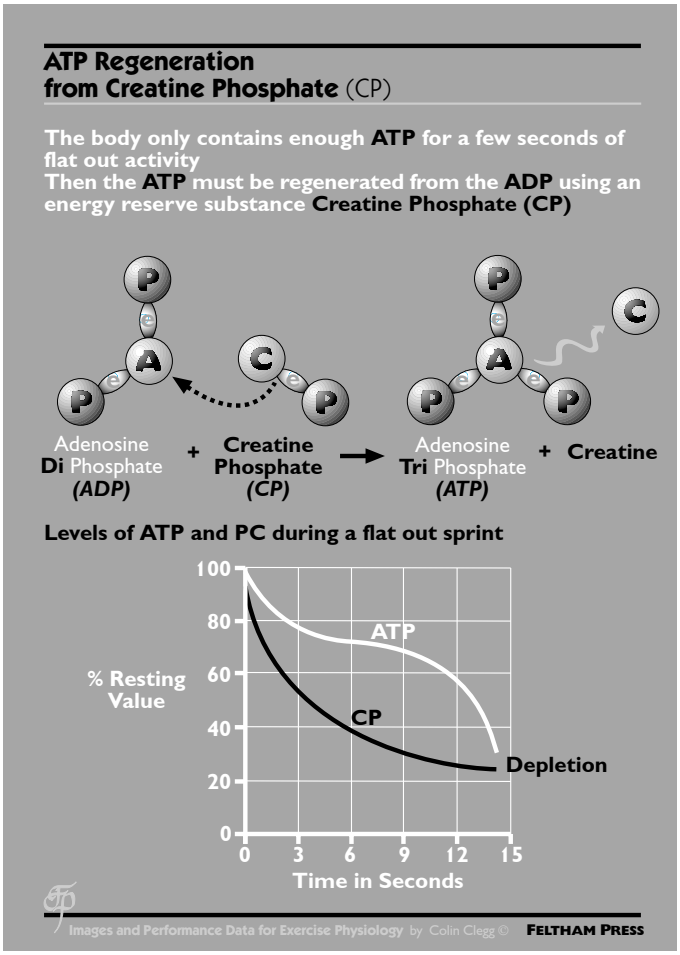
Images & Notes
for
Exercise Physiology

(64p)

Contents

ATP Regeneration from Creatine Phosphate *(CP) (Also known as Phospho-creatine or PCr)*

Image 2



An estimate of the amount of ATP present in the whole resting body is on average about 50g.

Any activity increases the rate of energy use via ATP, and it must be regenerated from other sources. The most immediate source being creatine phosphate *(or phosphocreatine)*. ATP & CP being collectively known as the alactic anaerobic phosphagen system.

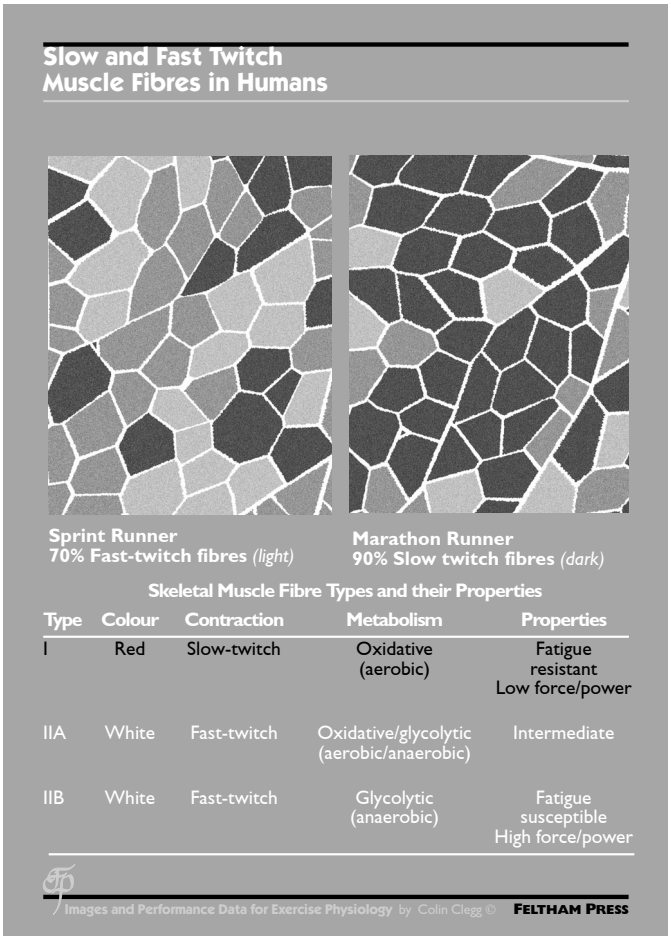
The graph shown is an approximation only, and the horizontal scale might be 'reduced' to between 1-6 seconds by some authorities. Also it must be remembered that all energy supply systems operate at all times, although the anaerobic lactic system would show the most immediate increase in maximal efforts.

The amount of ATP in the body appears to be relatively fixed, but the amount of creatine phosphate can be increased significantly by training, and by a dietary supplementation regime of creatine.

Continued...

Slow and Fast Twitch Muscle fibres in humans

Image 4



Skeletal muscles in humans contain mixtures of Slow Twitch Type I *(red)* fibres and Fast Twitch Type II *(white)* fibres; with the Type II fibres being further differentiated into IIA Fast Oxidative-Glycolytic *(FOG)* and IIB Fast Glycolytic *(FG)*.

A predominance of slow fibres will favour aerobic endurance activities. They are longer and thinner than fast fibres and result in relatively slender muscles which are very difficult to increase in bulk.

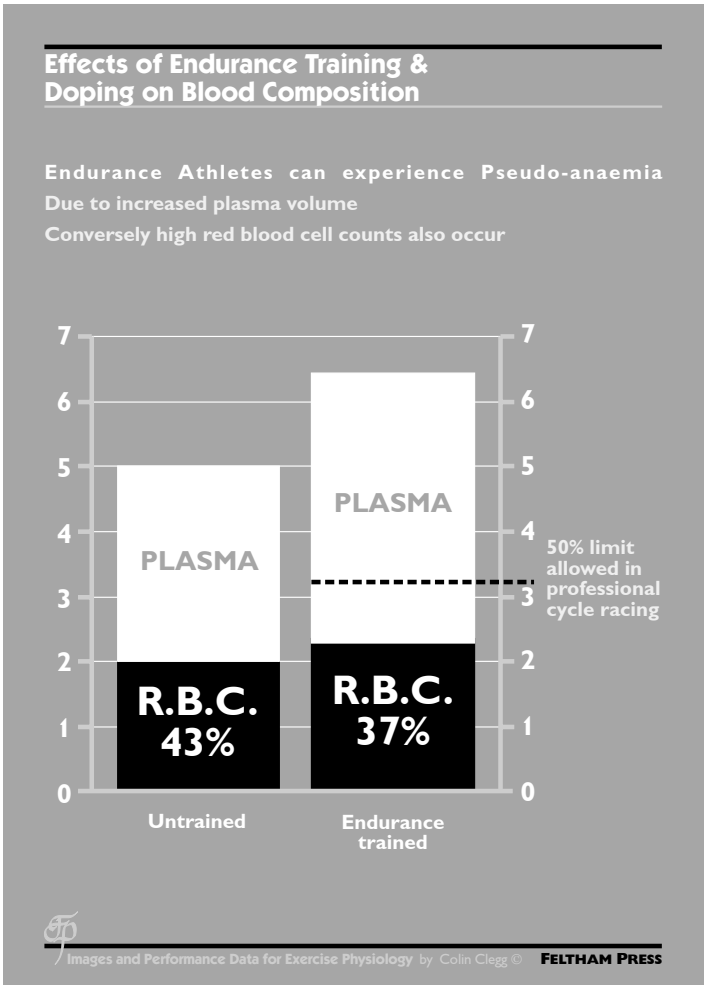
A predominance of fast fibres will favour anaerobic power activities and result in relatively bulkier muscles which are more easily increased in mass. IIA fibres have a mixture of aerobic *(oxidative)* and anaerobic *(glycolytic)* properties, and IIB fibres are purely anaerobic.

The particular proportion of each type of fibre in a muscle is determined genetically, but their properties can be changed by training, with for example Type IIA fibres in endurance trained individuals being more 'aerobic' than Type I fibres in untrained individuals.

Also the the presence of a third undifferentiated Type IIC fibre reported by some, may provide some scope for an apparent change in proportion of fibres with training.

Effects of endurance training and doping on blood composition.

Image 8



One of the most significant endurance training effects is that of increased plasma volume. Although there is a simultaneous increase in the number of red blood cells *(RBC)*, this increase is less than that of the increase in plasma volume, so that the % RBC by volume of blood decreases, giving rise to the condition of endurance athlete's pseudoanaemia. The % RBC by volume is determined by centrifuging a sample of blood, and is also known as the packed cell volume or haematocrit, although alternative techniques are now available.

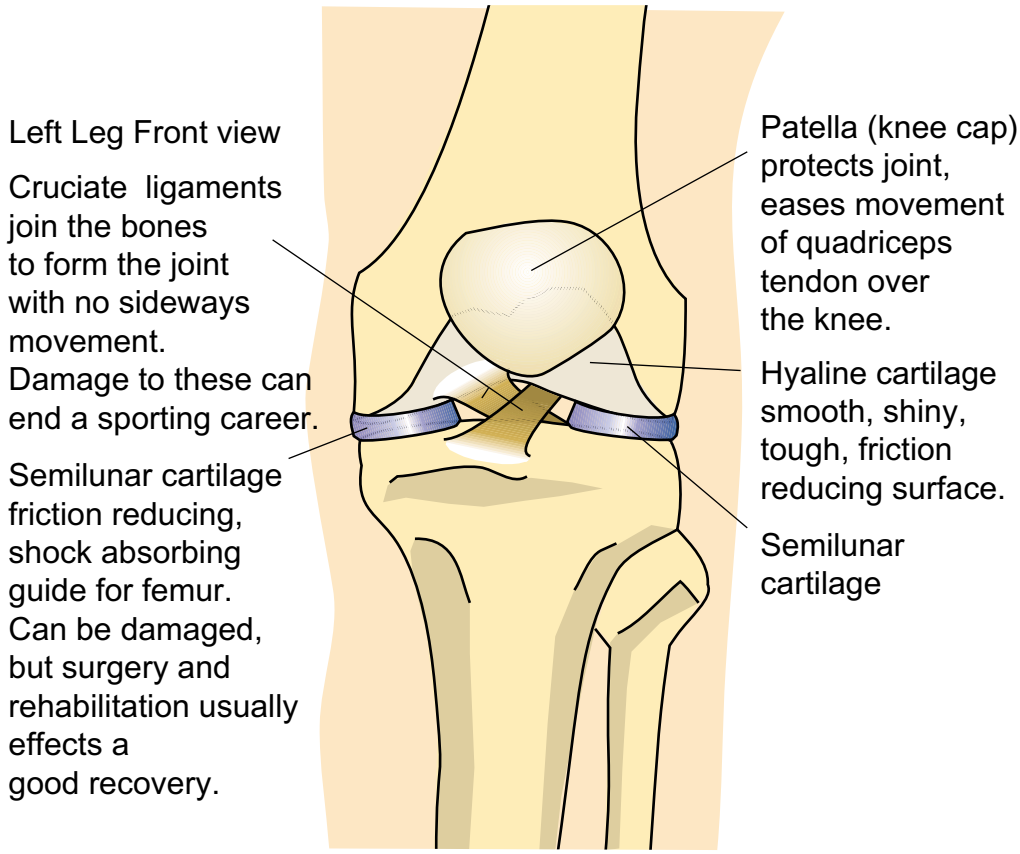
The misuse of the hormone erythropoietin or EPO has brought the study of blood composition to the forefront of exercise physiology. EPO is naturally produced by the kidneys, and is increases the synthesis of RBC by the red bone marrow, in response to oxygen stress, as for example in endurance training, particularly at altitude.

Continued....

Knee The knee is a hinge joint formed between the surfaces of the tibia and the femur. It only permits movements in a single plane, flexion and extension. It should be noted that the patella (knee cap) is a seismoid bone, preventing excessive friction between the moving parts of the joint, and is not part of the articulation at the knee.

Quadriceps The muscles causing extension at the knee are known collectively as the quadriceps. The four muscles within this group include the rectus femoris, which originates on the iliac spine and inserts on the upper border of the patella, and the vastus lateralis, vastus medialis and vastus intermedialis which all originate on the femur and insert on the patella and the tibia through the patella tendon. All four muscles cause extension at the knee, and the rectus femoris alone also causes flexion at the hip.

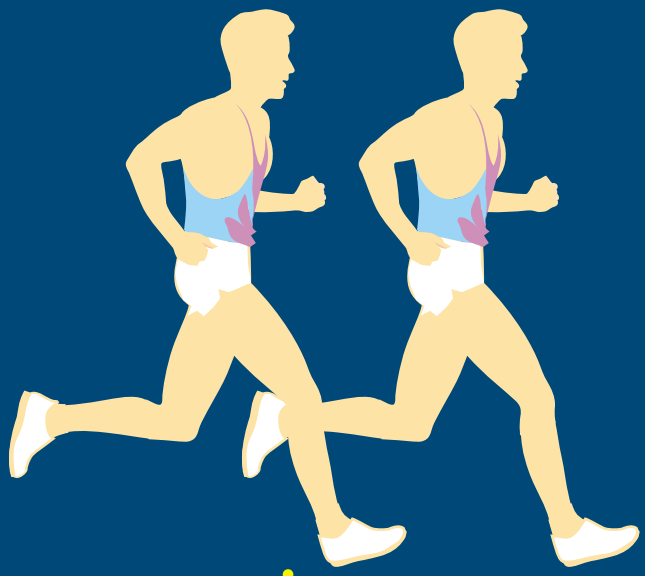
Hamstrings The muscle causing flexion at the knee are known collectively as the hamstrings group, and include the biceps femoris which originates on both the ischium and the femur, and inserts on the tibia and fibula, and the semimembranosus and semitendinosus which originate on the ischium and insert on the tibia. All three muscles flex the lower leg at the knee and extend the thigh at the hip.



Nature or Nurture- Twin Studies

10 pairs of Monozygote Twins

Fully standardised and laboratory controlled training programme for 20 weeks

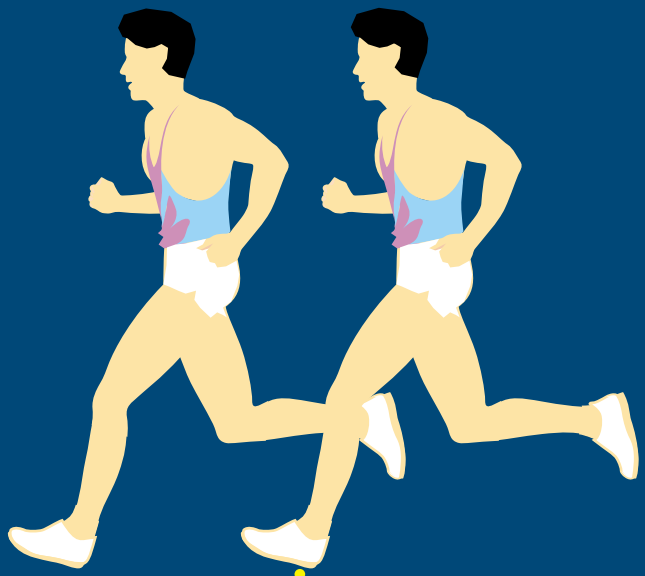


Relative $\dot{V}O_2$ max gain

+1 +3

Average

+2



Relative $\dot{V}O_2$ max gain

+15 +17

Average

+16

Members of the same pair make similar improvements but there are large differences between the different pairs