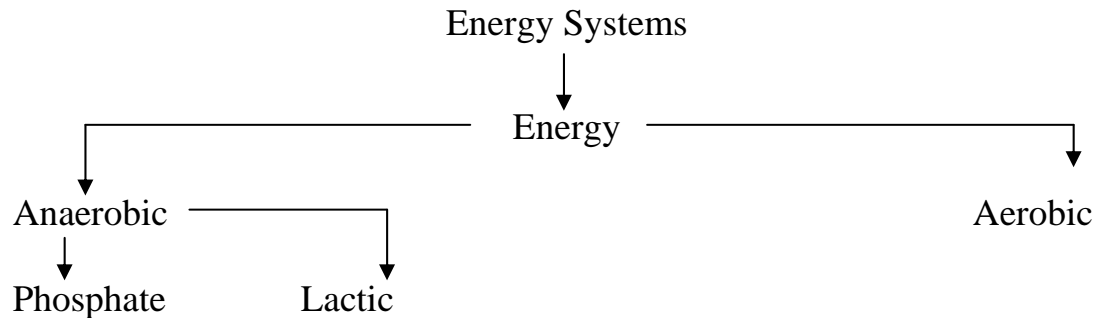


# THE ENERGY SYSTEMS

*This very important area is often the least understood or completely ignored by some coaches when designing a fitness program for their athletes. An understanding of the various energy systems of our body and which one to develop for a particular sport is extremely important as if the wrong energy system is developed i.e. specificity, then the athletes performance will invariably suffer dramatically.*

## The Energy Systems

An understanding of the body's energy systems when planning a fitness program for Rugby League is extremely important.



It is important to define that A.T.P. Adenosine Phosphate is a high-energy chemical manufactured in the muscles, and is the basic unit of energy in the body.

### Anaerobic System

Anaerobic means literally without oxygen. Used for activities of short duration.

#### Phosphate System

- Contains A.T.P. plus another high-energy substance, creatine phosphate (C.P.).
- They are already in the muscle and supply energy for 5-10 seconds, 50-100 m sprints, short dashes.
- Quickly rebuilds after effort i.e. 50% available after 30 seconds, 95% restored after 2-5 minutes.

#### Lactic Energy System

- Used in efforts beyond the phosphate system, 10-60 seconds.
- Energy is provided by glycogen stored in the active muscle i.e. stored, converted carbohydrates.
- A waste product of this system is lactic acid. A build up of this by-product results in fatigue.

The anaerobic systems can operate for up to 2-3 minutes at maximum intensity.

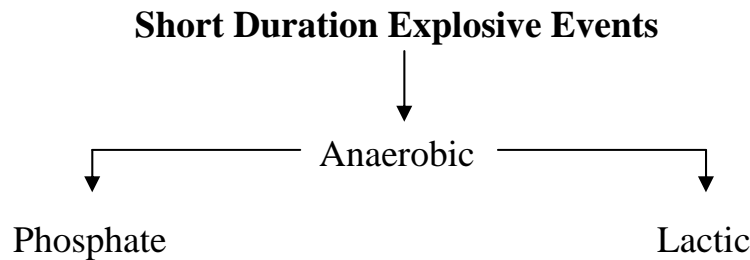
Correct training techniques will help develop the anaerobic system, which is important to our game of Rugby League. In fact, it could be said that the game of Rugby League is an anaerobic game.

## **Aerobic System**

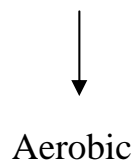
- Aerobic means literally with oxygen.
- Normally called the cardio-respiratory system i.e. the heart and the lungs.
- Remember oxygen is supplied to the working muscle via the bloodstream. An efficient cardio-respiratory system is essential for this to occur.
- The availability of this energy system is slow to activate and its main importance is for activities of 3-5 minutes to the ultimate marathon.
- An aerobic base is essential and must be developed before the other systems can operate efficiently.
- For Rugby League, mainly in the mid range lactic acid system i.e. training in intervals of 400 m at the beginning of the season, increasing to intervals of 3-4 minutes, fitter.
- Oxygen is used to release A.T.P. for muscle contraction, plus energy from glycogen and fat.
- Oxygen is used to release energy from glycogen (stored carbohydrates) and fat stored in the muscle.
- In long slow aerobic training fat is utilised efficiently for fuel – important in weight reduction combined with a low fat diet. Little relevance to Rugby League training unless the player is overweight.
- Glycogen is the primary source of fuel. Players who begin a game in a glycogen-depleted state will most certainly cover less total distance on the field – more walking pace – less speed! – importance of diet!
- If exercise intensity can be supported by the aerobic system, more efficient than the anaerobic system, without production of the by product lactic acid, carbohydrate fuel releases 13 times the amount of energy under aerobic conditions than is the case anaerobically for a particular exercise intensity.

## The Energy Systems and Sport

- Very few sports rely on a single energy system to supply A.T.P. for muscle contraction.
- Usually a combination of the 3 systems.



### Long Term Endurance



- Between these extremes there is a variation in the contributions of the 3 systems to provide energy for sporting performance.
- Important to note that the body does not change suddenly from one system to the other. All three systems may be used simultaneously.

What about our game of Rugby League?

- Will depend on the position player e.g. fullback would rely on the anaerobic system for short explosive efforts.

Phosphate system – 70%

Lactic system – 15%

Aerobic system – 15%

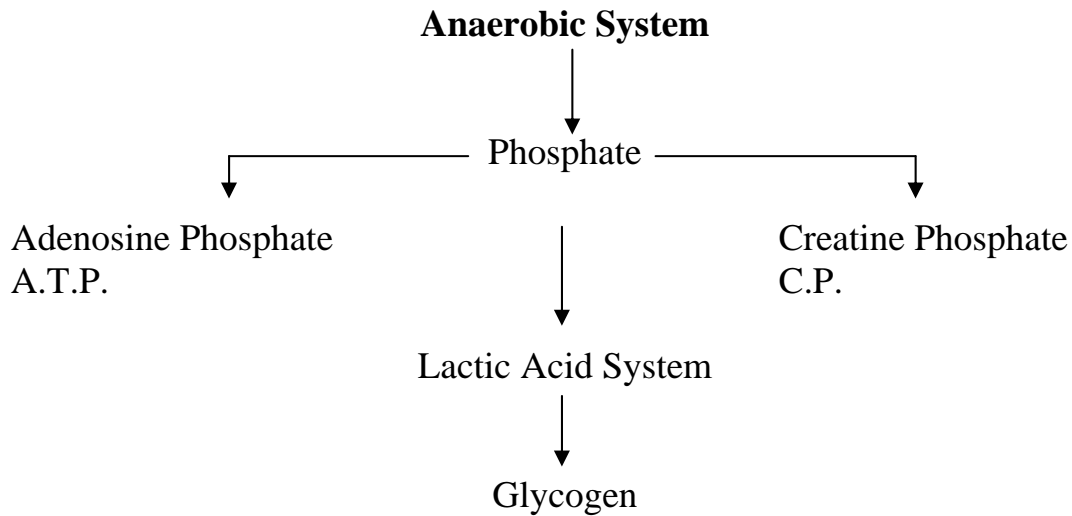
So ideally aerobic training for a Rugby League fullback should consist of 15% of his total training!

- What about halfback, front row, lock, centre, wing?
- A Rugby League player will be using his anaerobic system as soon as he commences the game whether he is aerobically conditioned or not. However it is stated in some quarters that the aerobic system can come into “action” in as little time as 30 seconds, during intensive exercise to allow the anaerobic systems to work to their full capacity. A Rugby League player needs the aerobic system to be developed as a base so the anaerobic system can be developed to its fullest in a predominantly anaerobic game.

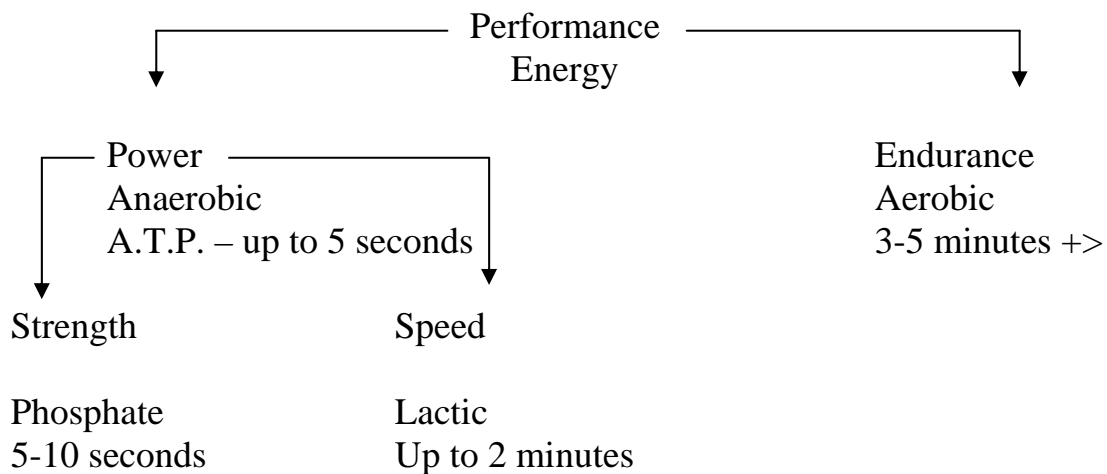
### **The Anaerobic Threshold**

- As a player works at a level close to maximum, lactic acid begins to accumulate. The intensity of effort at which this occurs is termed the anaerobic threshold.
- Results in an increasing imbalance between lactic acid production in the muscle and its removal.
- Endurance training results in larger increases in the anaerobic threshold. Developing the anaerobic threshold allows a player to perform at a higher level of output before fatigue results.
- In untrained players the anaerobic threshold could occur at 50% of his VO<sub>2</sub> max (maximum oxygen intake) to 85% VO<sub>2</sub> in endurance athletes. This also varies widely between individuals.
- It should be emphasised that lactic acid is produced in all forms of training, and this is often metabolised aerobically as fast as it is produced i.e. an equilibrium is produced.

This is why aerobic training for Rugby League must be developed as a foundation for more specific training.



### Ingredients of Fitness and the Energy Systems



You can determine that power, strength and speed are related to the anaerobic system and endurance to the aerobic system.

As a coach, what system do you think relates specifically to our game of Rugby League, or are they all specific?

### To Sum Up

The game of Rugby League places great demands on all systems, however it is a strength, power and speed game requiring the player to perform the many skills at varying speed and intensity (usually at a high level) whilst being also asked to work continuously (active rest).

All aspects being equal the stronger, faster team will emerge the winner (anaerobic). Throw in here also the team who can maintain this for the duration of the game (endurance), aerobic will have a distinct advantage.

So aerobic endurance (the base) is very important and must be the “building block”, “the foundation”. The building of anaerobic power then follows.

Aerobic endurance > higher anaerobic threshold / greater intensity of work > anaerobic power.

Rugby League could be termed a 10-metre game! What energy system would be dominant?

Now that we have knowledge of the energy systems there are certain very important principles that must be followed to bring a player to peak fitness for the game of Rugby League. The ingredients of fitness include:

- endurance
- muscular strength and endurance
- speed
- power
- agility
- flexibility

The principles used to develop these ingredients to their maximum are extremely important.

The aim of any training program is to systematically prepare the player for the demands of the game.

A training program should consist of two major areas of concentration:

- skills training
- physical conditioning

The training program must be based on the specific demands of Rugby League and it must be implemented by systematic planning and based on the following well-established and documented principles.

## **The Principle of Overload**

- Unless the body is subjected to stresses, its physical condition will not improve.
- The stresses must exceed what it is normally unaccustomed to.
- This stress or overload must be programmed progressively, i.e. “he must do more tomorrow than he did today”.
- This is based on three factors:
  - (a) frequency – number of sessions, day – week – month – year
  - (b) intensity – the training or work load
  - (c) how long they work

### **Frequency**

Minimum of 3 times per week will help attain peak fitness. To start with frequent sessions with plenty of recovery periods between efforts.

### **Intensity**

How fast or how hard the workload is. The golden rule “not too much too soon”. Start easy and gradually increase intensity as the body adapts to the increased stresses. Each session must be harder than the last one for significant gains. Use the policy “listen to your body” (beware).

### **Duration**

How long one works? Early short workouts with plenty of recovery, later 30-60 minutes at near maximum intensity.

### **Golden Rule**

“It is the quality of the session, not the quantity”.



## **To Sum Up**

- Commence slowly and progress gradually.
- Do not increase intensity, duration or frequency suddenly, particularly after a period of lay-off.
- Alternate hard sessions and easy sessions, 3 hard weeks, 1 easy.
- Avoid reaching a stage of exhaustion, careful planning.
- 24-48 hours of recovery should be allowed between hard sessions.
- A careful record of progression must be kept. Improvement is simply the bodies' response to carefully graduated stress, recovery.
- Be aware of individual players circumstances, emotional stress, poor diet, work load, sleep etc.
- Continual heavy loads, diminished returns – “more is not necessarily better”.
- Some players can train daily, not the same ingredients.
- Skills every day, except to exhaustion.

## **The Principle of Individuality**

A coach should soon realise that within his squad the players are all really quite different i.e. individuals

- different lifestyles
- nutritional habits
- tolerate hard training
- physical attributes
- different recovery periods from training, game
- training needs, skill
- physical profiles
- training enjoyment, different types
- environmental tolerances
- socialisation within squad
- muscle make up
- personal work loads
- psychological make up
- expectations

How are you as a Coach going to cater for this inevitable individuality within your team?

### **The Principle of Specificity**

Similarity must exist between training and the game of Rugby League both in the muscle groups used and the energy sources utilised and of course the all-important skills in our game.

Gone are the days, hopefully, when coaches merely run their players to exhaustion.

The physical requirements of the game of Rugby League must be analysed and the player prepared accordingly to the specific skills, energy systems, muscles, movements, distances etc. related to the game. For example, a player may be required to cover 5-7 kms at varying speeds, moving forwards, backwards, perform skills at maximum speed, withstand the rigours of harsh body contact, make around 30 tackles, be tackled and get up quickly etc. The training must evolve around these specific actions.

What about specificity of individual positions in the game of Rugby League?

**“Fail to plan is a plan to fail”.**

### **The Principle of Reversibility**

Once training ceases, levels of fitness deteriorate rapidly, far more rapidly than it takes to increase. This could be due to:

- illness or restriction due to an injury
- detraining after the competitive season (relevant to country)
- changes in training demands during the competitive season e.g. 3 weeks bed rest, 25% reduction in aerobic capacity. This takes 4-6 weeks to regain! Endurance is the most readily affected i.e. the aerobic system. Strength, power (anaerobic system) is less affected but still reversible. An example of this is a broken limb and the muscle waste and loss of strength that occurs, not the result of the break but lack of inactivity.
- Preparatory stage to competitive stage, change in training towards tactical skills development, endurance lost unless interval skills drills are done, often the reason for the failure of a team.

## **The Principle of Motivation**

The all-important question here is “how do we make training interesting to maintain a high level of motivation”. This particularly applies when a team is not “travelling too well”.

- interesting, challenging
- variation, routine, venues
- must be planned. Coaches who turn up to training and ask his players to train without planning are doomed for failure, respect, professionalism.
- variation of intensity, duration, long, short, intense, easy, high speed, easy distance
- don't forget the enjoyment factor
- don't be “pigheaded” flexibility, listen to your players, but don't lose control
- set attainable short term, long term goals, the more progress he makes the more he will want to continue
- don't be afraid to bring in “outsiders” with special expertise
- fitness testing is a good motivator
- be liberal with praise and encouragement
- be aware of a players problems, persona, injury
- give all players equal attention

Are there are other “tactics” that you as a coach use to maintain motivation levels at training?