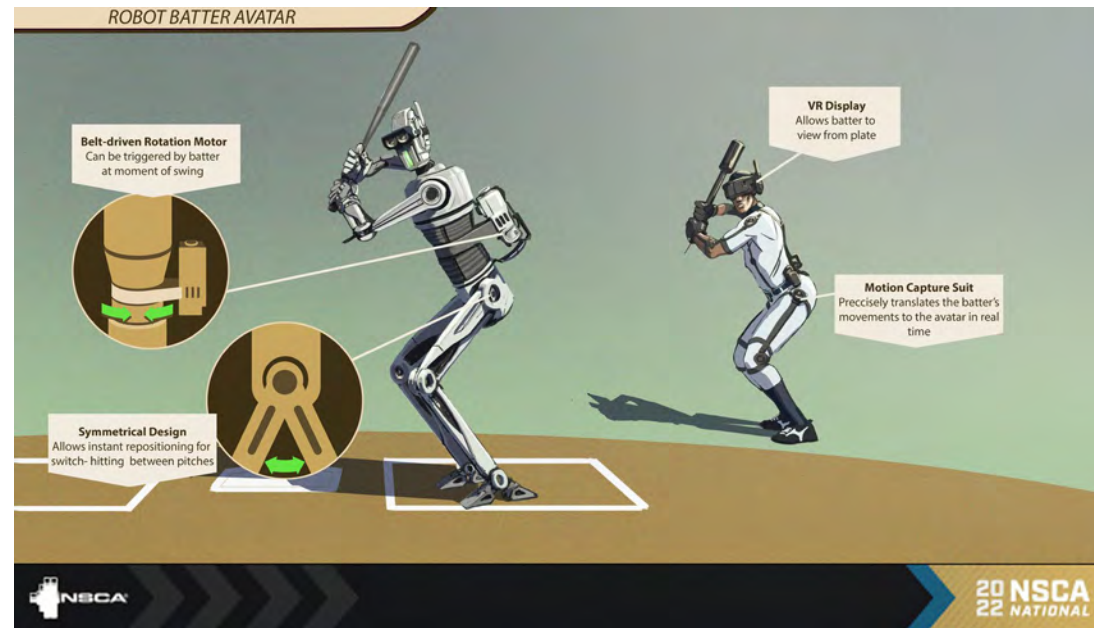
Current Robot: a machine often resembling a human being and able to replicate certain human movements and functions automatically. Robots can do three things: sense, compute, and act – so do humans.

The *singularity* marks the moment when technology overcomes limitations of the human brain, and the restraints of the human mind are surpassed by artificial intelligence.

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Kurzweil, R. The singularity is near: When Humans Transcend Biology. London, Penguin, 2005.

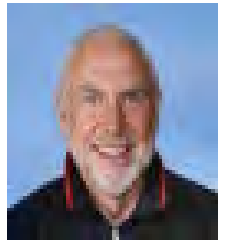


# The Future:

- Totally different “Coaching/Sport Science” paradigms – training or reliance on genetic manipulation or a better AI interface or modify your robot
- Are you a sport scientist, geneticist or robotics engineer?
- Re-evaluation of ethics?

# A last Thought

Everyone Needs Heroes



And my Students (some of them)

Henry V, Act IV Scene III  
R. Kipling: 1000<sup>th</sup> man

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Campbell J.W. The Last Evolution, Amazing Stories, New York, Experimenter Publishing, 1932

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# Finis

## Questions?

Galen divided exercises into three categories, which were termed "strong", "rapid and "violent", which is a combination of the preceding two. Galen's listing of the exercises gives us a fascinating glimpse into the everyday activities of the Paleastrae, Gymnasia and other more leisurely-areas of the ancient world.

The affinities they have with the various sporting events can be made out: kicking of the legs for Pankration, rope-climbing for wrestling, holding the arms up for boxing.

#### STRONG:

- 1) Digging
- 2) Picking up something heavy
- 3) Picking up something heavy and walking with it
- 4) Walking uphill
- 5) Climbing a rope using the hands and feet: commonly done to train boys in the wrestling schools
- 6) Hanging onto a rope or beam for as long as possible
- 7) Holding the arms straight out in front with fists closed
- 8) Holding the arms straight out to sides with fists closed
- 9) Holding out the arms while a partner pulls them down
- 10) The preceding three exercises but while holding something heavy such as jumping-weights
- 11) Breaking loose from a wrestling waist-lock
- 12) Holding onto a person trying to escape from a waist-lock
- 13) Picking up a man who is bending over at the hips and lifting him up and swinging him around
- 14) Doing the same but bending oneself at the hips also when picking him up
- 15) Pushing chest to chest trying to force the opponent backwards
- 16) Hanging from another's neck, attempting to drag him down

### **Exercises requiring a wrestling pit:**

- a) Entwine your partner with both your legs around one of his and try to apply a choke or force his head backwards
- b) The same but using only one leg to entwine the opponents leg closest to yours
- c) The same but using both legs to entwine both of the opponents legs.

### **Rapid:**

- 1) Running
- 2) Shadow-boxing
- 3) Boxing
- 4) Hitting punching bags
- 5) Throwing and catching a small ball while running
- 6) Running back and forth, reducing the length each time until finished
- 7) Stand on the balls of the feet, put the arms up in the air and rapidly and alternately bringing them forward and back; stand near a wall if afraid of losing ones's balance
- 8) Rolling on the wrestling-ground rapidly by oneself or with others
- 9) Rapidly changing places with people next to one in a tightly packed group
- 10) Jumping up and kicking both legs together backwards
- 11) Kicking the legs forward alternately
- 12) Move the arms up and down rapidly with open or closed fist, increasing in speed

### **VIOLENT:**

- 1) Digging rapidly
- 2) Casting the discus
- 3) Jumping repeatedly with no rest
- 4) Throwing heavy spears and moving fast while wearing heavy armour
- 5) Any of the 'strong' exercises executed rapidly: presumably running uphill, swinging jumping weights forward and back, and lifting them up and down, chin-ups and so on.

### **Other Exercises:**

- 1) Walking
- 2) bending up and down repeatedly at the hips
- 3) Lifting a weight up from the ground
- 4) Holding up an object for a long time
- 5) Full and loud breathing
- 6) Placing two weights on the ground approximately six feet from each other, picking up the one on the left with the right hand and then the one on the right with the left hand, then in turn placing them back where they came from on the ground and doing this many times with the feet stationary

Wrestling has been depicted on cave walls in Lascaux, France that are approximately 15, 300 years old.

Some of the earliest records of physical training are drawings on the walls of a funerary chapel in Beni-Hassan in Egypt (estimated at about 4500 years ago).

In the sixth century BCE, there were competitions between Egyptian athletes lifting heavy stones.

During the peak of Sparta's power and influence from around 800 BC to 600 BC, boys from the age of 7 underwent intense physical training to become warriors. This training involved fitness and combat practice in tandem with competitive athletic games, likely including ball sports like *episkyros*. Girls were expected to train alongside boys in an effort to develop healthy mothers of warriors, though they did not participate in coed competitions. In Spartan culture, both boys and girls, men and women were expected to maintain a healthy diet and engage in athletic training as it was considered a duty to their city-state, adding to their reputation of strict discipline and a zealous drive for excellence.

Banol, S. et al. 2016.  
Fontana S. et al. 2018.

**Suśruta** (6th century BCE) physician in India, has been credited with the first documented case of a written prescription for exercise. Advised that daily exercise would improve certain aspects of health, including muscle development, weight management, and digestive health.



Halteres, the ancient Greek equivalent of modern-day dumbbells, served multiple uses from training to competition. Ancient Greek records the use of halteres dating to as far back as 700 BCE.

As noted, in Ancient Greece, exercise and training were highly valued. By the 5th Century BC, halteres were of common use in Ancient Greek training regimes. Training with halteres grew globally as by the 2nd Century BC, the famous Greek/Roman physician, Galen, created a variety of exercises that required the use of halteres. Galen insisted halteres were a necessity for physical fitness as it trained the body for war.



Exercises included curls, squats, lunges  
and deadlifts

# Galen (129 CE– c. 216).

Considered the greatest physician of ancient Rome. Whereas Hippocrates laid the foundation of Greek medicine, Galen further developed its theory and practice, and carried Greco-Roman medicine to its zenith.

The origins of Sports Medicine as the oldest science that treats and prevents disease are described, as well as the use of exercise as a therapy, which is attributed to Herodicus, teacher of Hippocrates, and which is considered the very beginning of Sports Medicine. The ultimate expression of the origin of this discipline owes to Galen, who practices it as gladiator physician, who starts a fundamental aspect of Sports Medicine as multi-disciplinary and who practices the profession not only as a treatment of injuries, but also as instruction in the preparation of athletes.

Over his four years there (with a gladiator school), he began to discover the importance of diet, fitness, hygiene and preventive measures, as well as living anatomy, and the treatment of fractures and severe trauma, referring to their wounds as "windows into the body". Only five deaths among the gladiators occurred while he held the post, compared to sixty in his predecessor's time, a result that is in general ascribed to the attention he paid to their wounds. Wrote extensively about the gladiators diet and training practices .

## **Described Exercises and training practices of the Gladiators:**

**Divided Exercises into categories: Strong, Rapid, Violent and other**



Ergen E. From medicine and science to sports medicine and sportsciences: relations, definitions, historical roots. 10th ECSS Congress 14-17 July 2005, Belgrade, Serbia and Montenegro

## (Lucius Flavius) Philostratus (170-247 CE)

- Sophist -a paid teacher of philosophy and rhetoric in ancient Greece, associated in popular thought with moral skepticism and specious reasoning.
- a person who reasons with clever but fallacious arguments.

***Gymnasticus***, written after 220 AD, contains accounts concerning the Olympic games and athletic contests in general. Described early “periodization/Programming” procedures (4 day cycles)

Flinterman J-J. Power, paideia & pythagoreanism. Greek identity, conceptions of the relationship between philosophers and monarchs and political ideas in Philostratus' Life of Apollonius. Amsterdam, Brill, 1995.

Bertrand, Jean-Marie. "Power, Paideia and Pythagoreanism. Greek Identity, Conceptions of the Relationship between Philosophers and Monarchs and the Political Ideas in Philostratus' Life of Apollonius.(Dutch Monographs on Ancient History and Archaeology, 13): 503-504, 1997.

Rusten J. and König J. (eds) Philostratus. Heroicus. Gymnasticus. Discourses 1 and 2.. Loeb Classical Library 521. Cambridge, MA: Harvard University Press, 2014.

Abul-Walid Ibn Rushd, (Averroes), was born in Cordoba in (1126- 1198 BCE) under Almoravid rule. Physician, Scientist – studied exercise for health and sport

Exercises can be intense or mild, fast or slow. described resistance exercises, **“such as the lifting of rocks and other things” and exercises in power, “sometimes they join together in the exercise of speed and strength, as is the case of javelin throwers.”**

The ideal exercise to maintain health is one that fulfils its purifying and toning function “hardening the limbs” in his words. In order to do this, exercise should be a balance between “intensity and calm, speed and slowness”

Leonardo (1452-1510) was born on 15 April 1452 "at the third hour of the night" in the Tuscan hill town of Vinci, in the lower valley of the Arno river in the territory of the Medici-ruled Republic of Florence.

Most historians and scholars regard Leonardo as the premier example of the "Universal Genius" or "Renaissance Man", an individual of "unquenchable curiosity" and "feverishly inventive imagination", and he is widely considered one of the most diversely talented individuals ever to have lived.

Intensely studied how animals and humans move. – Beginnings of biomechanics



Cristobal Mendez (1500? – 1556 BCE) wrote El Libro del Ejercicio Corporal y Sus Provechos (1553 BCE). This was the first book to solely address physical exercise and its benefits. **The book described in considerable detail exercises, games, sports and training methods:** how they were classified, analyzed, and described primarily from a medical standpoint. Advice is given on prevention and recovery from injuries resulting from these physical pursuits. Several chapters dealt with specific advice on particular exercises and games for women, children, and the elderly.

**As describe by Philostratus: Four Day cycle developed by ancient Greeks (BCE) – and cycling of training had much earlier roots earlier -Imhotep (2600 BCE) – basically a microcycle**

- Day 1** – day of preparation, which consisted of light exercises and short, high intensity workouts
- Day 2** – day of high intensity and volume, which consisted of long, strenuous exercise
- Day 3** – day of rest (short, very light workouts were also done, but it mostly concerned resting)
- Day 4** – day of moderate intensity
- Note** : heavy and light days

## Early 20<sup>th</sup> century: Training organization

Boris Kotov. “Olympic Sport” (1916), introduced the original concept of periodized training that proposed three stages of purposeful athletic preparation: general fitness preparation, more specialized training, and specific preparation for forthcoming competition.

Lauri Pihkala (1930), expanded theoretical background - postulated a number of principles such as dividing the annual cycle into preparatory, spring and summer phases and active rest ending the season. Also introduced the principles of sequencing extensive and intensive workloads, focusing on the proper “work:rest” ratio in training design and the basics of long-term athletic preparation.

G. Dyson (UK: 1930 – 1960s) A New System of Training (1946) presents 5 phases of training. 1) non-competitive preparation period (5 months), 2) pre-competition period (1 month), 3) initial competition period (6 weeks), 4) main competition period (6 weeks), and 5) post competition period (6 weeks)

1930's several textbooks published in the USSR for skiing (Bergman, 1938), swimming (Shuvalov, 1940), track-and-field (Vasiljev & Ozolin, 1952).

# Brief History: Mid 20<sup>th</sup> Century – Training Organization

## L. Nadori and Associates:

Hungary – lesser known than Matveyev but came to many of the same conclusions in the 1950's and 60's – greatly altered training practices in Hungary particularly in track and field, gymnastics and weightlifting

## L. Matveyev

- Russian pedagogist Leonid Matveyev published a model of an annual training plan in 1965 (Based on his dissertation)
- Matveyev's original model was developed through the monitoring of the Russian athletes preparing for the 1952 Olympic Games –particularly Track and Field
- Thus, Matveyev is credited for *creating* the “traditional” model of periodization – this is somewhat misleading as the foundation for this modeling had already been laid

# Matveyev-Periodization: The Classic Model

- L.P. Matveyev is often considered to be the father of modern-training periodization.
  - He first presented the formalized theoretical concept known as “**periodization**” around 1960-1965.
  - His model provided great insight into the training process.
  - His model is often erroneously termed a linear model of periodization.

- Matveyev stated in his text that:
  - “..wave oscillations characterize load dynamics in both relatively small and more prolonged phases (stages, periods) of the training process.” (pg. 81)
  - “Correspondingly we can single out ‘waves’ of several categories:
    - Small characterizing load dynamics in the training in microcycles
    - Average, expressing a general tendency of loads in several microcycles
    - Big, which are revealed when evaluating the general tendencies of load dynamics in several average cycles which make up the states of periods of training microcycles” (pg. 81)

Matveyev, L. (1965). *Periodization of Sports Training*. Moscow, Russia: Fizkultura i Sport.  
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# Introduction to the U.S.

## Physiology

### PERIODIZATION OF STRENGTH TRAINING FOR ATHLETES

by John Garhammer, Department of Kinesiology, UCLA

*The body copes with the strain of exercise in a very specific adaptation pattern. Coaches and athletes can maximize training benefits by creating workout periodization schedules, based on the body's adaptive abilities.*

The concept of cycling or variation during the course of an athlete's training year is common to most training theories. This is physiologically sound, and relates to the *General Adaption Syndrome* (GAS) formulated through experiment by Dr. Hans Selye.

GAS is concerned with the response of the body to stressors (i.e., heat, germs, emotion, exercise) which demand some readjustment as alterations in blood flow, and nonspecific responses which are biochemical in nature. The nonspecific responses are technically referred to as stress.

It is important to note that qualitatively distinct stimuli differ only in the specific responses they elicit; the nonspecific effects are essentially the same unless modified by internal or external factors. Conditioning factors, for example, can selectively enhance or inhibit one or another stress effect.

GAS is a 3-phase response pattern exhibited by all organisms exposed to stressors. The first phase is the *alarm* stage which is characterized by a period of time during which the organism becomes aware of a new stimulus and readies itself to cope with it.

This is followed by a *resistance* stage during which the organism makes the readjustments required to meet the demands of the stimulus.

If the stimulus is too strong or of too great a duration the third or *exhaustion* stage is

Considering the extreme time reference Selye has made a GAS analogy to a life span: "childhood (with its characteristic low resistance and excessive responses to any kind of stimulus), adulthood (during which adaptation to most commonly encountered agents occurs and resistance is increased), and finally, senility (characterized by irreversible loss of adaptability and eventual exhaustion) ending with death."

The question to be considered here is: "how do I apply the concepts of GAS to strength training and training for sport in general?"

One must first have some objective measures to evaluate the exercise stressors contained in a training program. These are measures of the quantity (extent, volume, or load) and quality (intensity) of training. In running we have total distance covered per training session and average time per unit distance (ie. 10 miles at 6 minutes per mile). Throwers count total number of throws and the distance range in which they land. In weight lifting one measures absolute load in terms of total repetitions or total weight lifted, and intensity as average weight lifted per repetition.

To plan a yearly training schedule within the context of GAS one should begin with a goal for the year's training load. For high level athletes the load will probably exceed 10,000

PERIODIZATION: A HYPOTHETICAL TRAINING  
MODEL FOR STRENGTH AND POWER/

A Dissertation

Submitted to the Graduate Faculty of the  
Louisiana State University and  
Agricultural and Mechanical College  
in partial fulfillment of the  
requirements for the degree of  
Doctor of Philosophy

in

The School of Health,  
Physical Education, Recreation, and Dance

by  
Harold Stephen O'Bryant  
B. S., Appalachian State University, 1972  
M. A., Appalachian State University, 1974  
August 1982

## Early Experimental Studies of Strength-Power Training in the USA (Block Periodization Programming):

Stone M.H., O'Bryant H, Garhammer J. A hypothetical model for strength training. *J Sports Med Phys Fit* 21: 342–351, 1981.

Stone M.H., O'Bryant H., Garhammer J., et al. A theoretical model of strength training. *Nat Strength Cond Assoc J* 4: 36–39, 1982