

Blood doping is not only illegal but harmful to athletes and should be stopped

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# What is blood doping?

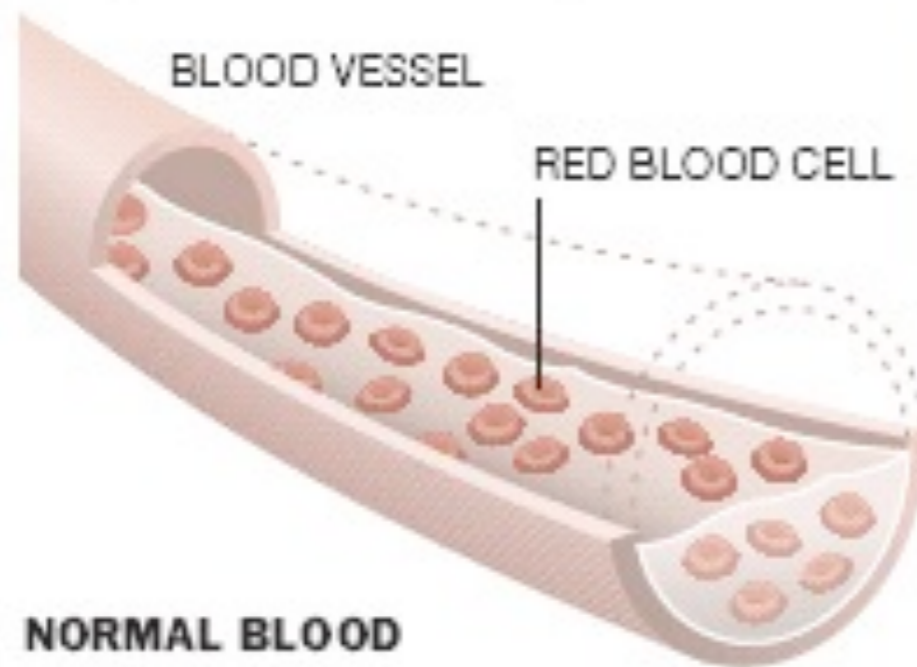
- ✦ Method of extracting ones own blood (or donor blood) only to reinsert it at a later date, usually before a big race or game.
- ✦ Doping can also be used to describe any sort of injections into the body (hormones, steroids, etc). Specifically Erythropoietin (EPO).
- ✦ Athletes hope that the increase of red blood cells (RBC) will increase the oxygen intake level in their body.

# History of Doping

- Ancient greek athletes are known to have used special diets and potions to strengthen themselves.
- 1968 - Urgency of anti-doping was again pushed by the death of cyclist Tom Simpson during the Tour de France the year before.
- 1974 - A reliable testing method was introduced. Doping related disqualifications increased in the late 1970s
- Following the Conference, the World Anti-Doping Agency (WADA) was established on November 10, 1999.
- In May, 2010, Floyd Landis, a cyclists admitted to doping for the majority of his career, and also cited Lance Armstrong as also using some form of performance enhancing drugs.

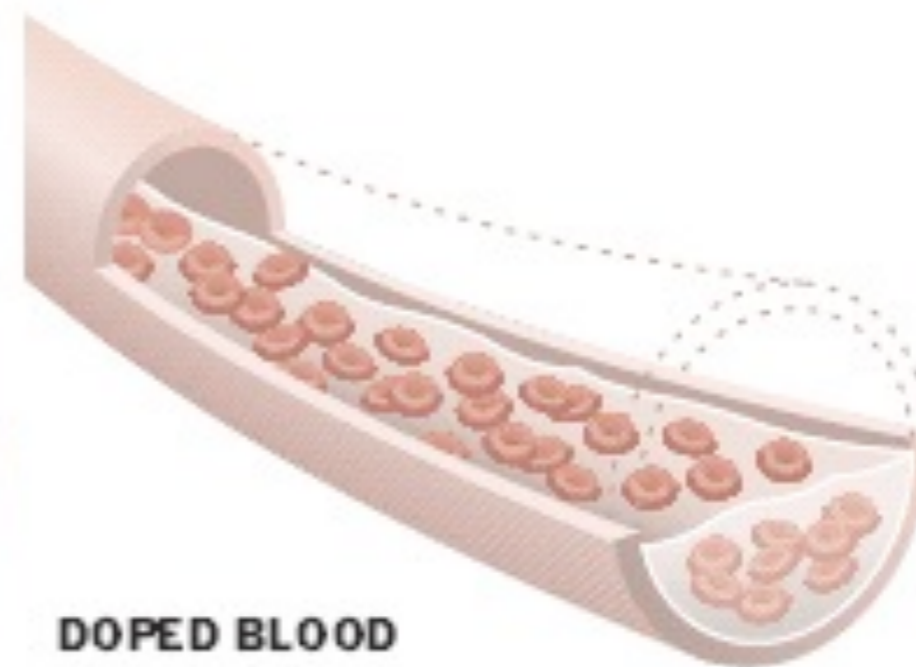
# How Blood Doping Works

Elevated levels of red blood cells found in an athlete's bloodstream can be a sign of blood doping.



## **NORMAL BLOOD**

The blood of a typical adult male is made up of 40 to 50 percent red blood cells, which carry oxygen to tissues. Typical levels for women are 35 to 45 percent.



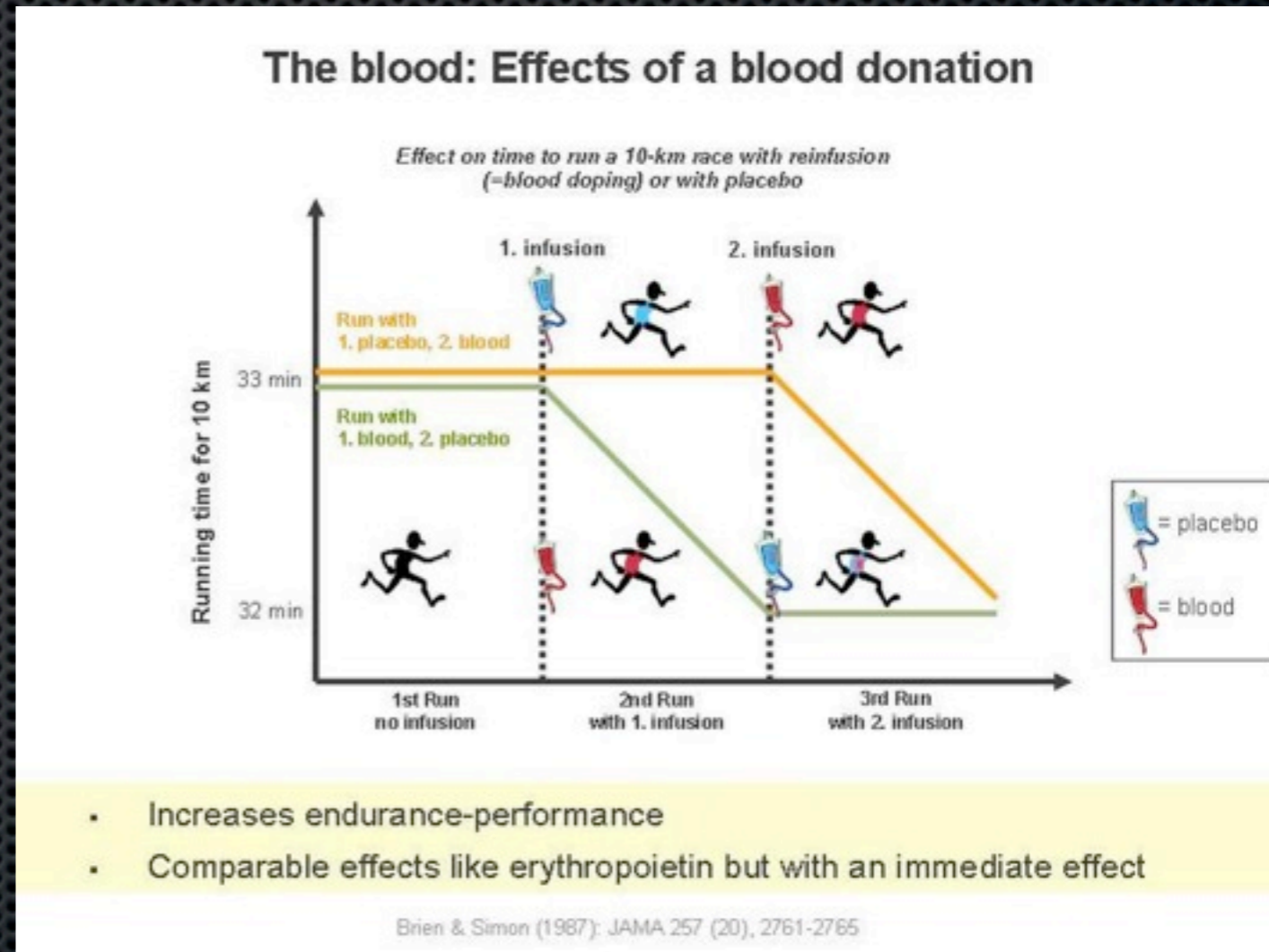
## **DOPED BLOOD**

Red blood cells (from a donor or previously removed from the athlete) or the hormone erythropoietin (EPO) are injected. The increase in red cells allows muscles to work longer and harder without cramping.

*Sources: Harrison's Principles of Internal Medicine; Quest Diagnostic Laboratories*

# The problem - it works

- A test of skiers showed that in a 15km cross country ski, their time improved by 5.3% only 3 hours after the injection
- 3% increase of red blood count levels to move it over 50% (illegal) in the Tour de France can give the athlete an advantage over the rest of the competition



# Why?

- ✦ Athletes constantly feel the pressure to be better than everyone else, be the best.
- ✦ According to studies, it is estimated that between 50-80% of athletes among baseball and cycling have been doping
- ✦ Floyd Landis, a cyclist admitted to doping for the majority of his career, and also cited Lance Armstrong as also using some form of performance enhancing drugs. He maintained that he does not regret it because it was something that he, as a cyclist, needed to do.

# Science - Blood Doping Techniques - EPO and Transfusions

- ✦ The hormone Erythropoietin (EPO) increases the production of oxygen-carrying blood cells.
- ✦ Naturally promotes the oxygen-carrying capacity of red blood cells
- ✦ The hormone was synthetically produced originally to treat anaemia.
- ✦ In an average human body, 40-45% of the blood is taken by RBC's. Some riders reach 60%.
- ✦ Transfusions of either self blood or donor blood.

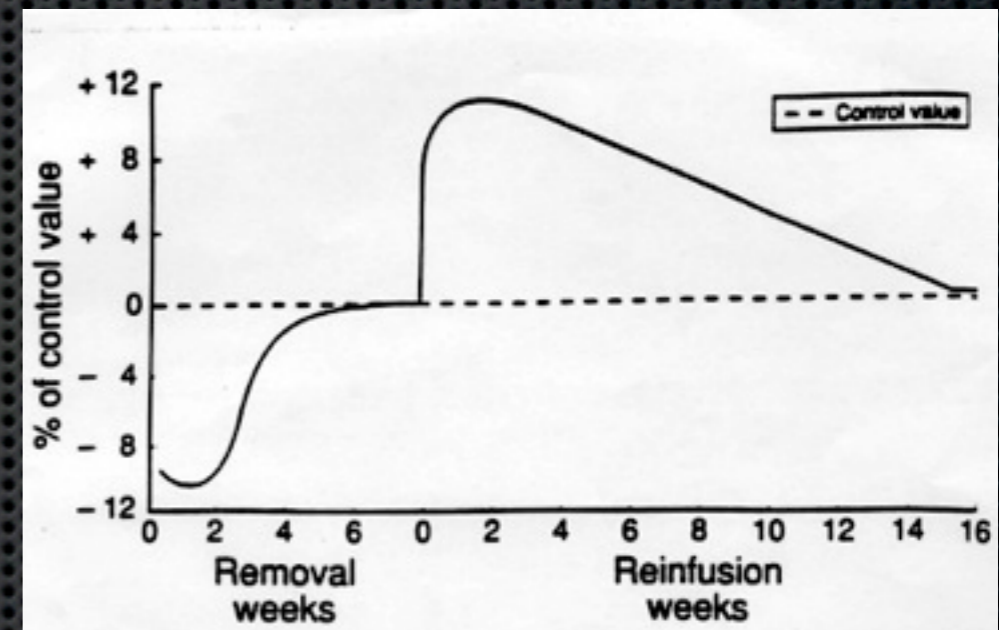
# Dangers

- ✦ Blood clotting- athletes can become easily dehydrated causing their blood too thicken or 'sludge'
- ✦ Reports of cyclists collapsing before their race are not uncommon.
- ✦ Personal transfusions not performed by doctors or trainers could have increased risk of contracting blood-borne diseases and getting sick from bacteria in stored blood
- ✦ Sudden death due to a reduction in heart rate overnight, and anti-erythropoietin antibodies could cause an over reduction in red blood cells
- ✦ EPO could also effect the brain and may resemble other harmful substances such as amphetamines, cortisone, and anabolic steroids



# Incidents

- ✦ Eighteen young cyclists died from unknown causes right around the time erythropoietin was introduced into cycling in the late 1980's.
- ✦ Deceased New York Rangers prospect Alexei Cherepanov was believed to have been blood doping prior to his death in 2008.
- ✦ EPO use is a suspect in nearly 20 deaths in 4 years in European cyclists



# Transfusion Detection

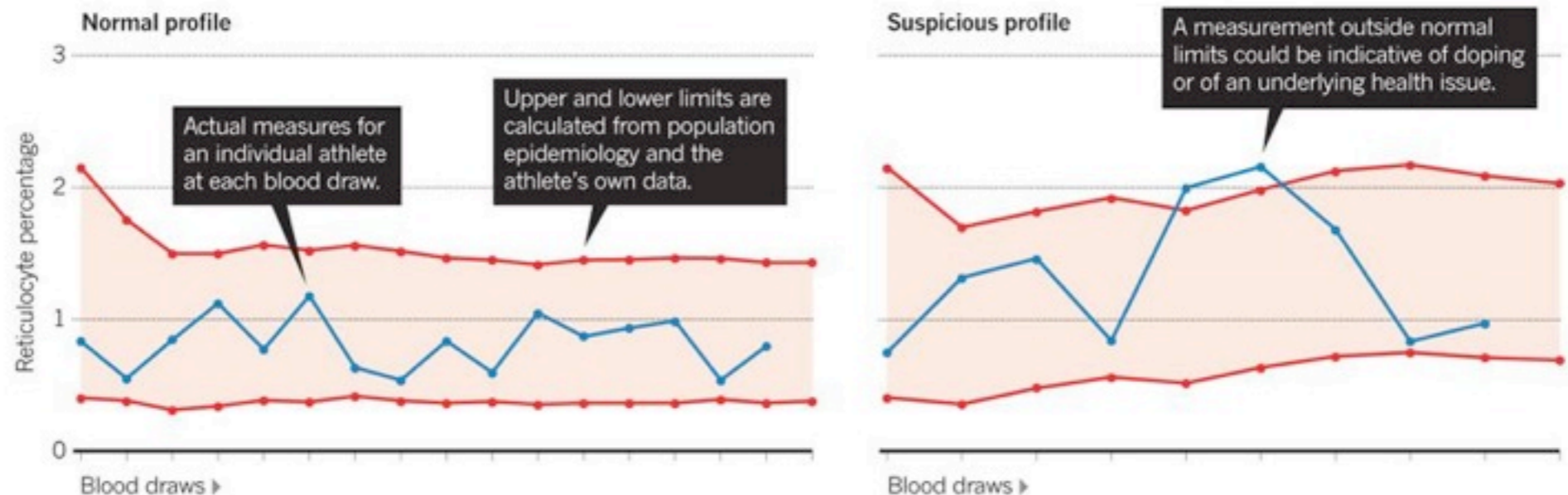
- ✦ Has been made successfully testable.
- ✦ Anti-body based test can detect abnormal cells by a simple blood sample.
- ✦ If several sets of antigens are found in the body, it means that there is blood from two different people.
- ✦ Does not catch blood that was drawn directly from the athlete

# EPO Detection

- ✦ The main problem for detecting EPO uses among athletes is that the drug nearly looks the same as hormones produced by the kidneys, making it nearly impossible to detect.
- ✦ With the help of drug agencies, discoveries have shown that there are slight biochemical differences between the drug molecules and the natural ones found in the body.
- ✦ “Passport”- electronic record of several different characteristics of red blood cells collected periodically in and out of competition for an individual athlete.

## GOOD BLOOD, BAD BLOOD

The biological passport tracks nine blood characteristics for an athlete over time. Below are normal-looking (left) and suspicious-looking (right) measurements for one of these: the percentage of reticulocytes, or immature red blood cells, in the blood. Although an abnormal result for one characteristic doesn't necessarily raise suspicion, abnormal readings for more than one could indicate that the athlete is doping.

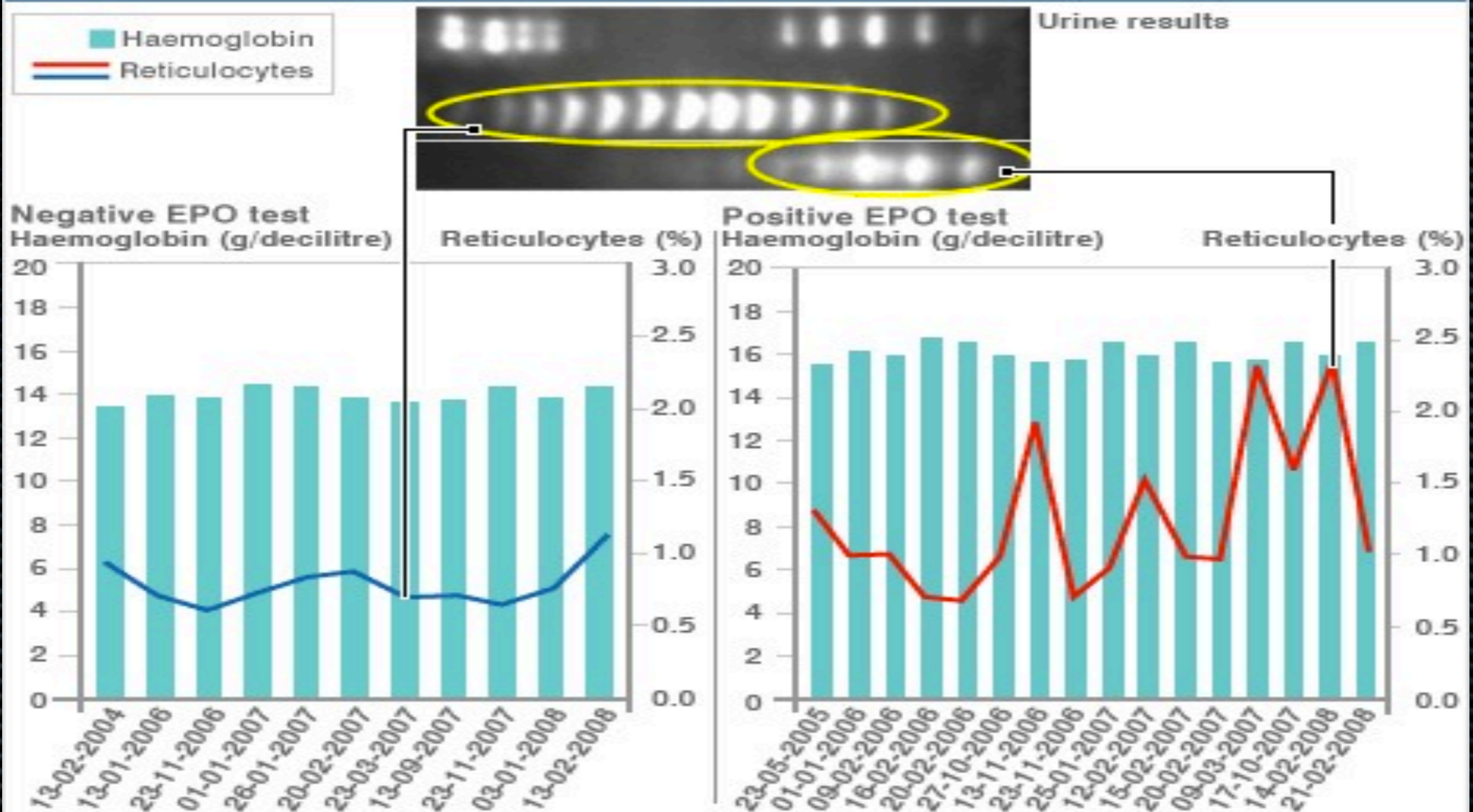


- ✦ Although this technique does not outright prove if someone has doped, it does tell you the abnormality over time of the athlete's RBC's and from there assumption can be made.

# Technology detection effectiveness

- ✦ Still not completely reliable.
- ✦ Urine testing can now be implemented, but there are still risks of false positives.
- ✦ A study in Switzerland found that the passport only correctly found 58% of the doped volunteers.
- ✦ It is assumed by the International Cycling Union (ICU) that doping has decreased since the use of passport testing has been applied.

## RESULTS OF EPO TESTING



SOURCE: Rasmus Damsgaard

- ◆ The left hand graph shows the blood profile of an athlete who has not taken EPO. The urine test shows a grouping of white markers which represent a normal level of EPO in the blood.
- ◆ The right hand graph shows the blood profile of an athlete who has taken EPO. It shows a higher-than-normal proportion of reticulocytes, the young red blood cells produced by the bone marrow, due to stimulation by EPO.
- ◆ The positive urine test shows a lack of normal EPO - indicated by fewer white markers - suggesting the body has stopped producing its own EPO.

# Outlook/Future

- ✦ With the technology we have today, our only hope is that it helps scare away potential dopers who know that it is at least somewhat effective.
- ✦ The International Cycling Union (UCI) created a rule to not allow any cyclers to race if their RBC's were any higher than 50%.
- ✦ Safer alternatives - physical training, eating well, living in high altitude
- ✦ The only way to stop this prevalence in today's athletic society is to become tougher, test more frequently, and create stricter rules that will deter athletes from using.

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