

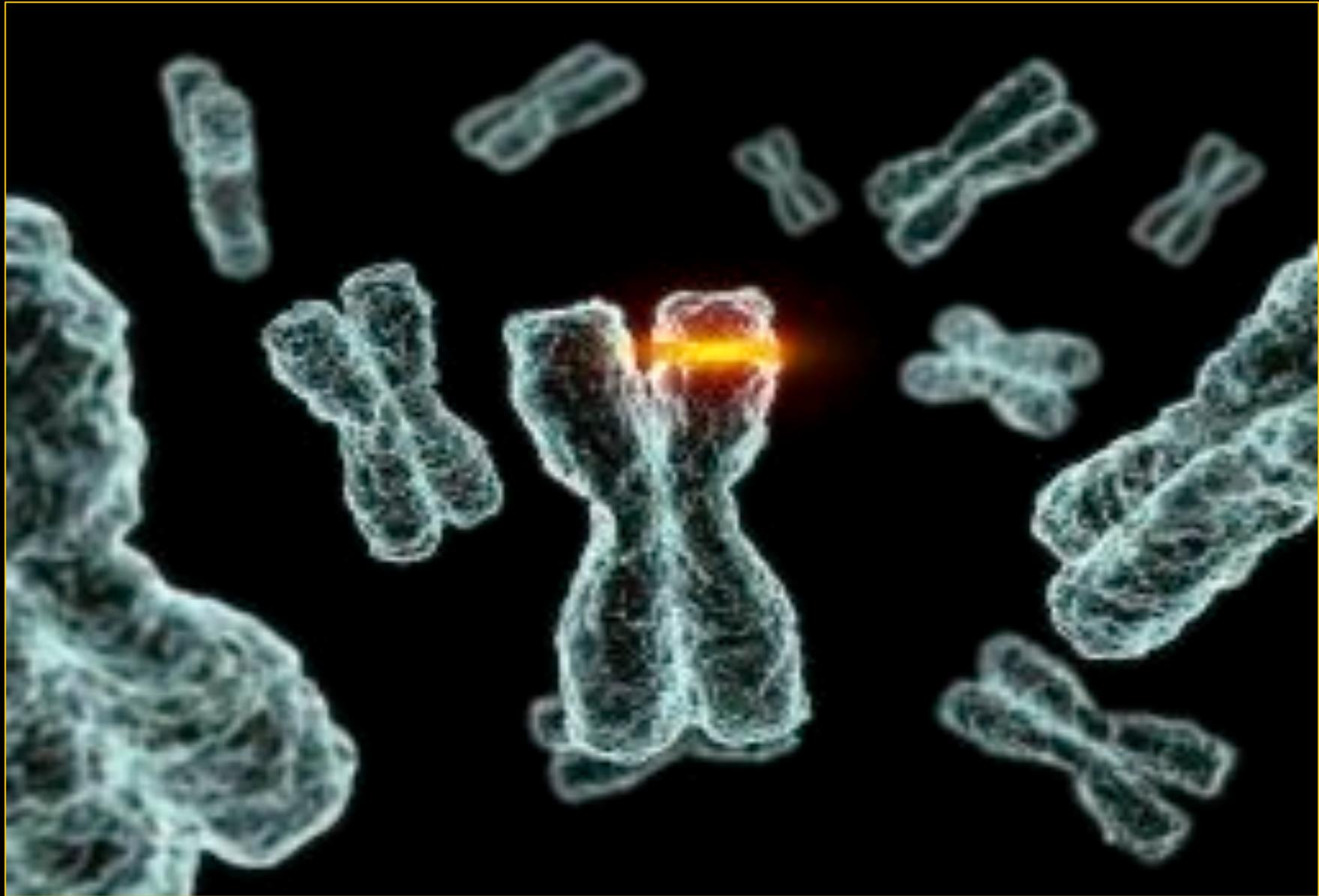


ASPC  
International  
Forum on  
**ELITE  
SPORT**



Human Performance Project

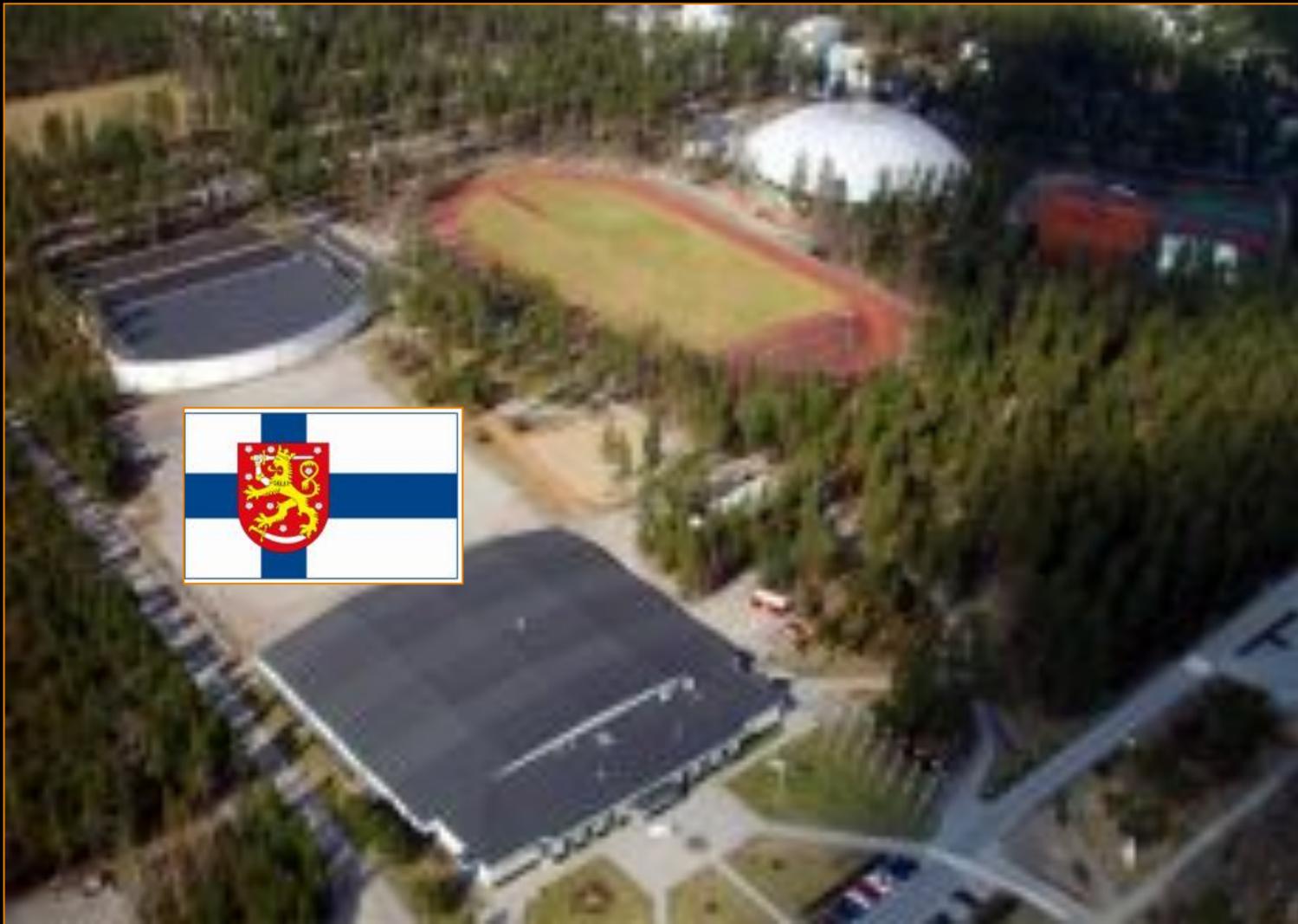
John Underwood



# Human Performance Project



**Human Performance Project**





# Lake Placid

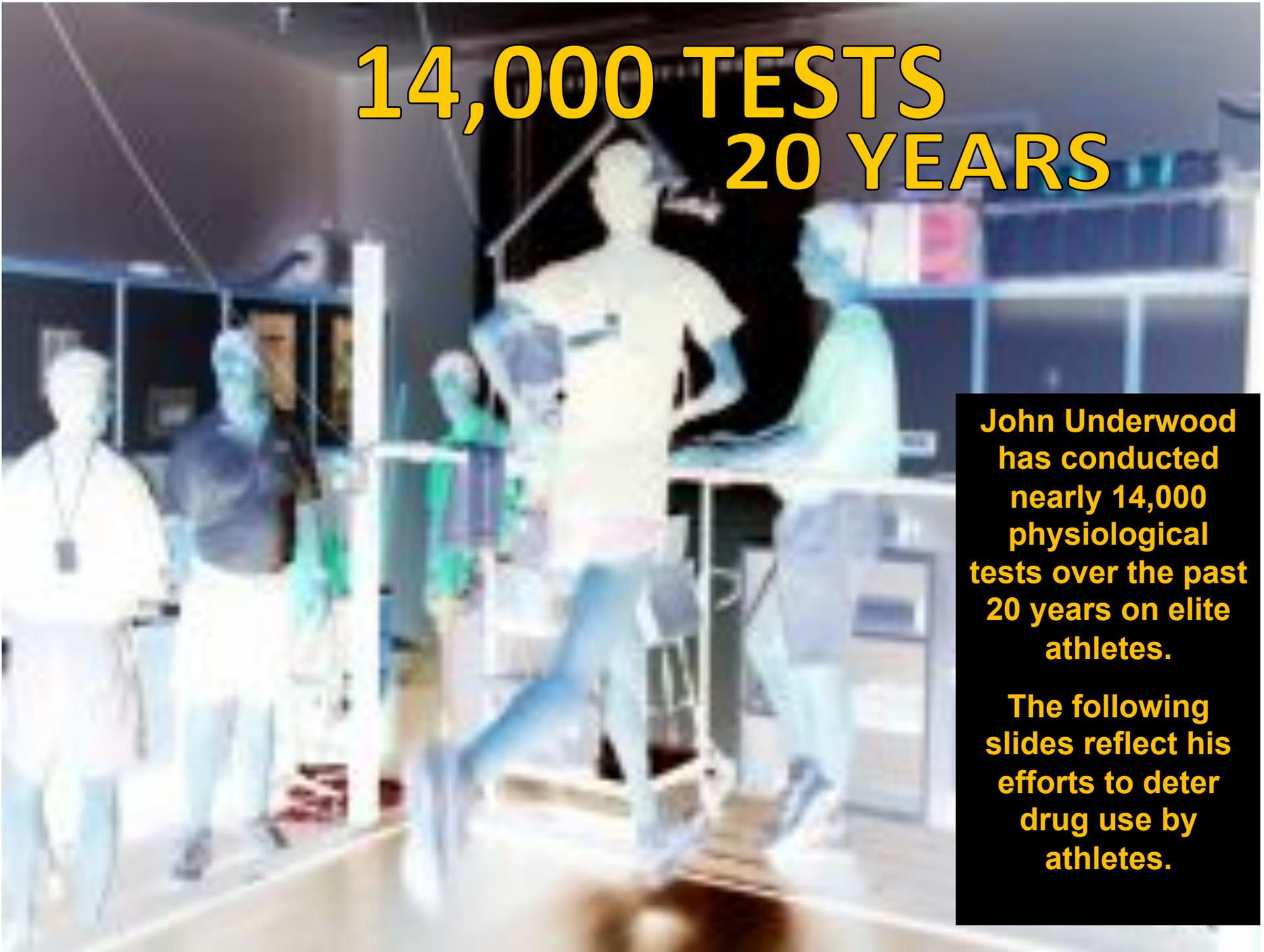


# USOC Lab

Lake Placid, NY



# 14,000 TESTS 20 YEARS



**John Underwood has conducted nearly 14,000 physiological tests over the past 20 years on elite athletes.**

**The following slides reflect his efforts to deter drug use by athletes.**

# 28 OLYMPIANS





**Naval Special Warfare**

# Laboratory Testing





# RECOVERY

**Physiological Considerations for Recovery in Elite Hockey**

**John Underwood** Director American Athletic Institute

# Understanding Recovery







CHAMPION  
ATHLETE  
PROGRAMS



ATHLETE  
LIFESTYLE  
EDUCATIONAL  
MODULES





Neuromuscular  
System

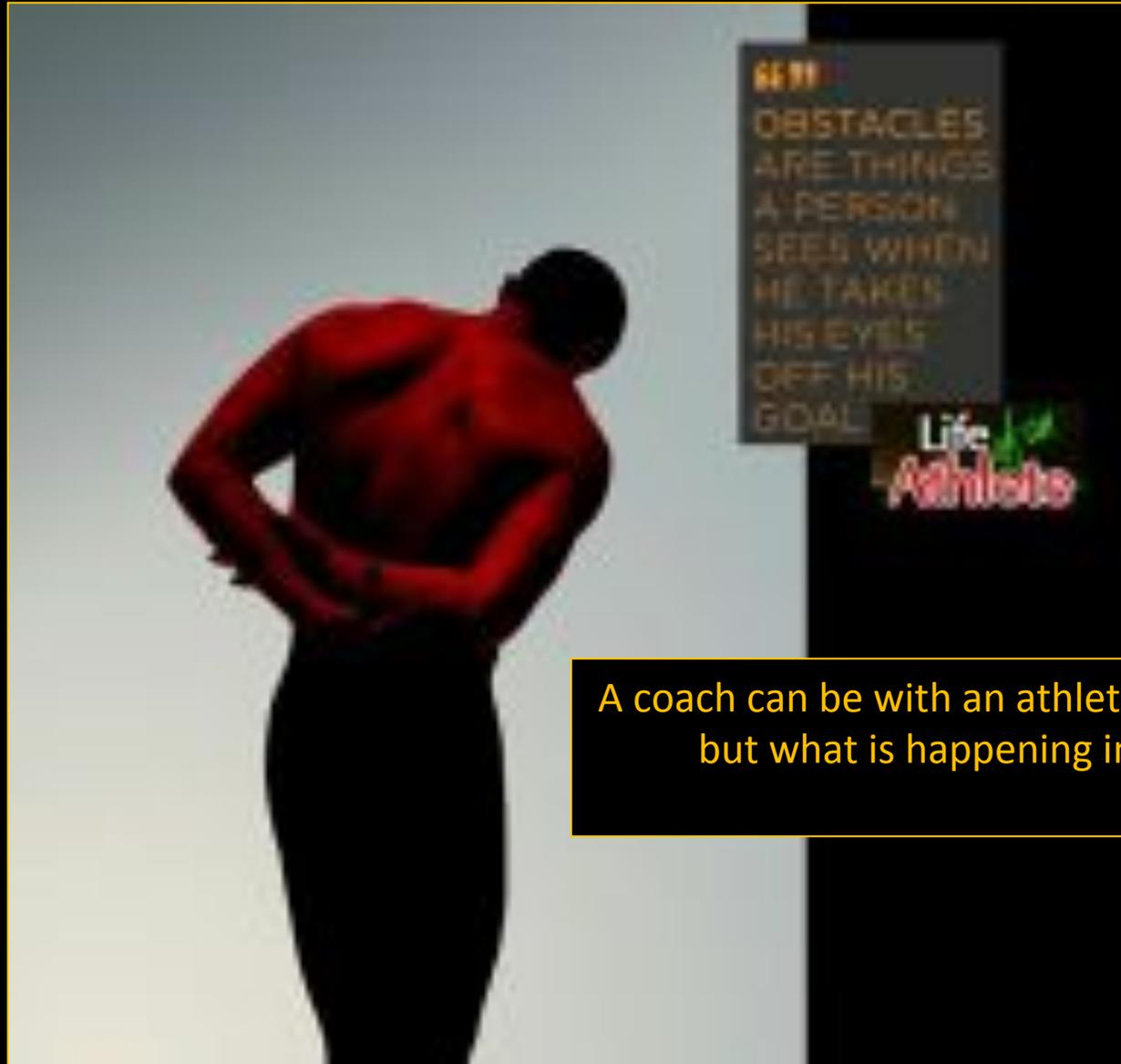
Cardiovascular  
System

Biological  
Power

Metabolic  
System

Hormonal  
System

# Lifestyle matters... Lifestyle counts



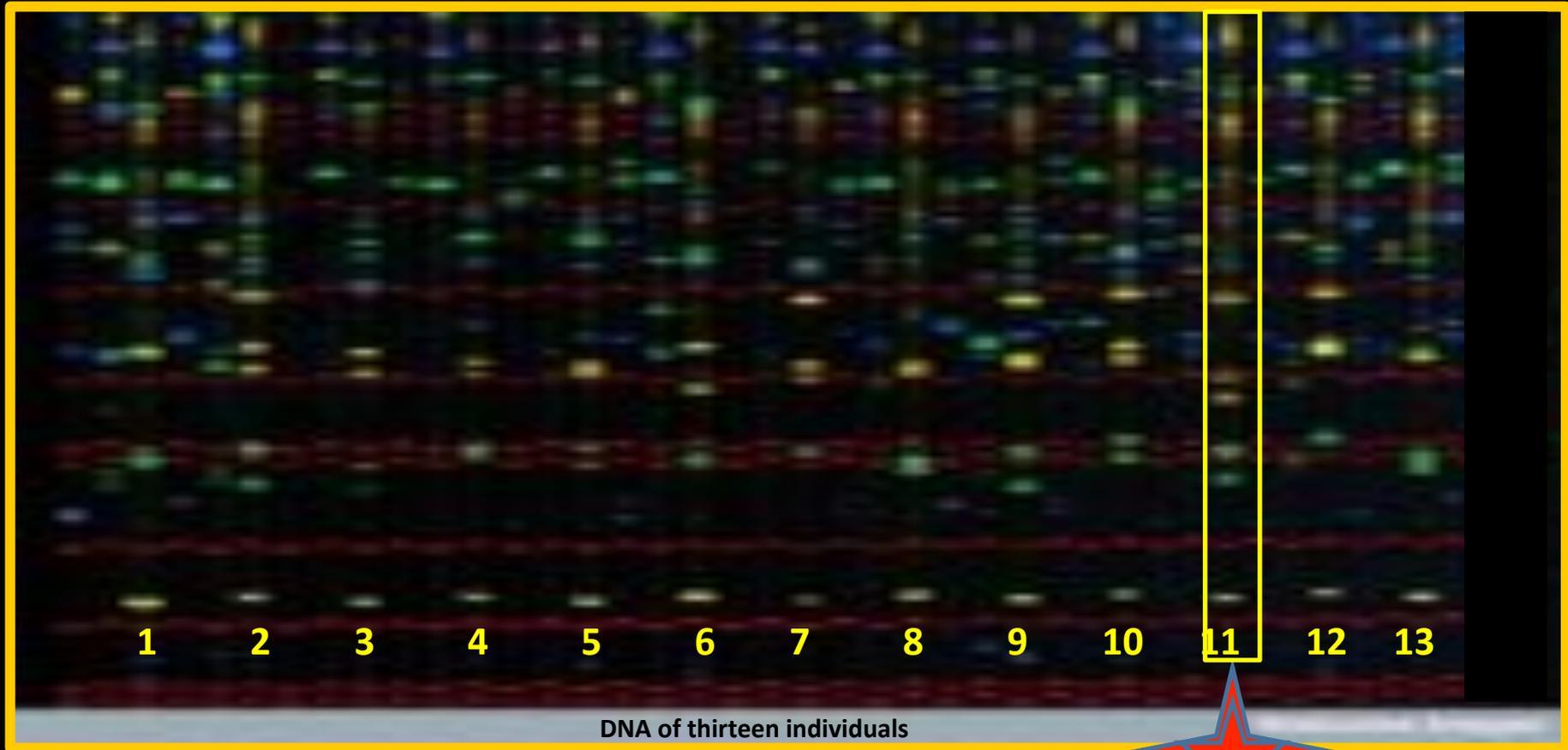
1%

A coach can be with an athlete for three hours in a day...  
but what is happening in the other 21 hours?

Joachim Cruz



# ALL THAT MAKES YOU



8%

TALENT



## **TALENT**

*Takes you to the crossroad of opportunity... it's the rest of the journey that makes a champion!*

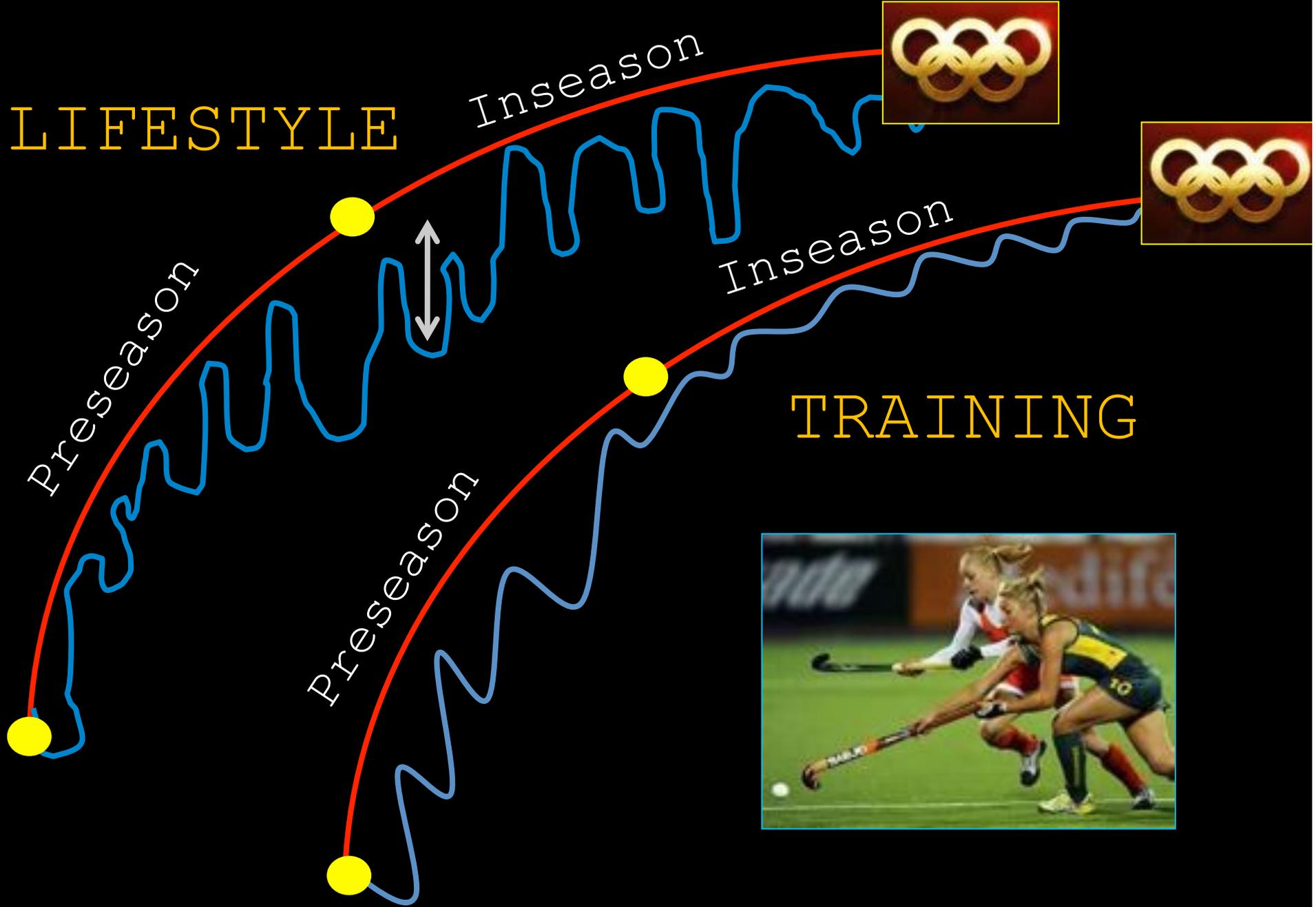
Life *of an*  
**Athlete**

No amount of talent will overcome a lifestyle that is in conflict with elite athletic performance...



# Performance Factors

LIFESTYLE



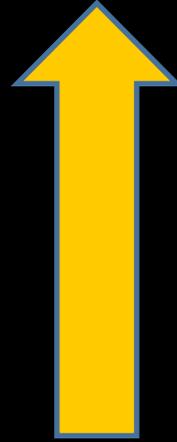
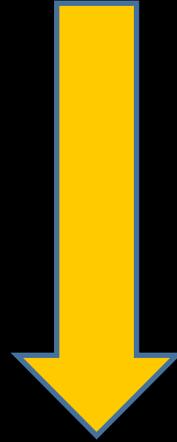
TRAINING



# Peaking Training

100 DAYS

Olympic  
Games



Modernization has affected factors in athlete development which are clearly not conducive to optimal mental and physical performance...

# Training Recovery Performance



Athlete lifestyle is changing



Mostly Downward



facebook.

# LIFE AS WE LIVE IT



The lifestyle of this century has created conflicts and dilemmas that greatly reduce the effectiveness of top level athletes to train, recover and perform consistently at or near their best.



6:35  
Time to train



# EDUCATION FOR OLYMPIANS



If we do not teach athletes to live an optimal lifestyle They will still make one up!



**For many there is no rhythm!**

**BIO  
CIRCADIAN**



**RANDOM EVENTS**

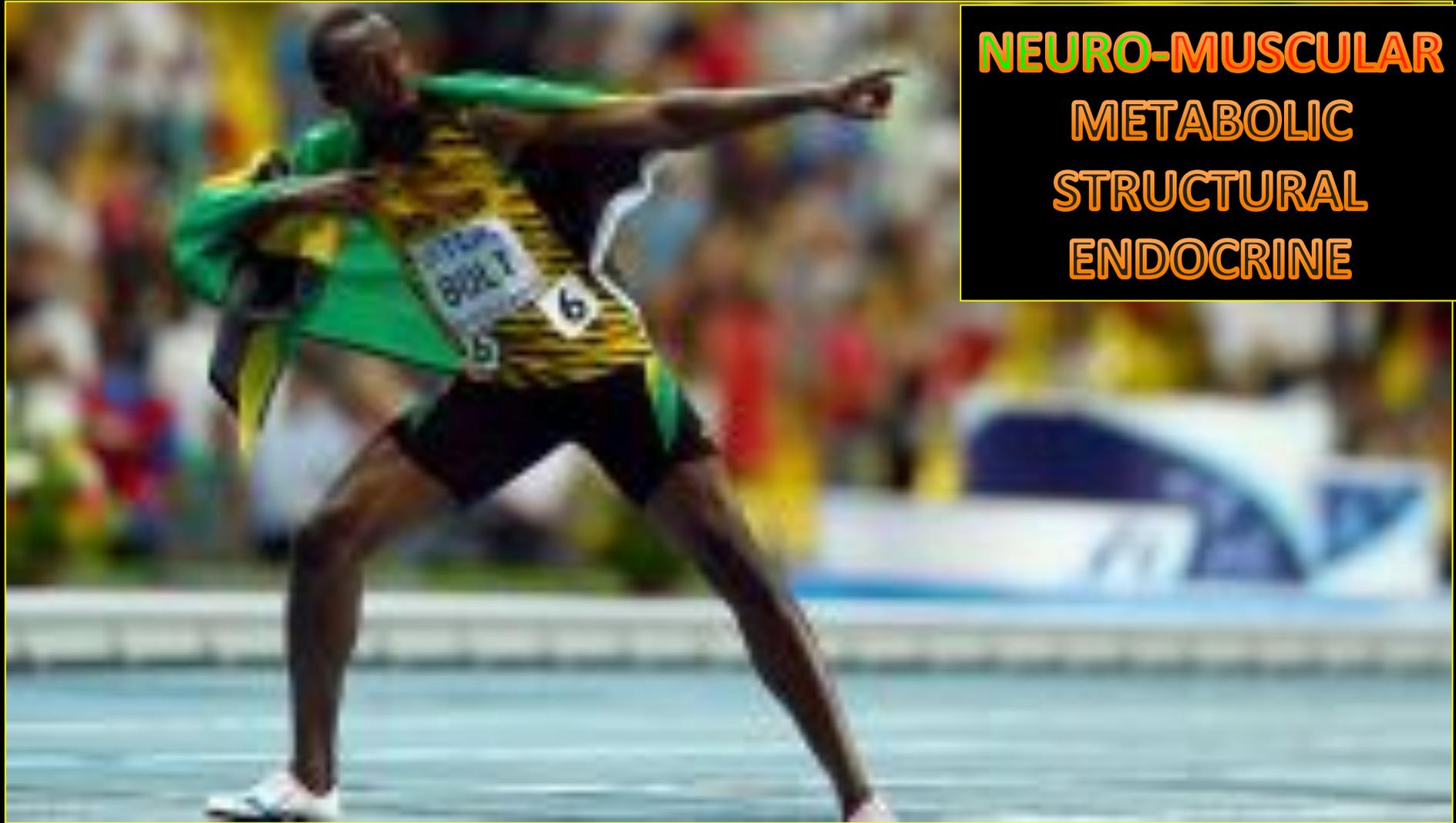
# LIFESTYLE AND RECOVERY



The single most overlooked aspect of athlete failure is issues related to recovery...

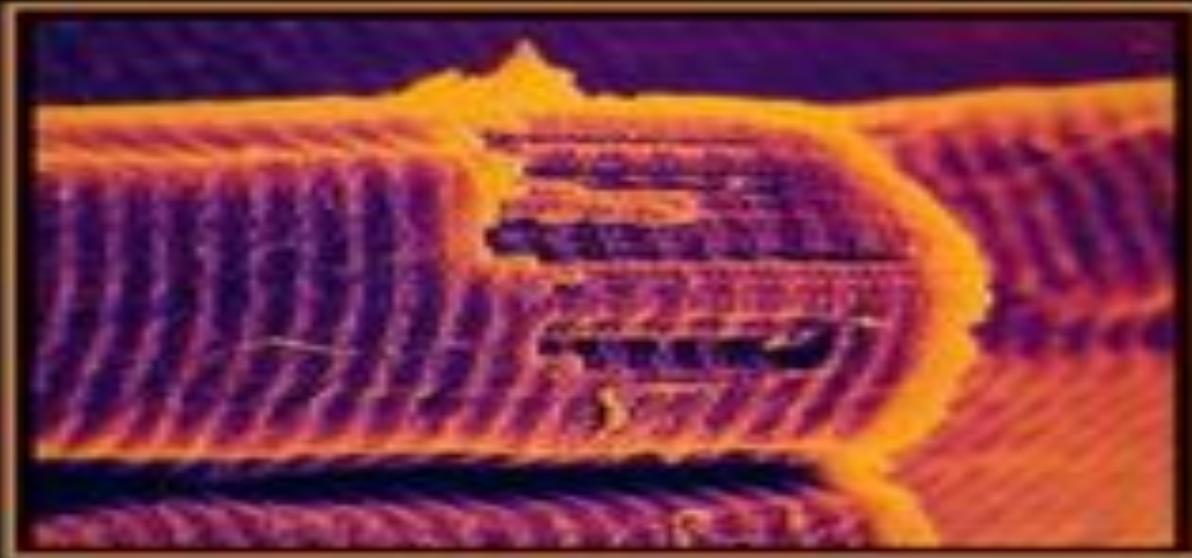


Fatigue, which is at the root of the whole recovery paradigm, can be split into four categories



**NEURO-MUSCULAR**  
**METABOLIC**  
**STRUCTURAL**  
**ENDOCRINE**

# Example Muscle Concerns



WARMDOWN  
NUTRIENTS  
COMPRESSION  
HOT/COLD  
MASSAGE  
ELASTICITY/FLEX

Where has the same consideration  
been for CNS?



**#1**



The single biggest factor in  
optimal performance

**CNS READINESS**

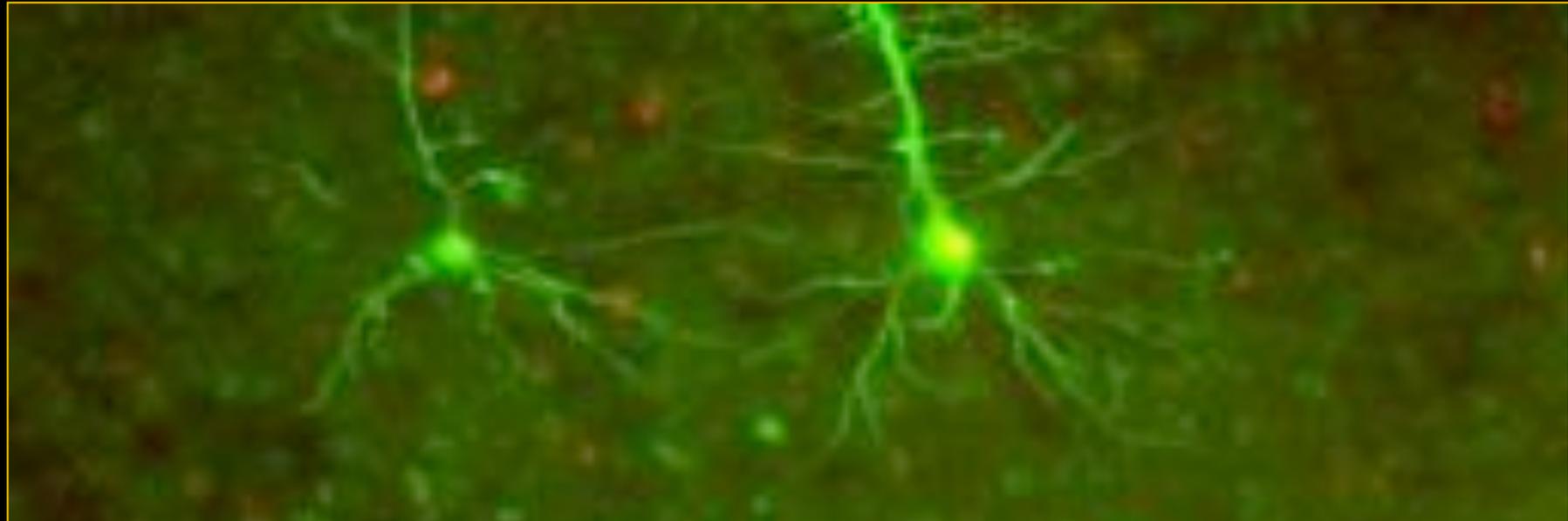


The brain  
processes  
400 billion  
points of data  
every second.

Life of  
Palmita

Is your brain ready to play?





100,000 Chemical reactions per second during athletic competition





## Brain Drain

Learn how you can either waste or save CNS readiness for when you need it in a competition...





# SLEEP

The effect of sleep on high level mental and physical performance



# STRESS

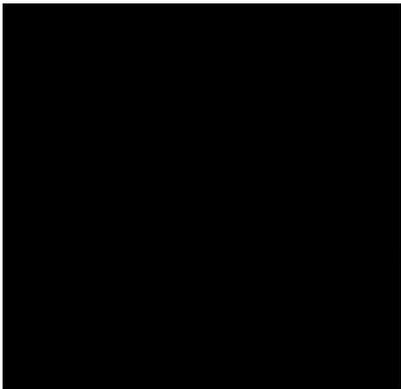
The effect of stress on high level mental and physical performance



# SOCIAL DRUGS

The effect of social drugs on high level mental and physical performance



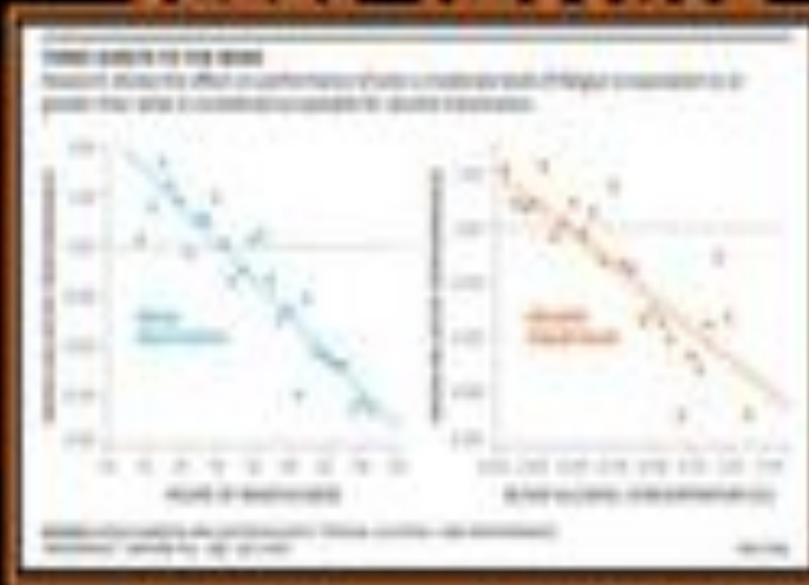


**AWARENESS**





# SLEEP ALCOHOL



Lack of sleep  
and decreased  
performance

Alcohol impairment  
and decreased  
performance

Note the similarity of decreased performance from sleep and to alcohol. It shows a nearly identical profile the performance that is clearly diminished. Athletes need to understand how much you lose when you don't sleep or booze!



# Nutrition



These essential superfoods are rich in antioxidants that can help protect your muscles and joints from injury. The most powerful are polyphenols and omega-3 fatty acids.

**eat right.**

Life by Athlete

THE UNIVERSITY OF TEXAS AT AUSTIN

**Power Back Diet**

THE UNIVERSITY OF TEXAS AT AUSTIN

www.utexas.edu



Worse than we thought!

160,000 fast-food restaurants strewn  
across the U.S., serving approximately  
50 million people each and every day.

35% of the U.S. population considered obese



Life of an Athlete  
Human Performance Project

Life of an Athlete

FOOD CHOICE DETERMINES ENERGY LEVELS

# SOCIAL ISSUES 2013



**STRESS**  
**TIME MANAGEMENT**  
**SLEEP/CNS FATIGUE**  
**RECOVERY**  
**DIET/NUTRITION**  
**ADVANCED**  
**TECHNOLOGY**  
**SOCIAL DRUG USE**  
**PRESCRIPTION DRUG USE**  
**SUPPLEMENTS**



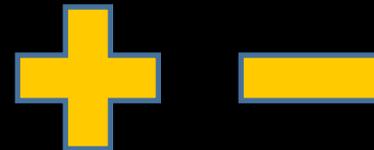
It's not just what you are willing to give...  
It's what you are willing to give up!



# PERFORMANCE FACTORS



In sport we spend most of our time looking at positives and ignore to a great extent the negatives...





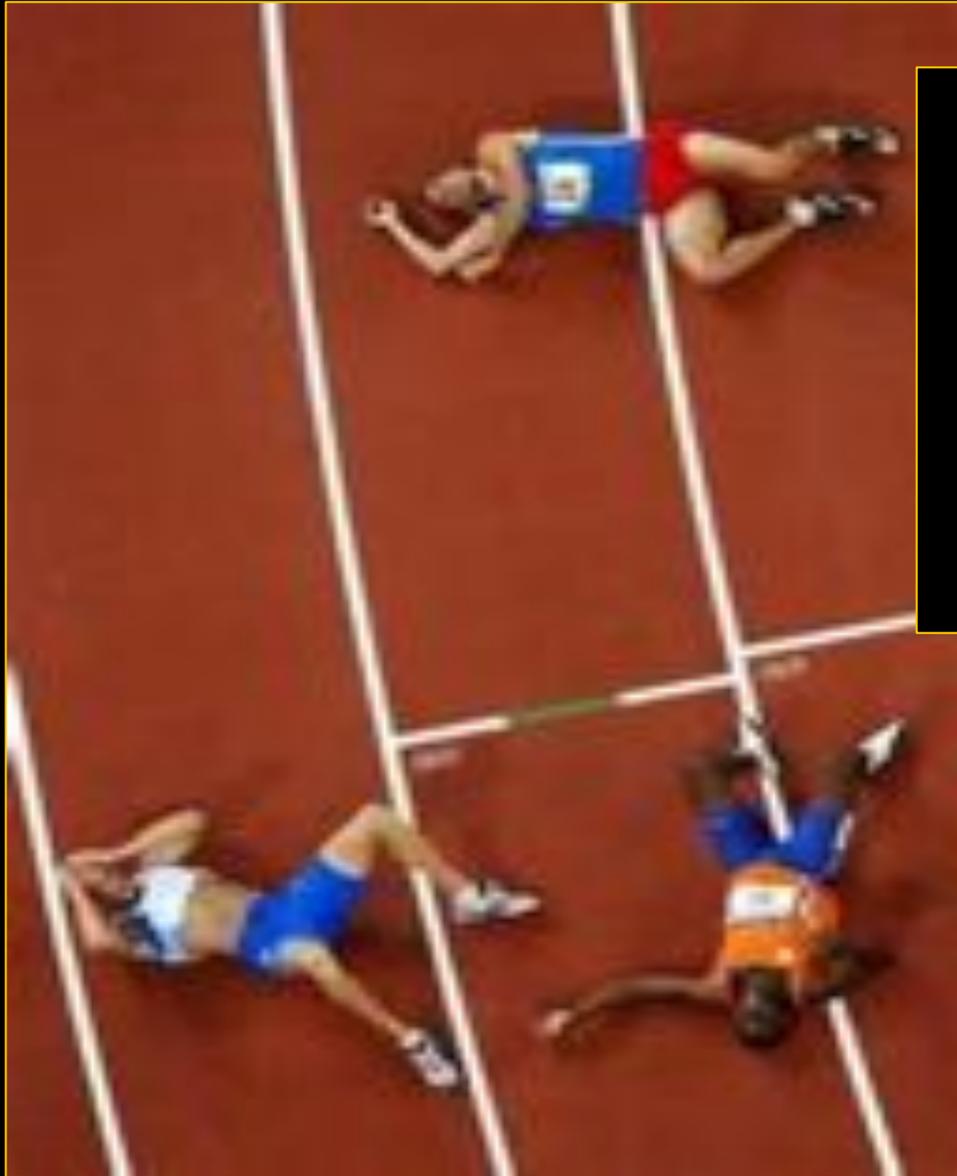
Blood glucose up  
Muscles Fueled  
Hydrated  
Body systems rested  
CNS rested  
Hormones up



**FACTORS**

**ALL SYSTEMS GO**



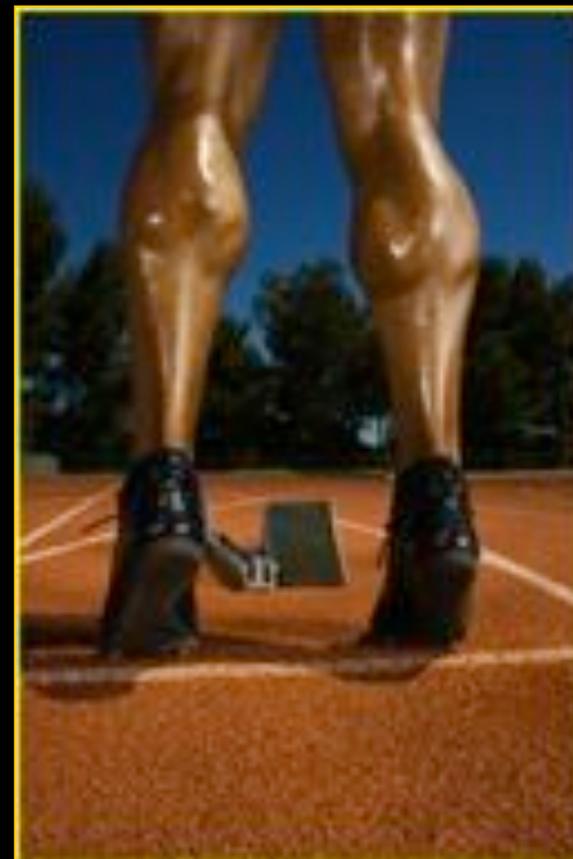


Poor Diet  
Poor Sleep  
Stress  
CNS Overstimulation  
Social Drug Use  
Poor Recovery  
Poor Training Methods

— FACTORS

ALL SYSTEMS NO





**24 HOURS**

**BODY RECOVERY**



# BODY MUST BE RESTED WHEN YOU TRAIN

The CNS takes much longer to recover than the heart lungs and muscle systems...

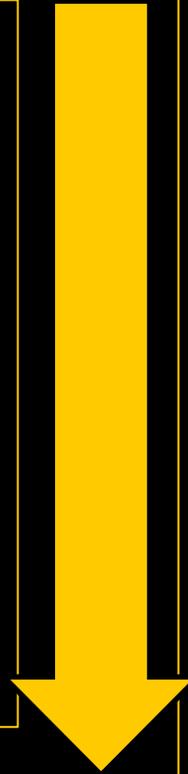
48 HOURS

24 HOURS



# RECOVERY

HOUR 1  
HOUR 8  
HOUR 24



70%  
20%  
10%

DYNAMICS OF RECOVERY AND TIME



**60**  
MINUTES

## The first hour

During the first hour after a workout the majority of recovery takes place and training effect is maximized.





The single most critical factor in training effect taking place or not...

# POST TRAINING NUTRITIONAL RECOVERY





The highest rates of nutrient uptake occur during the first 10mins after training .



This is because all the nutrient transport and storage mechanisms become switched on thus increasing the body's absorption rates. The nutrients that are required are glucose (from Carbohydrate) and amino acids (from Proteins).

**THE QUICKER THE BETTER**





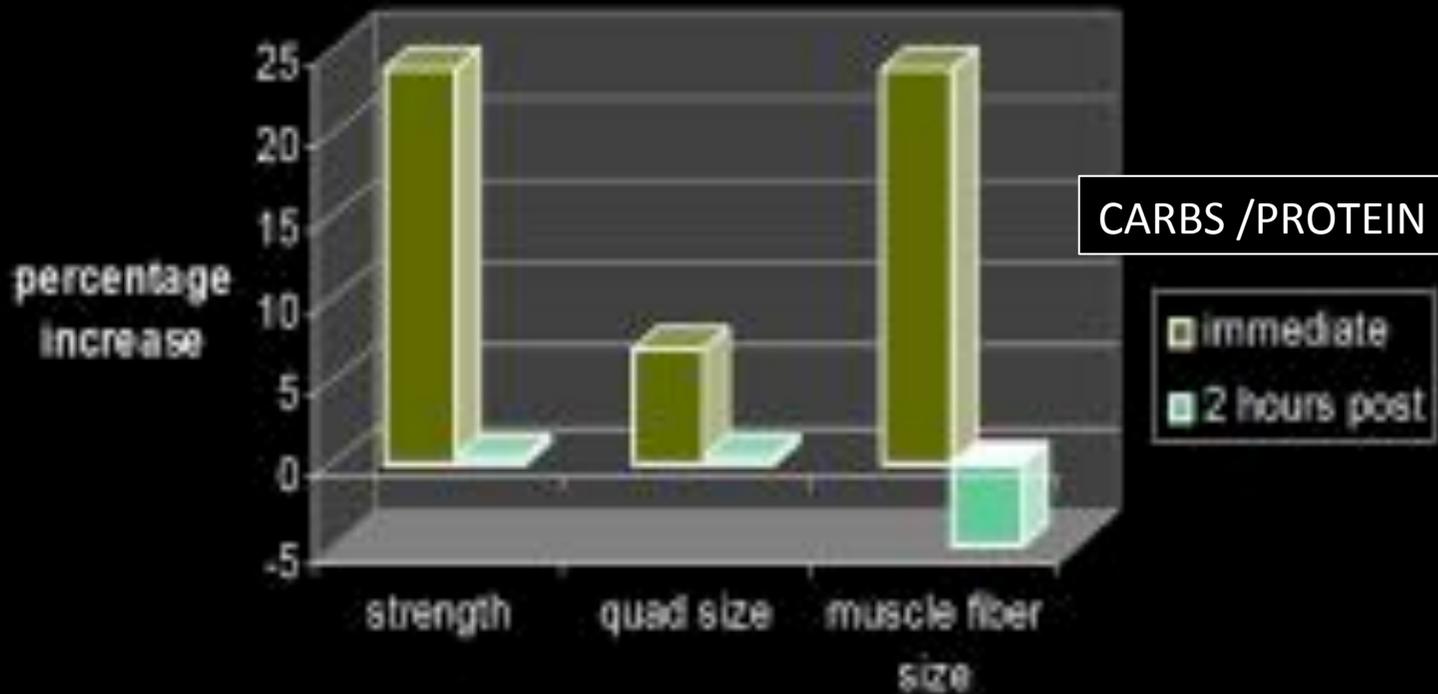
# PROTEIN

Protein blunts negative effects  
Accelerates positive factors in muscle

## Fast Protein Critical



## Changes in strength, muscle size, and muscle fiber size



# Don't Wait



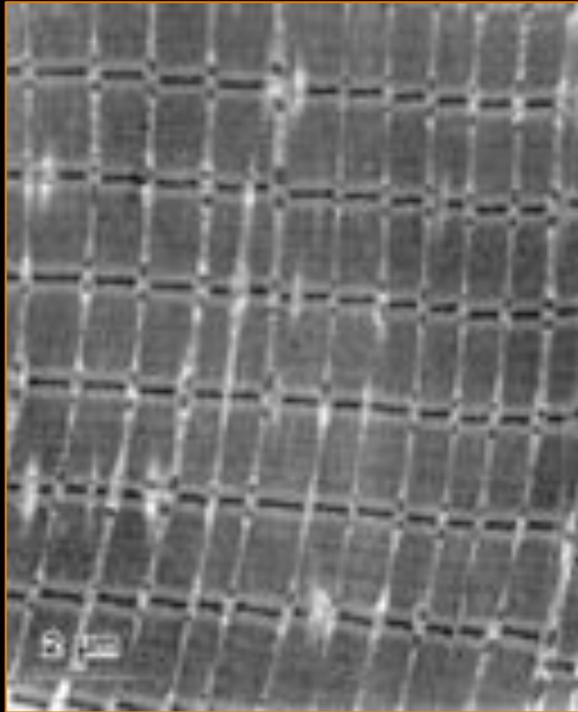


There is muscle damage from any kind of physical activity

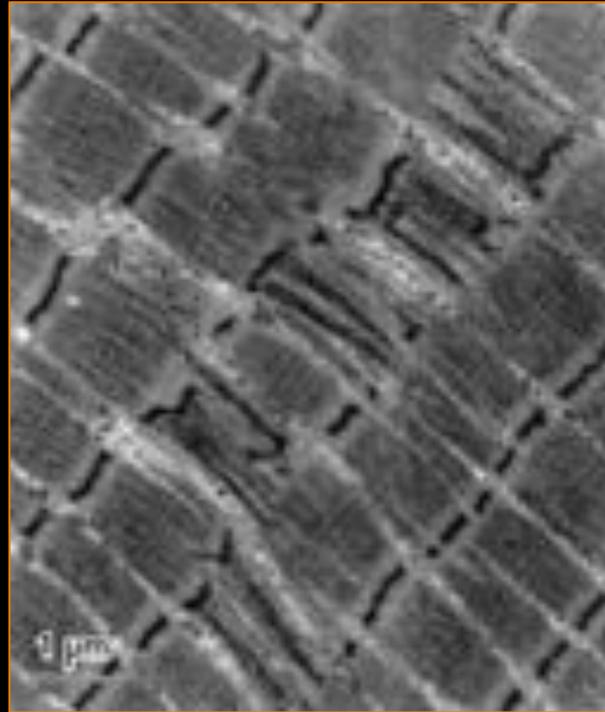
The higher the intensity the greater the damage

**MUSCLE DAMAGE**

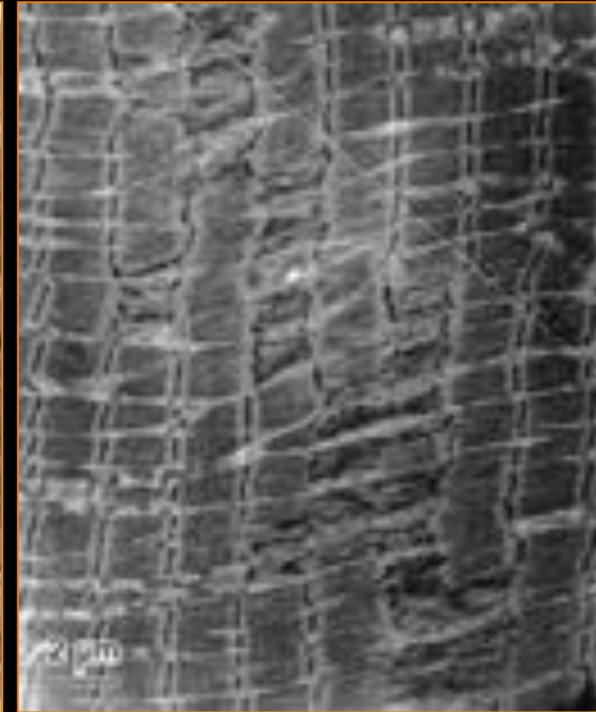




NORMAL



MODERATE

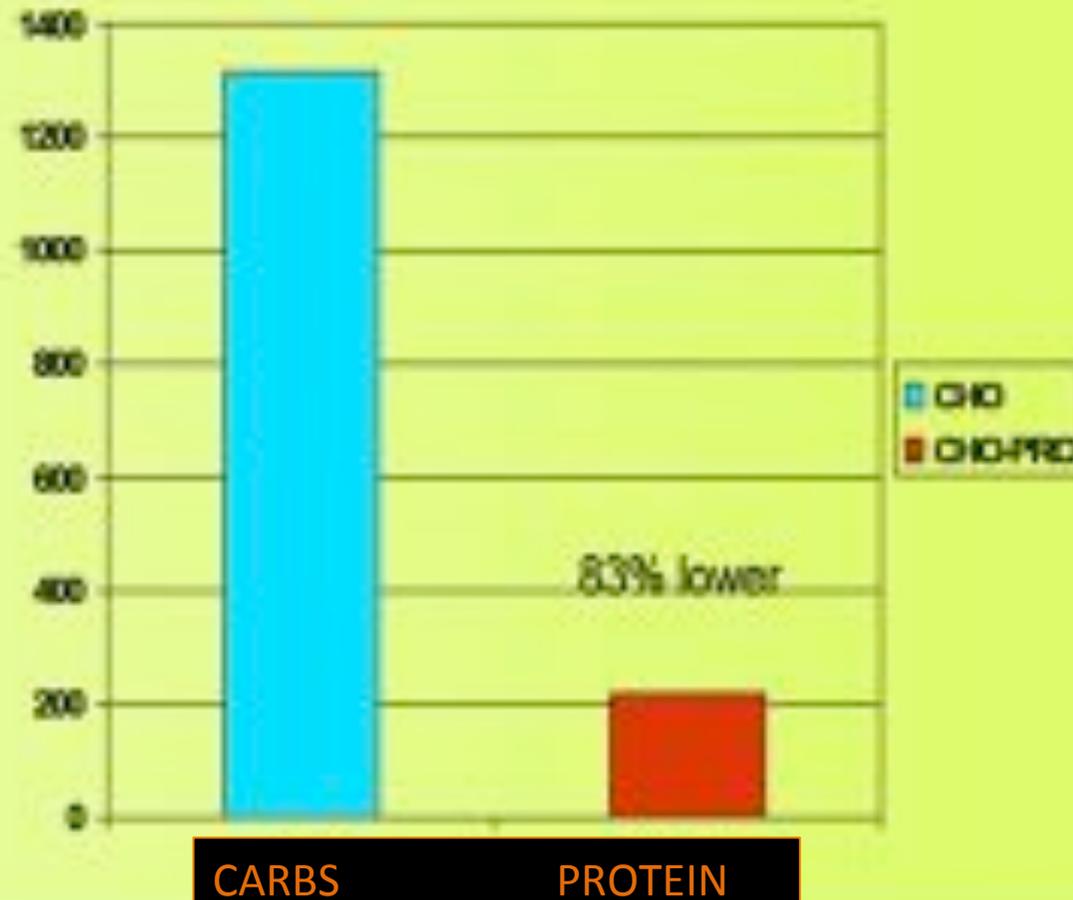


EXTREME

# Muscle Damage



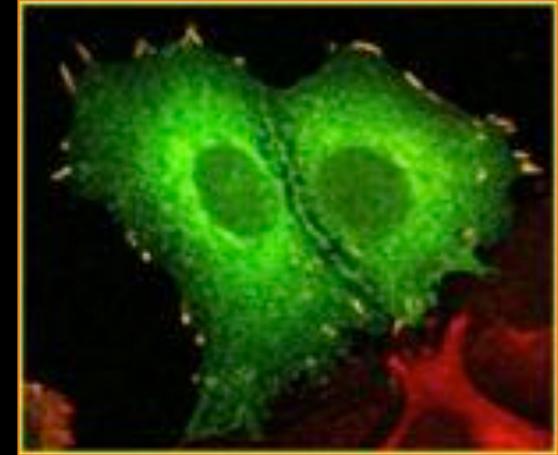
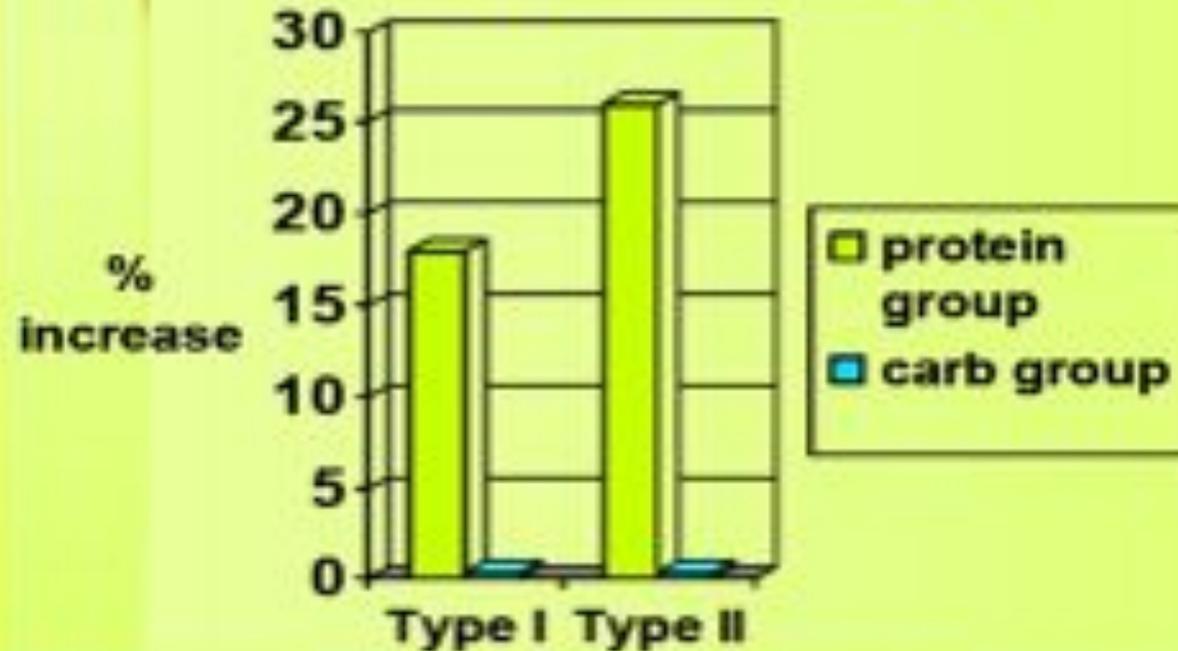
## CARBS AND PROTEIN AFFECT ON MUSCLE DAMAGE



How sore do you want to be?



## Muscle Fiber Hypertrophy in Protein Group

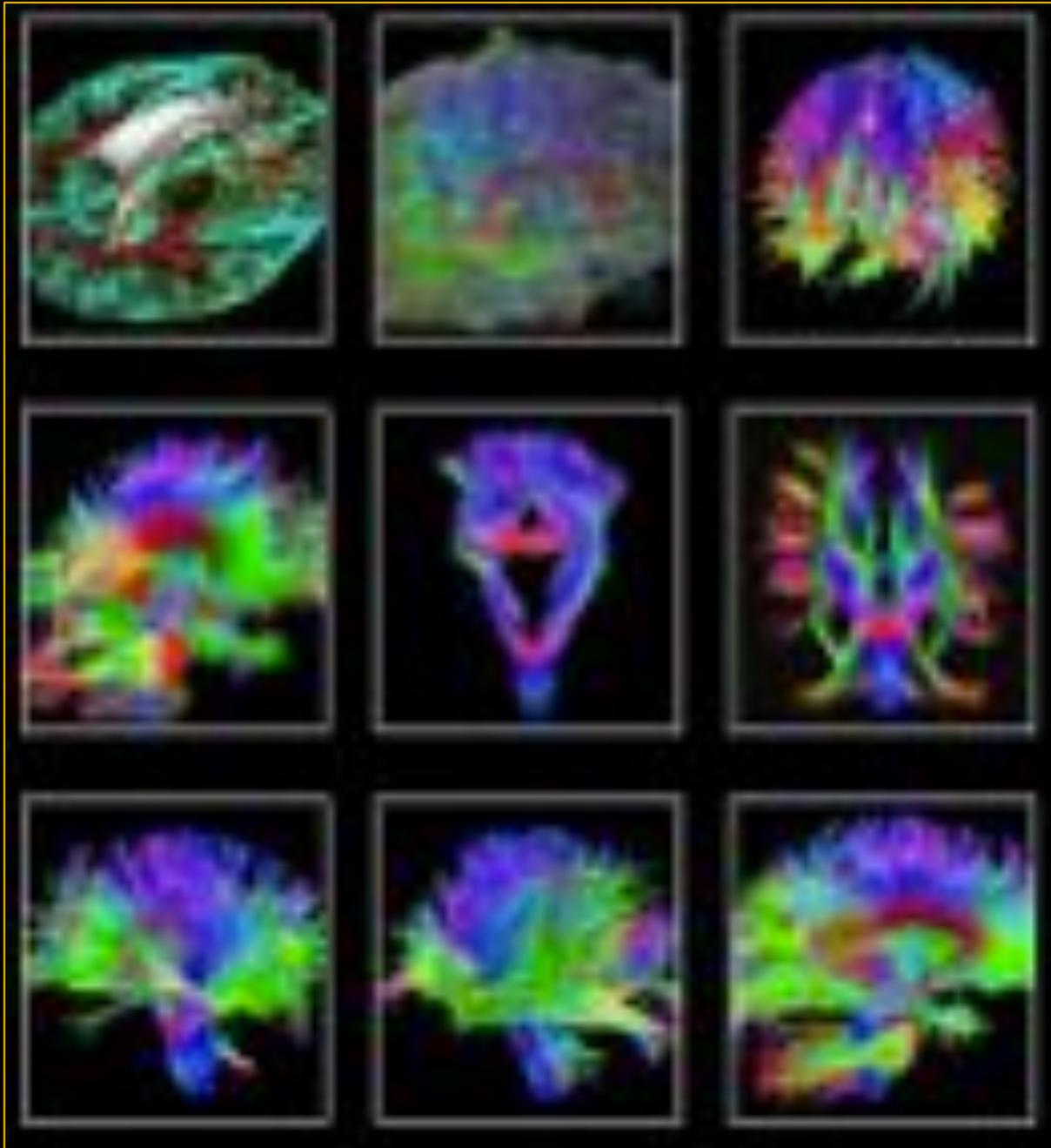


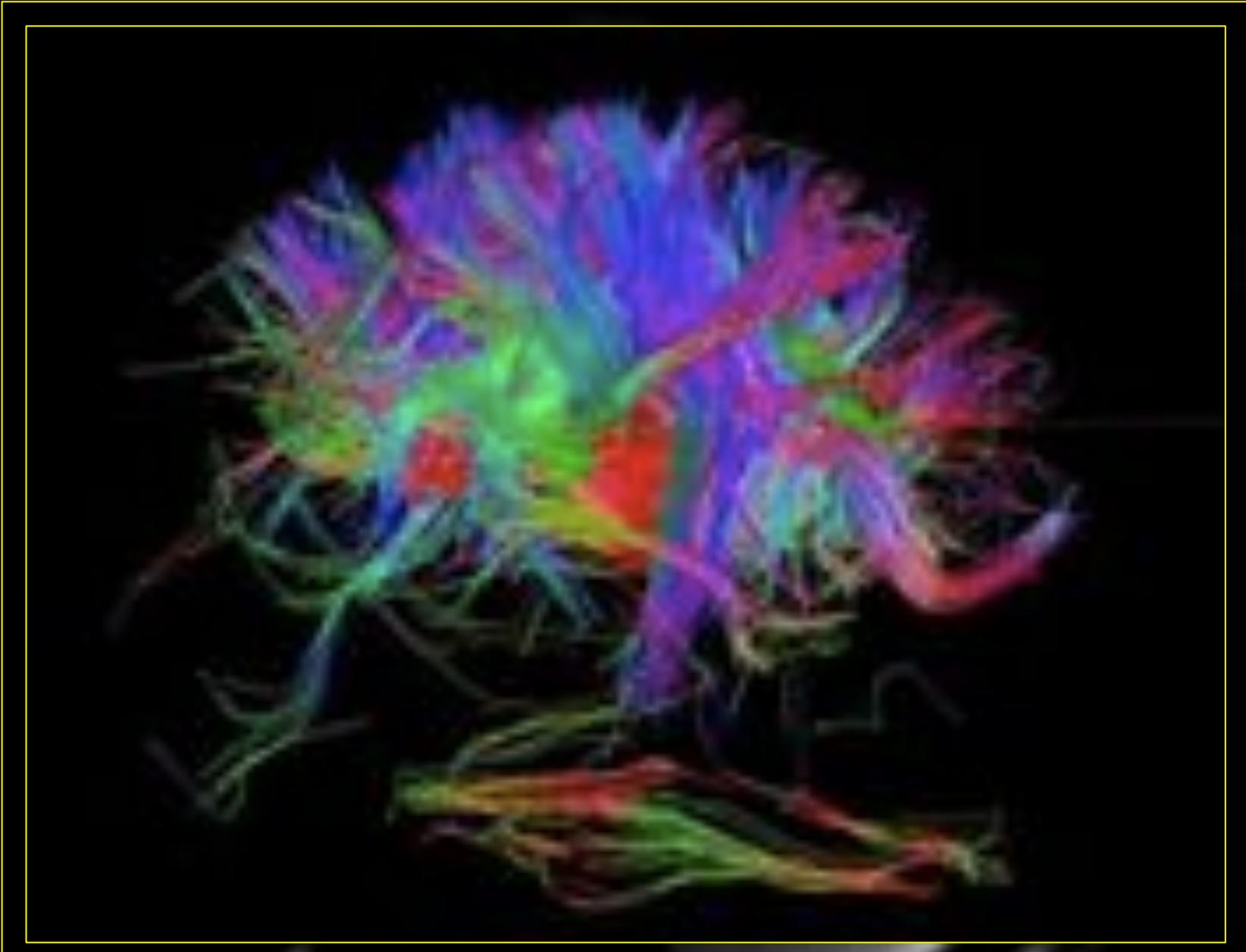
**NEW  
MASS**

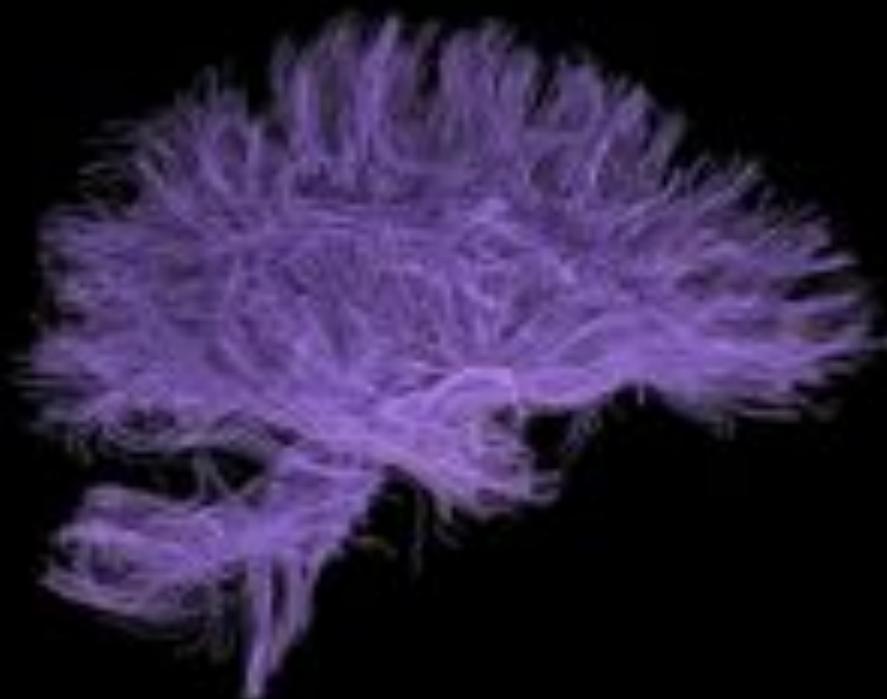
**Muscle Protein Synthesis**

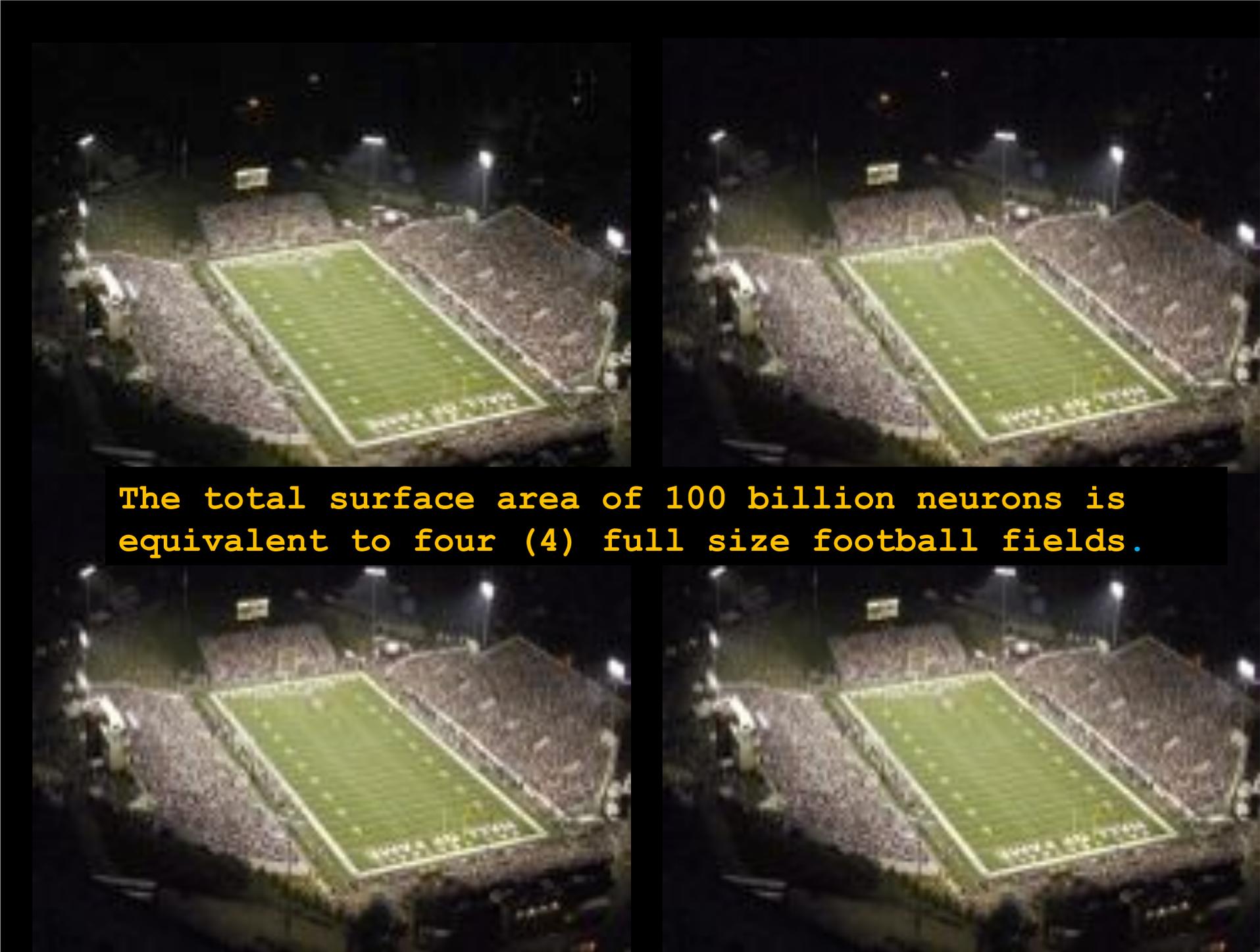




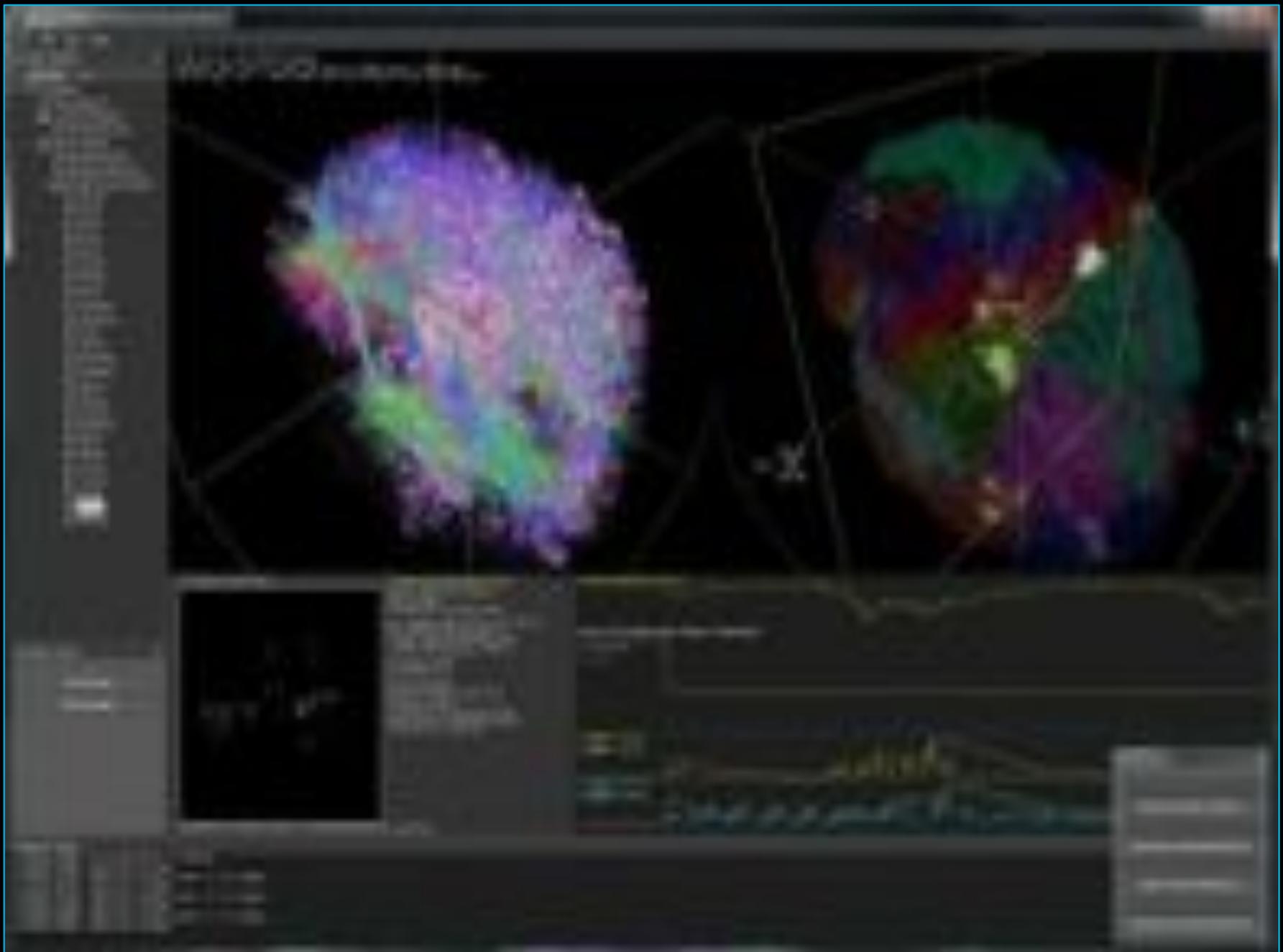








The total surface area of 100 billion neurons is equivalent to four (4) full size football fields.



**Play Video Clip**

THINKING

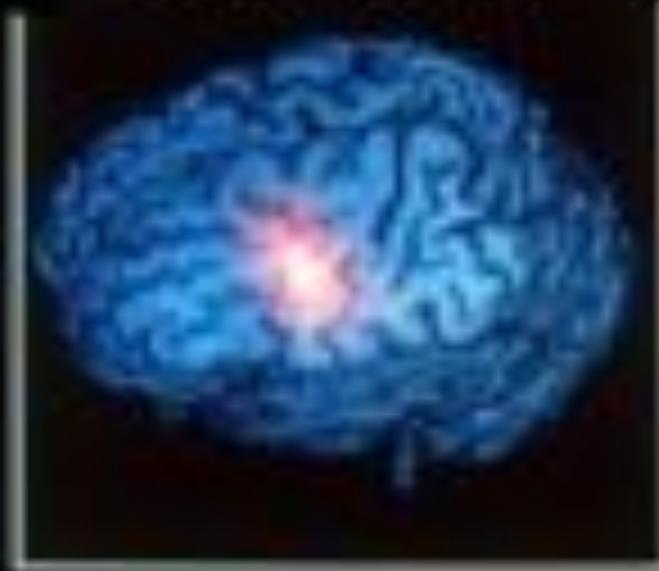
PRE-MOVEMENT

MOVEMENT

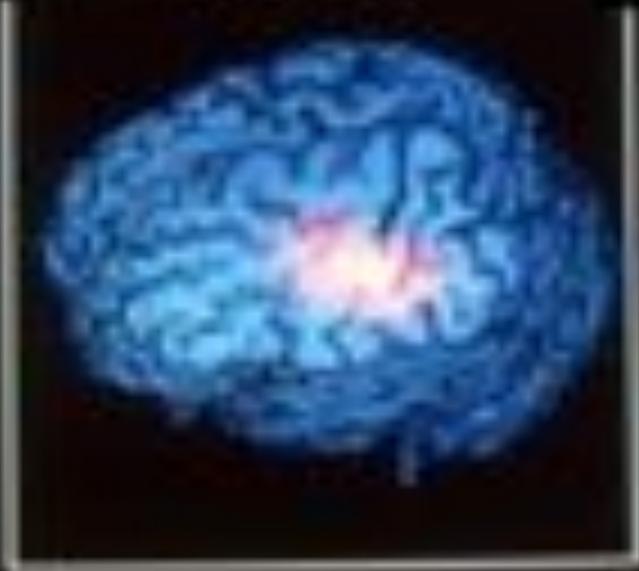


Brain and Movement

PRE MOVEMENT



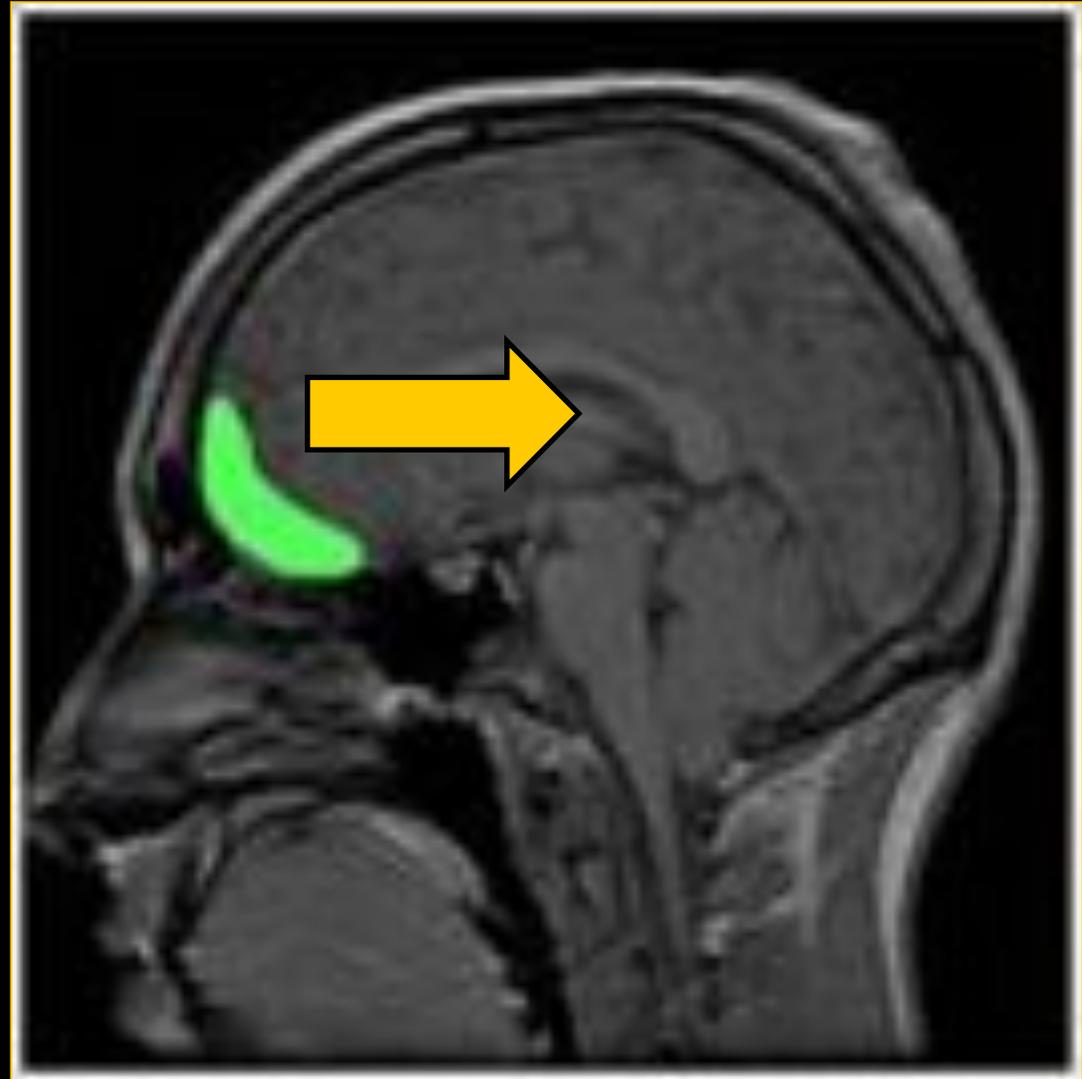
MOVEMENT



Two computer images of the human brain (side view), depicting brain to hand nerve control. At left, milliseconds before a patient starts moving their right index finger, nerve cells in the pre-movement motor area of the brain (pink) send movement commands to the muscles. At right, actual movement area transmitting impulses to muscles.

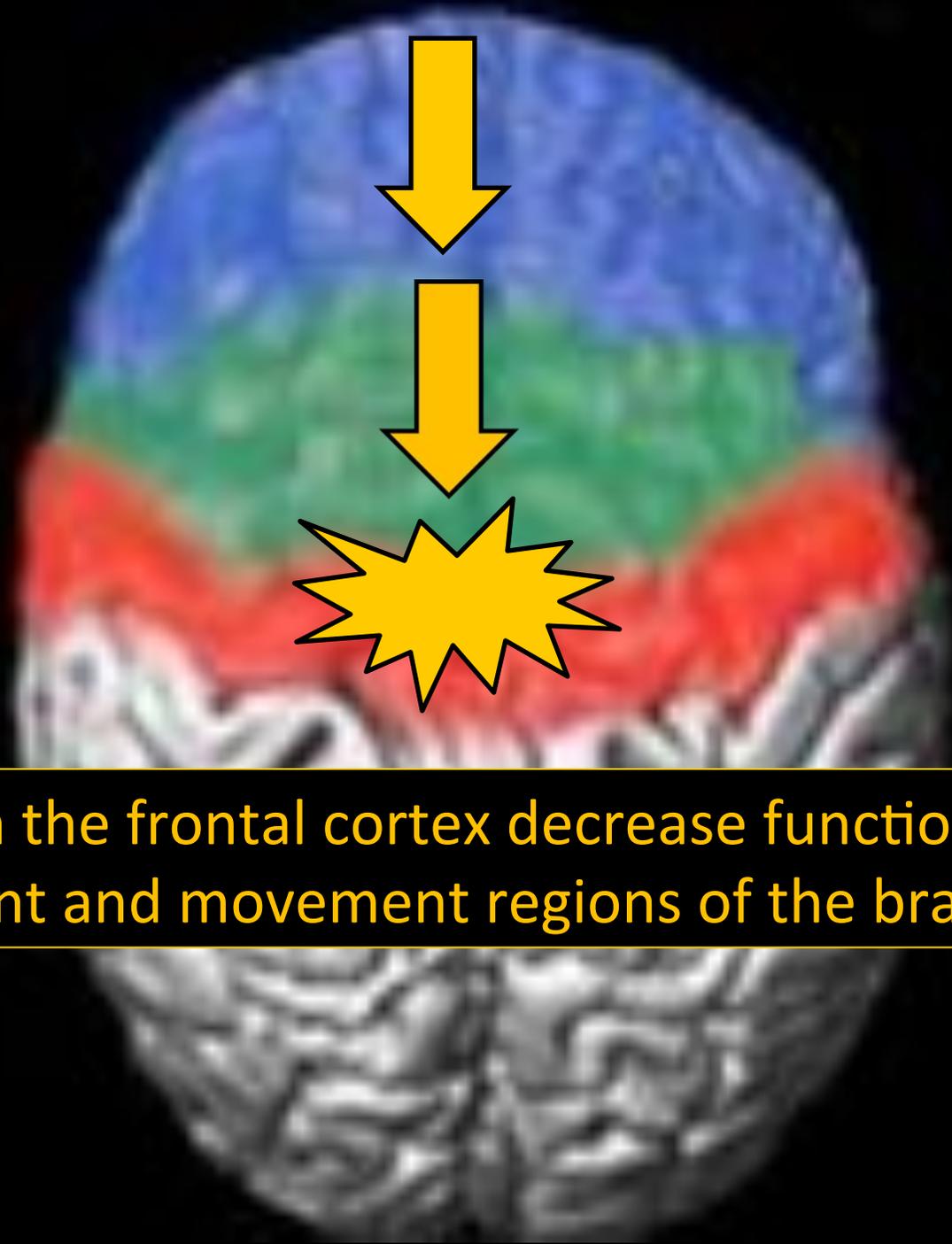


# Physical Movements



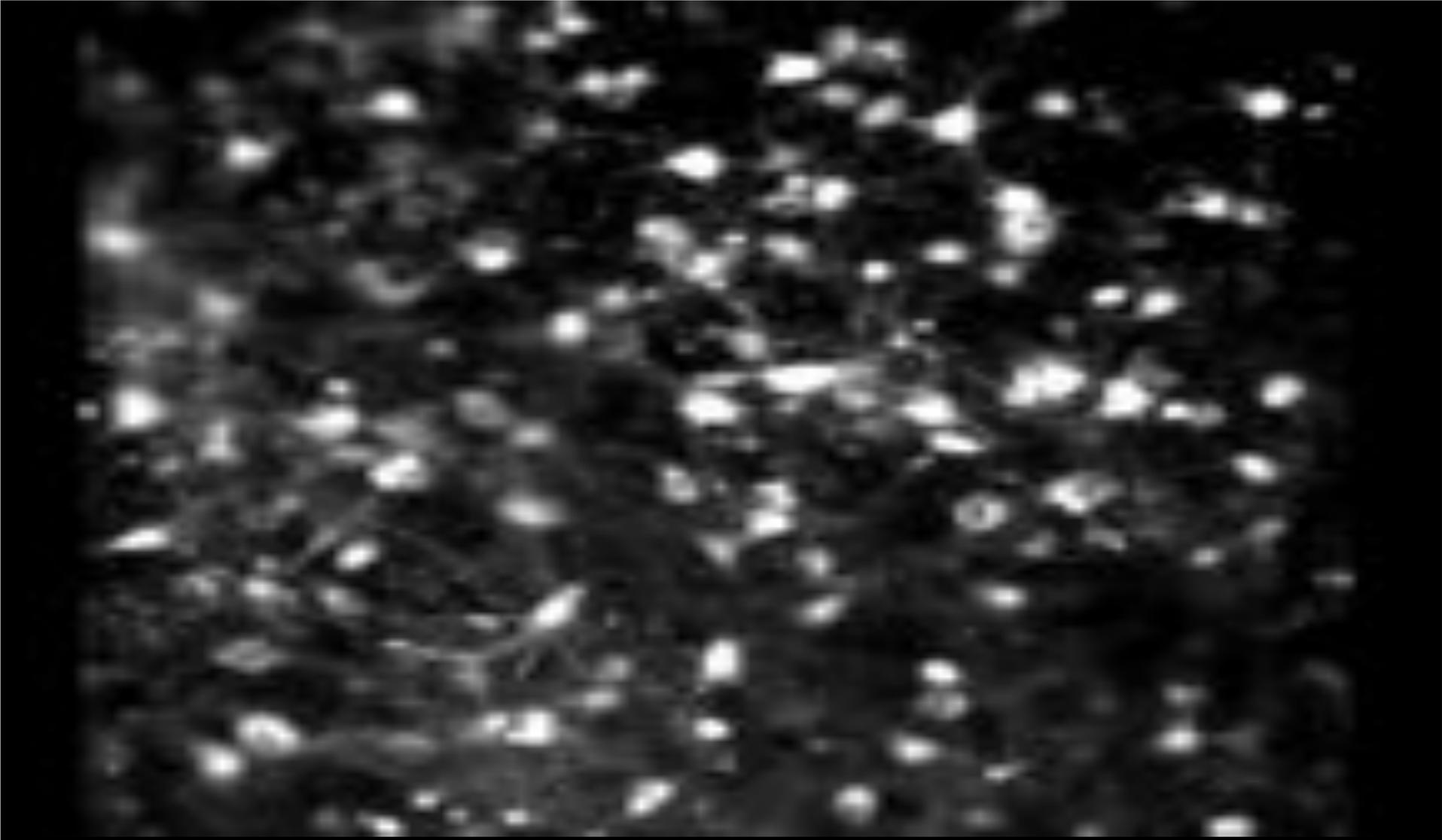
Neural fatigue in processing (FRONTAL CORTEX)  
fatigues other regions of brain function...





Fatigue levels in the frontal cortex decrease functions in pre-movement and movement regions of the brain





*Neuronal activity during physical activity*

**FIRESTORM**



The amount of information we are now exposed to has increased more in the last 50 years than in the previous 5,000.

*"Every piece of information you are consciously or unconsciously exposed to - has to be processed by your brain!"*

# Information Overload Athletes included!

P.S. “  
So if you want a sense  
**MORE THAN HALF OF THE HUMAN  
RACE IS UNDER THE AGE OF 30.**



to watch  
what kids  
are doing.”

How much does technology effect mental  
and physical performance?

More than you think!

 Life of an Athlete  
Human Performance Project

# PROCESSING

4 years  
1460 days  
35,040 hours

# OLYMPIC TIME

Time management

Every day matters  
Every day counts



The single largest factor in  
athletic development is time... Matveev USSR





**Everyone gets 24 hours ...  
its how you use them that matters**

**The human body can adapt to less time  
but there are serious deficits in mental  
and physical performance...**



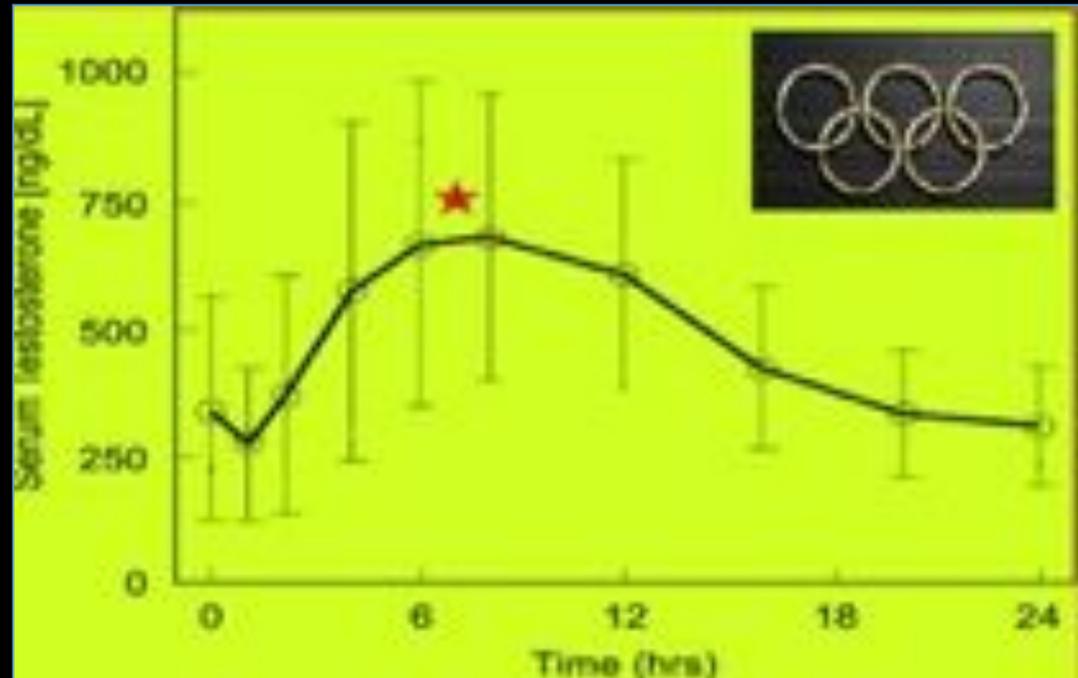
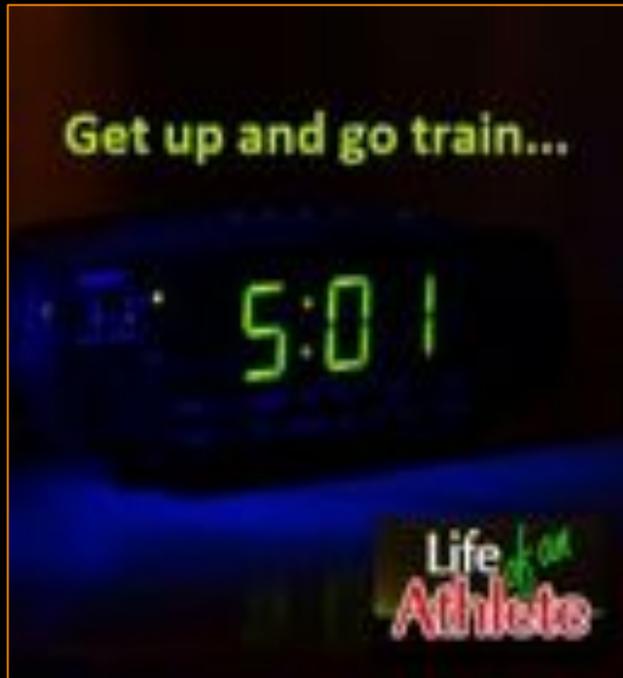
# ATHLETE TIME

1-3 WORKOUTS PER DAY  
4-6 HOURS BETWEEN WORKOUTS  
24 HOURS FOR FULL RECOVERY  
1 HOUR MAX FOR HIGH INTENSITY



It is now necessary to monitor athlete time management with them and for them due to the societal influences that are affecting development.





We know training , training effect and recovery are optimal early in day..



**WORKOUT IN  
THE MORNING**  
BEFORE YOUR BRAIN FIGURES  
OUT WHAT YOU'RE DOING

**Fatigued  
Forget it**

The body and all physiological systems must be rested and restored in order for training effect to take place. Any disruptions to the recovery process leaves the body unable to respond anabolically. The net outcome is at best a flatline. Come ready to train...

**DON'T WASTE YOUR TIME**





# OPTIMAL?

Morning training is only effective when athletes are rested...

We know fatigue levels are very high in morning due to many factors...





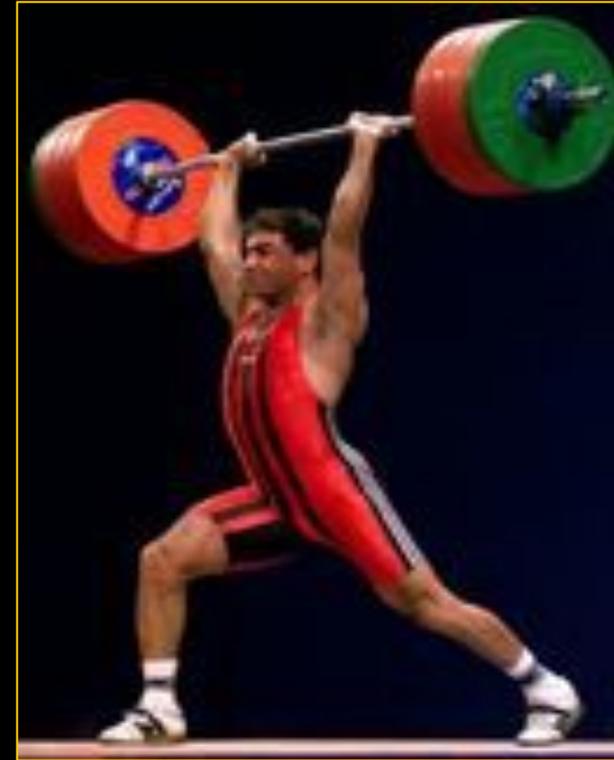
**HORMONE RELEASE**  
**HEARTRATE**  
**EFFICIENCY**  
**MUSCLE FUNCTION**

Neural Fatigue (NF) is defined as an involuntary reduction in voluntary activation.





**1-3 days**



The brain seems to be able to build up energy deficits or energy reserves over several days and will function at that level.

**CNS READINESS**



**If you go too hard on your easy days ...  
Soon you will be going too easy on your hard days.**

# **QUALITY RESTED**

**If you are going to train very hard...  
Of course you need to rest very hard.**

**Keijo Hakkinen FIN  
( World's Leading Power Strength  
Scientist)**



# The whole brain and CNS must be rested





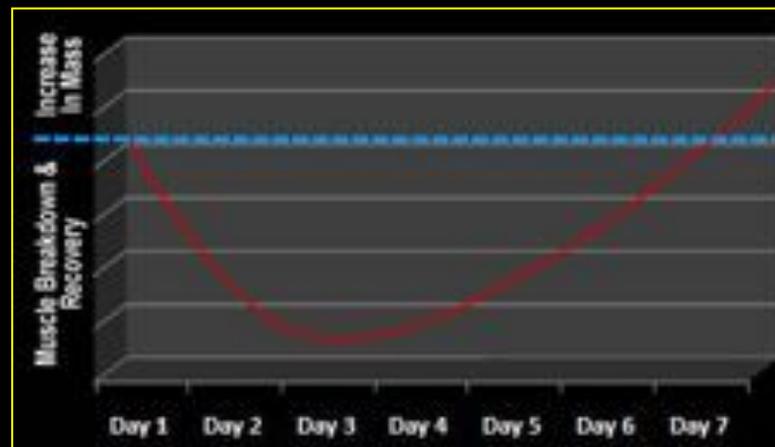


## Neural Fatigue NF

The inability to attain training loads or subpar performance is experienced regularly by elite athletes. It is common for athletes and coaches to have quality workouts that must be postponed or cut short due to fatigue, soreness or the inability to attain desired workloads.

Scientific recommendations have centered in recent years on recovery methods (reactive) and minimizing training damage (reactive)

# RECOVERY MINIMIZE DAMAGE



Attempts to prevent rather than treat conditions or decreased performance potential related to NF.

# PROACTIVE CONSIDERATIONS

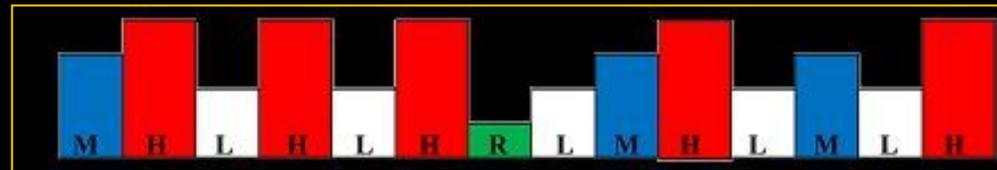




**The approach of simply hoping for the adaptation of high intensity capacities to build up an athlete's tolerance to NF is no different than an athlete getting use to sleeping less and less while having to train and compete, tired, at world class levels.**



COACH



## Change of plans

Is neural fatigue (NF) taken into consideration in the planning of training or do we just react to these negative issues when decreased performance outcomes are visible in training and or competition results?



**What lifestyle issues affecting are our athletes?  
What are the causes?  
How can we limit/minimize them?**



**PHYSICAL  
PSYCHO-SOCIAL  
EMOTIONAL  
CNS**

**ATHLETE STRESS**



# Many athletes create stress!

Just from a hormonal standpoint testosterone and cortisol indicate that stress destroys much of the training stimulus and recovery that results in adaptation...

Daily activity  
yields stress!

OPEN  
24 HRS

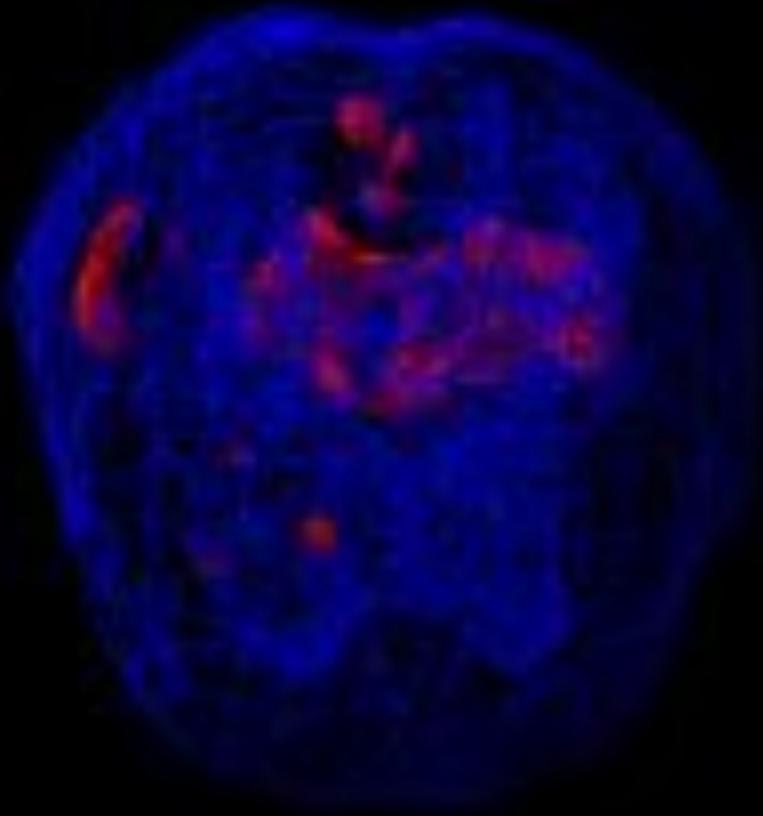




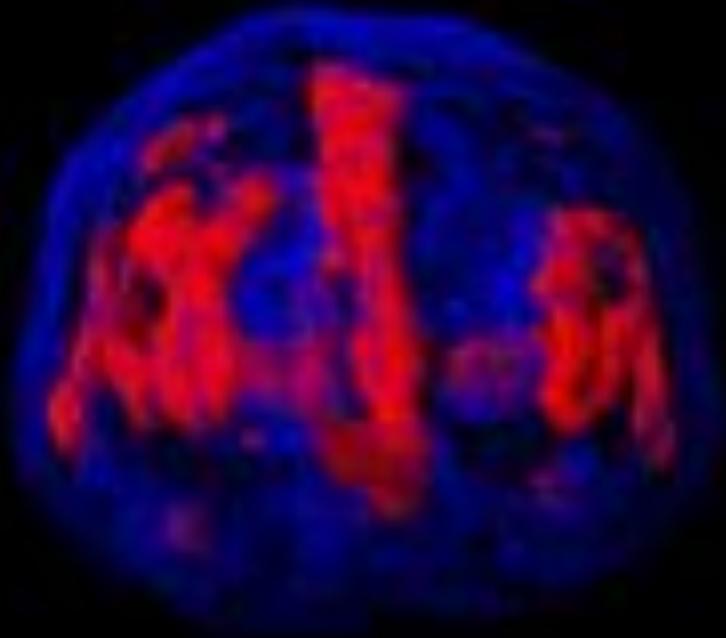
**% TOTAL ENERGY EXPENDITURE**



# CALM



# STRESS



If we can limit the expenditure of energy during the waking hours we can build energy reserves for high level physical /mental activity. Much of this can be utilized in CNS readiness!



High<sub>MR</sub> = lost fuels  
Structural fatigue  
Lost CNS readiness  
Lost performance

# Wasting Energy





# Monitoring STRESS and RECOVERY

TRAVEL STRESS  
JOB STRESS  
RELATIONSHIP STRESS  
FAMILY STRESS  
PHYSICAL STRESS  
EMOTIONAL STRESS  
METABOLIC STRESS

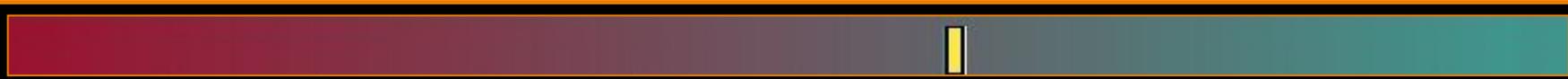
TV VIDEOS  
TEXTING  
FACEBOOK  
SOCIAL LIFE  
AFFILIATIONS  
ACADEMICS



omegawave



# READINESS TO TRAIN/COMPETE



## Poor recovery

Increased risk of overtraining

## Moderate recovery

Easy training recommended

## Good recovery

No risk of overtraining



**2:1**

**AWAKE  
STRESS**

**ASLEEP  
RECOVER**



**16 HOURS**

**8 HOURS**

**DAILY STRESS**





 omegawave™

**HRV**



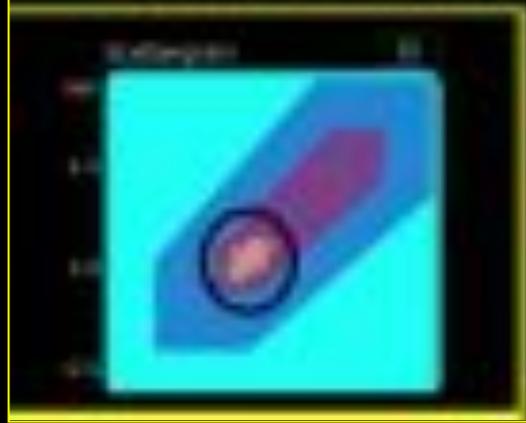
**HEARTRATE VARIABILITY**



Activity  
Assessment date  
Date of birth  
Weight, Height

# Normal profile

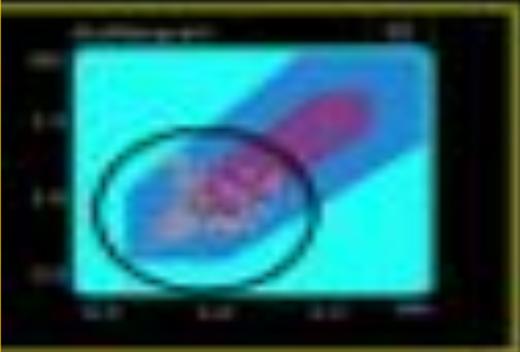
HRV



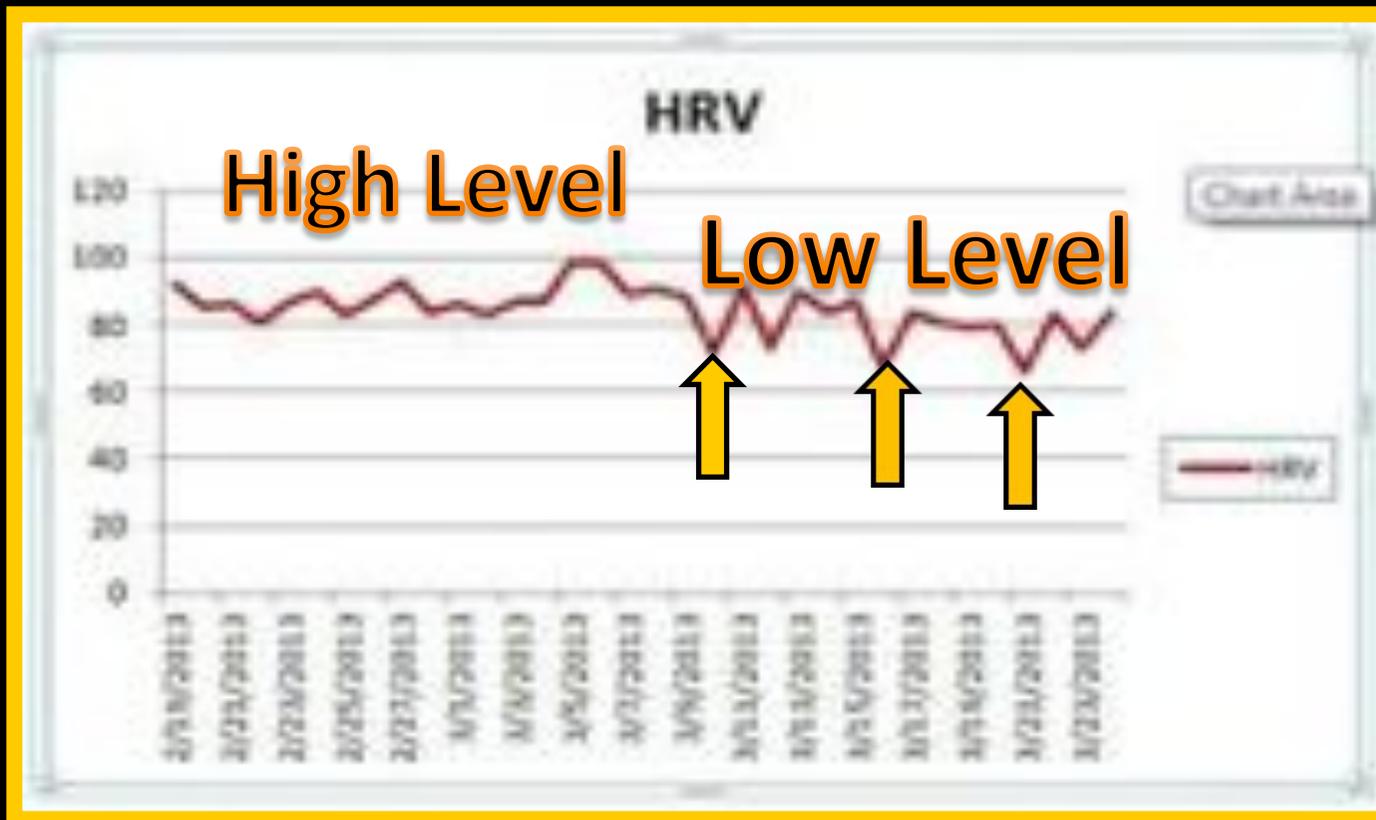
# Disturbances

Author:  
Affiliation:  
Date:  
Page:

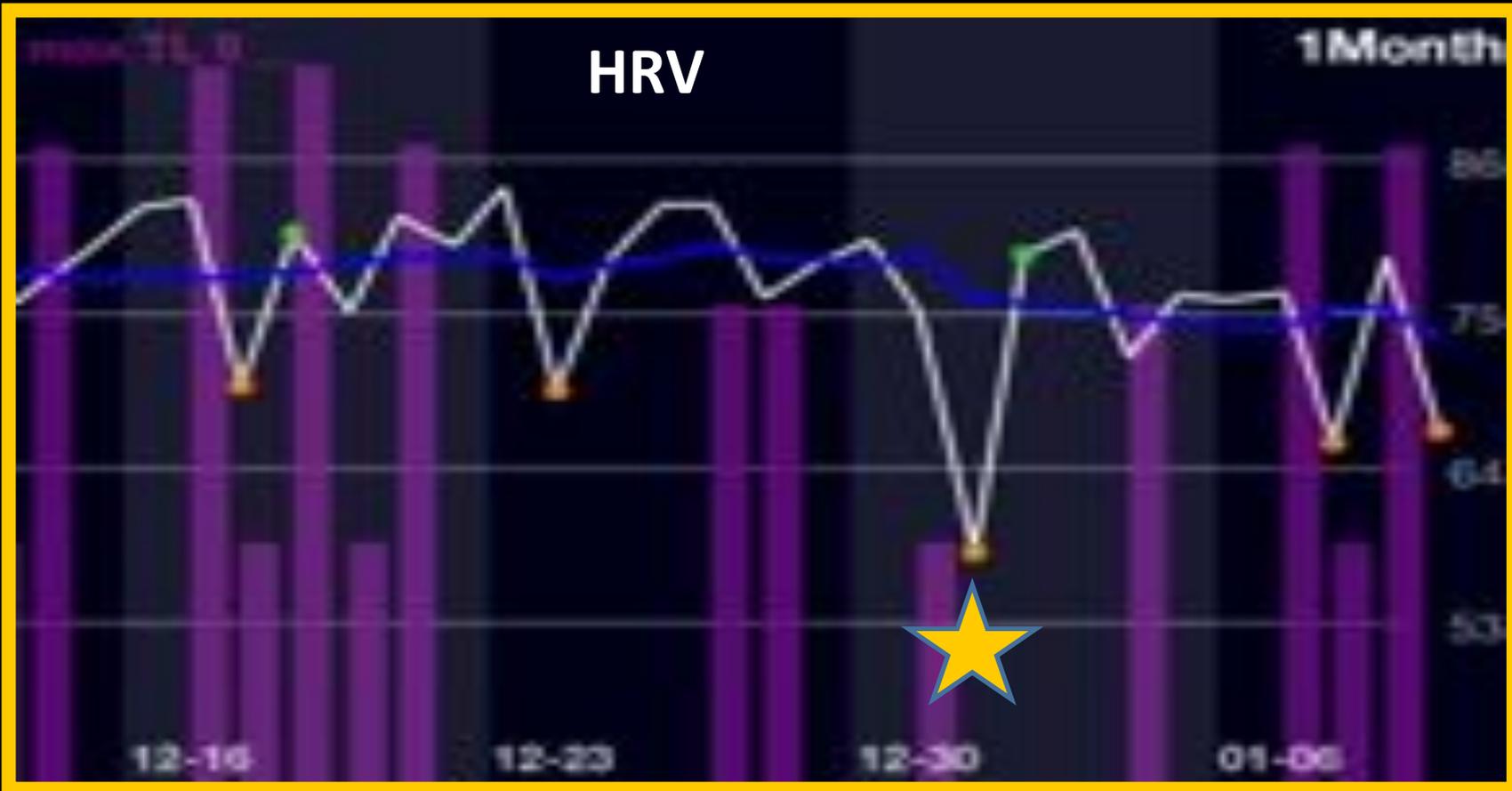
HPV



HPV is a common virus that can cause cervical cancer and other health problems. It is spread through sexual contact. There are many different types of HPV, but only a few are known to cause cancer. The HPV vaccine can help protect against these cancer-causing types of HPV. It is recommended for both men and women aged 9 to 26.



The three lowest dips on the trend all occur in March after nights out drinking on the 10th, 16th and 23rd. The dip from the 12th is reported to be caused by other stressors.



A marked drop in HRV on New Year's day following a late night of NYE celebration that included alcohol consumption.

# Reaction Time best indicator of CNS Recovery/Readiness

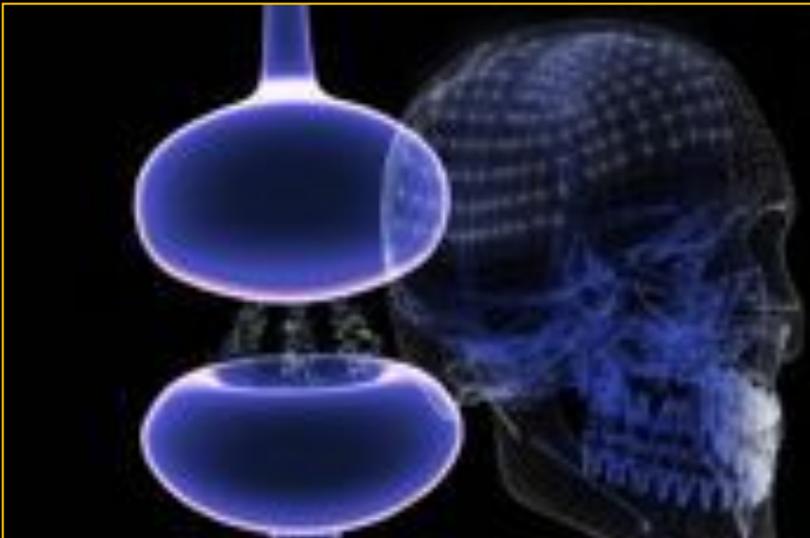


## Sending Signals





**Reaction Time**



**SENSORY MOTOR**

A high jumper in a red uniform is captured mid-air, performing a Fosbury Flop over a bar. The athlete's body is arched, with one leg extended upwards and the other bent. The background is a blurred crowd of spectators. The text ".186 Sec." is overlaid on the left side of the image.

.186 Sec.

Under training conditions elite skill based reactions are at about .186 msec.

TEST FINISHED

some people will find that the last score, when the dot flashed up big, was their quickest reaction time. This generally means that the rest of the time, you were not using your 'startle' reflex to react quickly.

your average reaction time was 0.136  
...that's fast!

**times - seconds**

0.166

0.211

0.167

0.204

0.183

**average** 0.196

**back**

# Reaction Timing Test



# SLEEP



The Importance of SLEEP  
in Mental and Physical Performance



NEVER  
SLEEP

Never  
Win

Sleep is an absolute predictor  
of performance in any sport

The more you sleep the better you play...



# SLEEP

Just a decrease of 1.5 hours of normal sleep time can result in a 30% drop in alertness

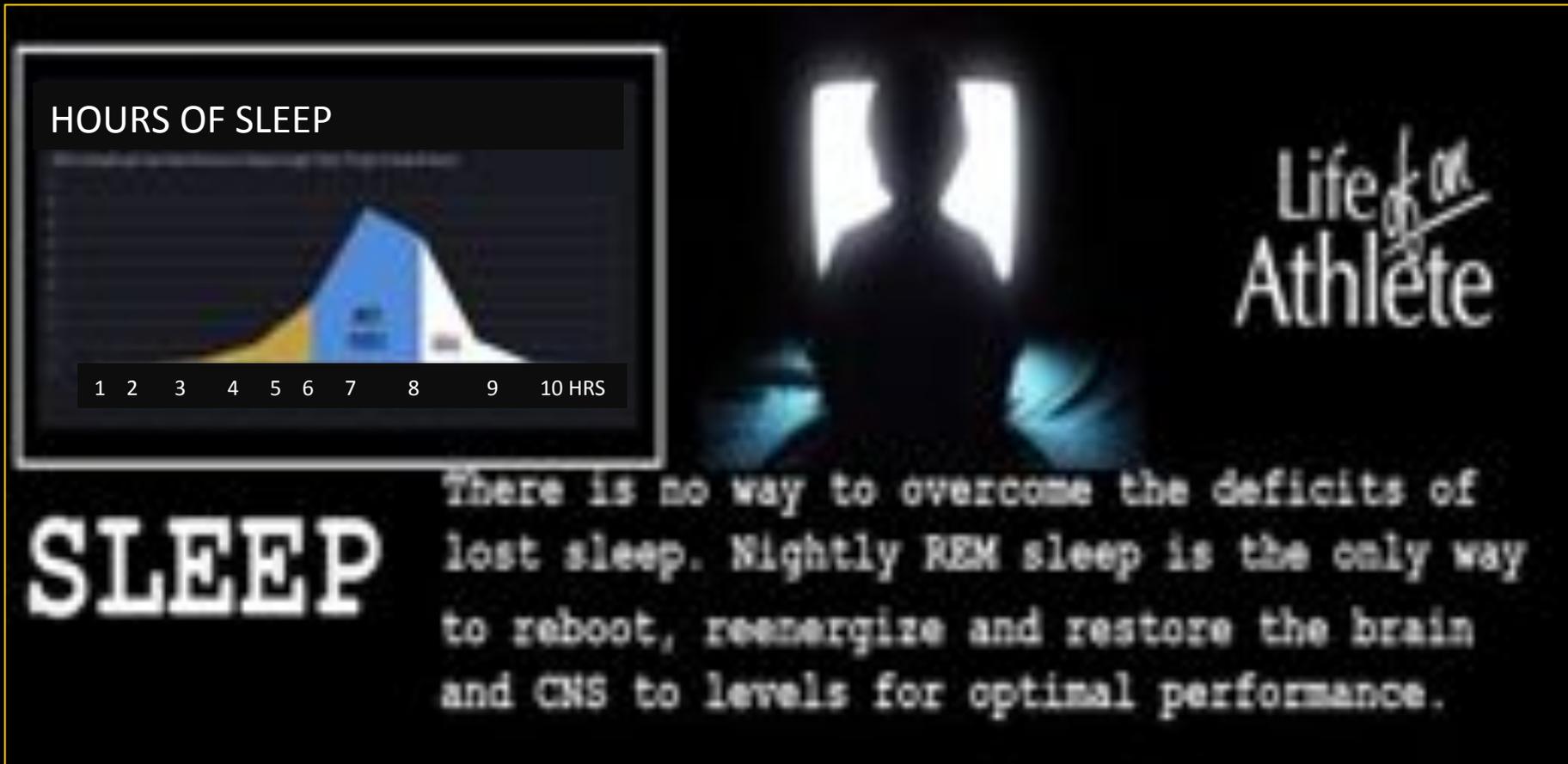
Life <sup>of an</sup> Athlete

A photograph of several athletes on a track. In the foreground, a female athlete in a red and white uniform is kneeling on the ground, holding her head in her hands, appearing exhausted. Other athletes in various uniforms are standing or bending over in the background. The scene is set on a track with a blurred crowd in the distance.

**6 Hours 40 Minutes**  
**4-6 Hours**

**Average sleep for most athletes**

# 27% < 6 HOURS 17% 8 HOURS >



**HOURS OF SLEEP**

1 2 3 4 5 6 7 8 9 10 HRS

**SLEEP**

There is no way to overcome the deficits of lost sleep. Nightly REM sleep is the only way to reboot, reenergize and restore the brain and CNS to levels for optimal performance.

Life of an Athlete



# REACT

Twenty four elite athletes reaction time to visual stimulus rested:

**.186** Sec.

Twenty four elite athletes reaction time no sleep overnight:



**.246** Sec.



## Don't fight it... SLEEP



To train and compete at a high level, you need regular sleep cycles. That means you need to go to bed at night at the same time every day... Even on weekends. Your body gets used to being physiological responses during sleep and they happen at certain times during the night. Sleep includes muscle restorative phases, organ restorative phases and brain and CNS restorative phases. If you have regular sleep patterns, these responses will be regular. Mental recovery and adaptation occurs based on these cycles. In the recent Stanford Sleep Studies it was proven that the more you sleep the better you perform.



Life of an Athlete  
Human Performance Project

**Muscle Restorative**  
**Organ Restorative**  
**CNS Restorative**



# Stanford Sleep Studies

Cheri Mah

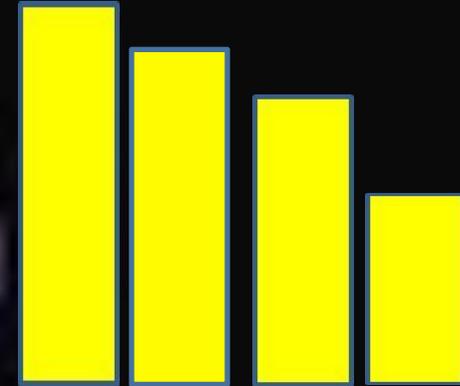
The more you sleep the better you perform  
Universal + effect on performance  
All stats improve in competition level performance  
All improve in measured core battery of tests  
Most personal bests/records set

Sleep is an absolute predictor of performance in any sport!



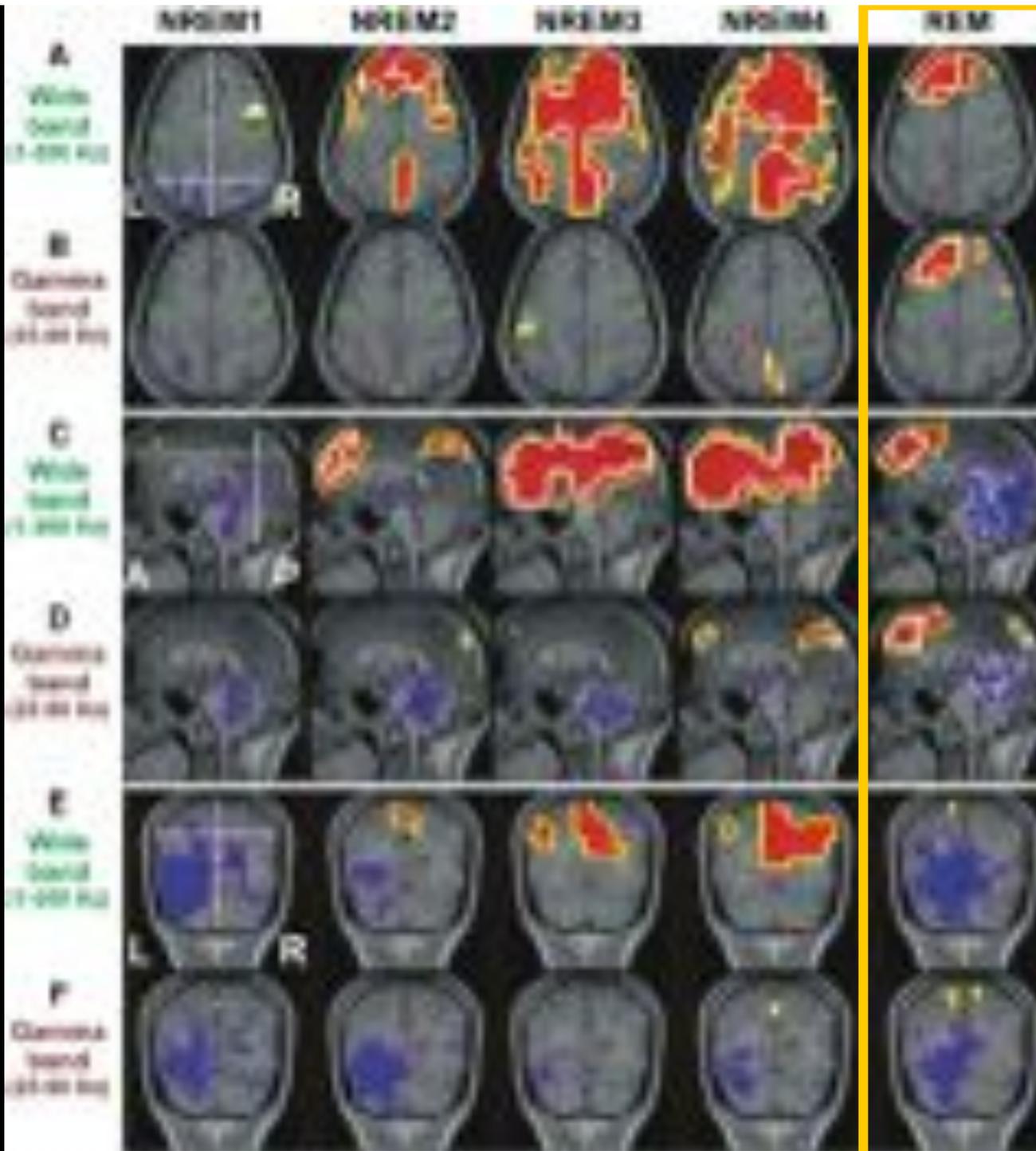


11/2 - 21/2 HOURS  
OF REM  
IN 24 HOURS



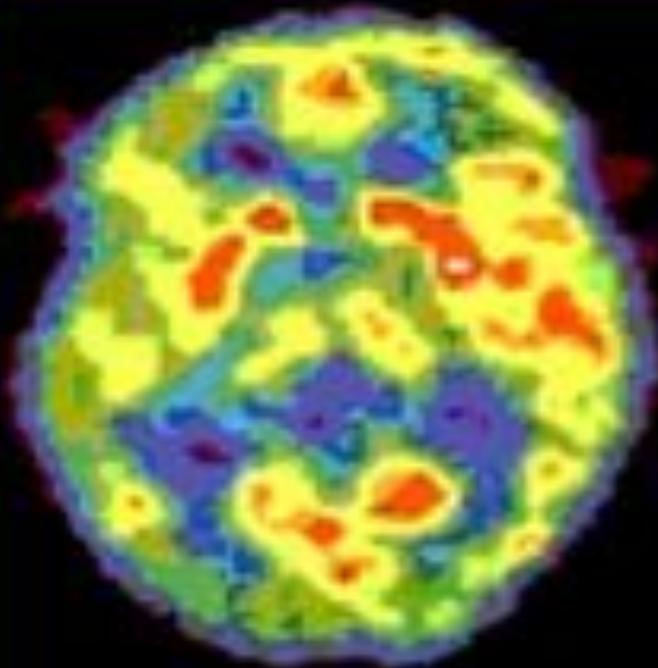
A red glowing graphic with a circular border containing the text "24 hrs". Below the circle, the word "REM" is written in large, bold, yellow letters with a white outline. The entire graphic is set against a dark red background with vertical lines.



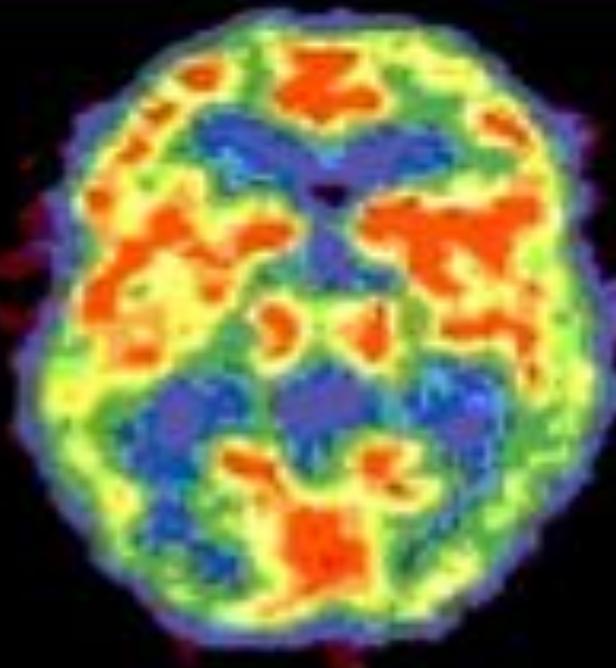


R  
E  
M

RECHARGE



NON REM



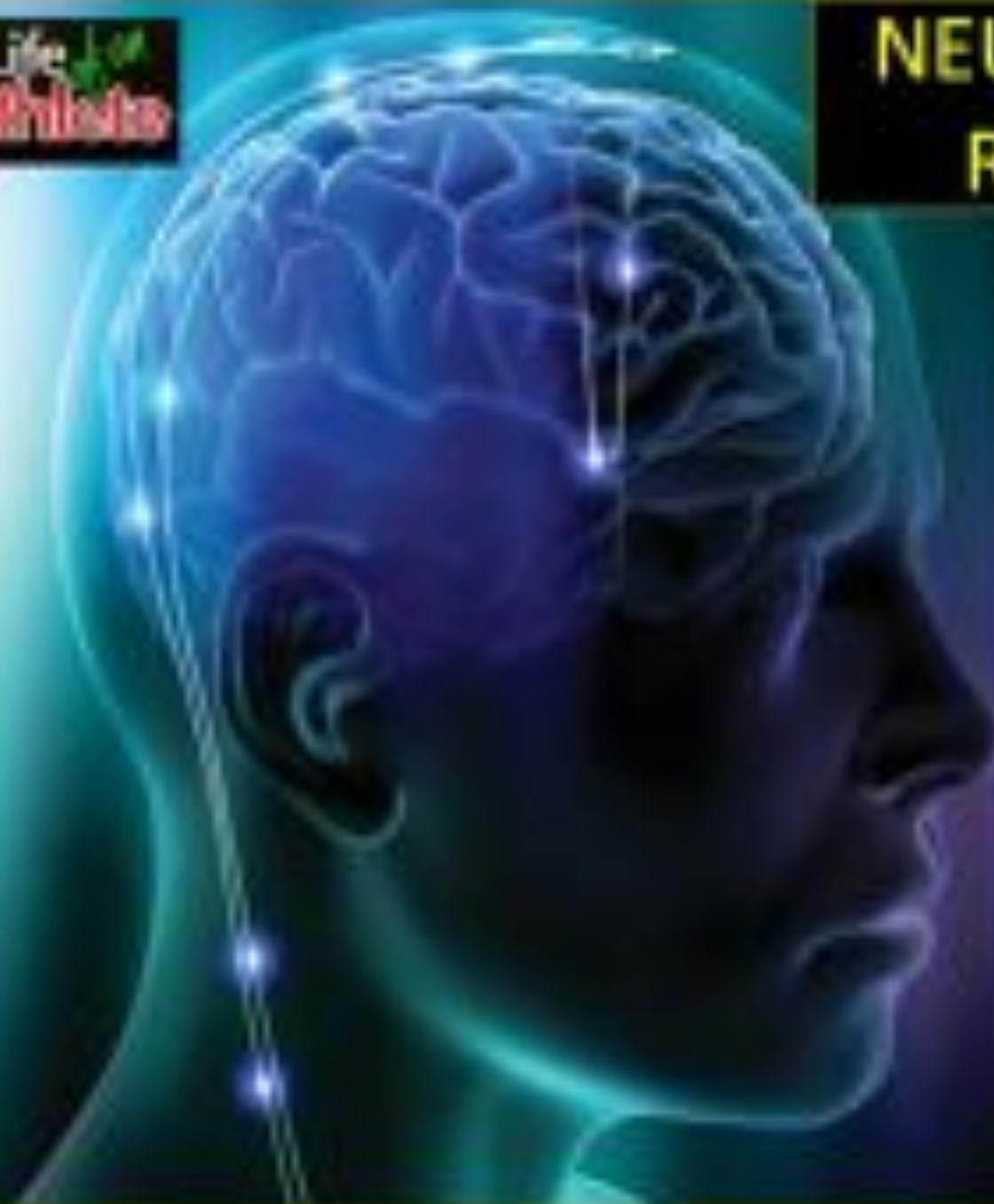
REM

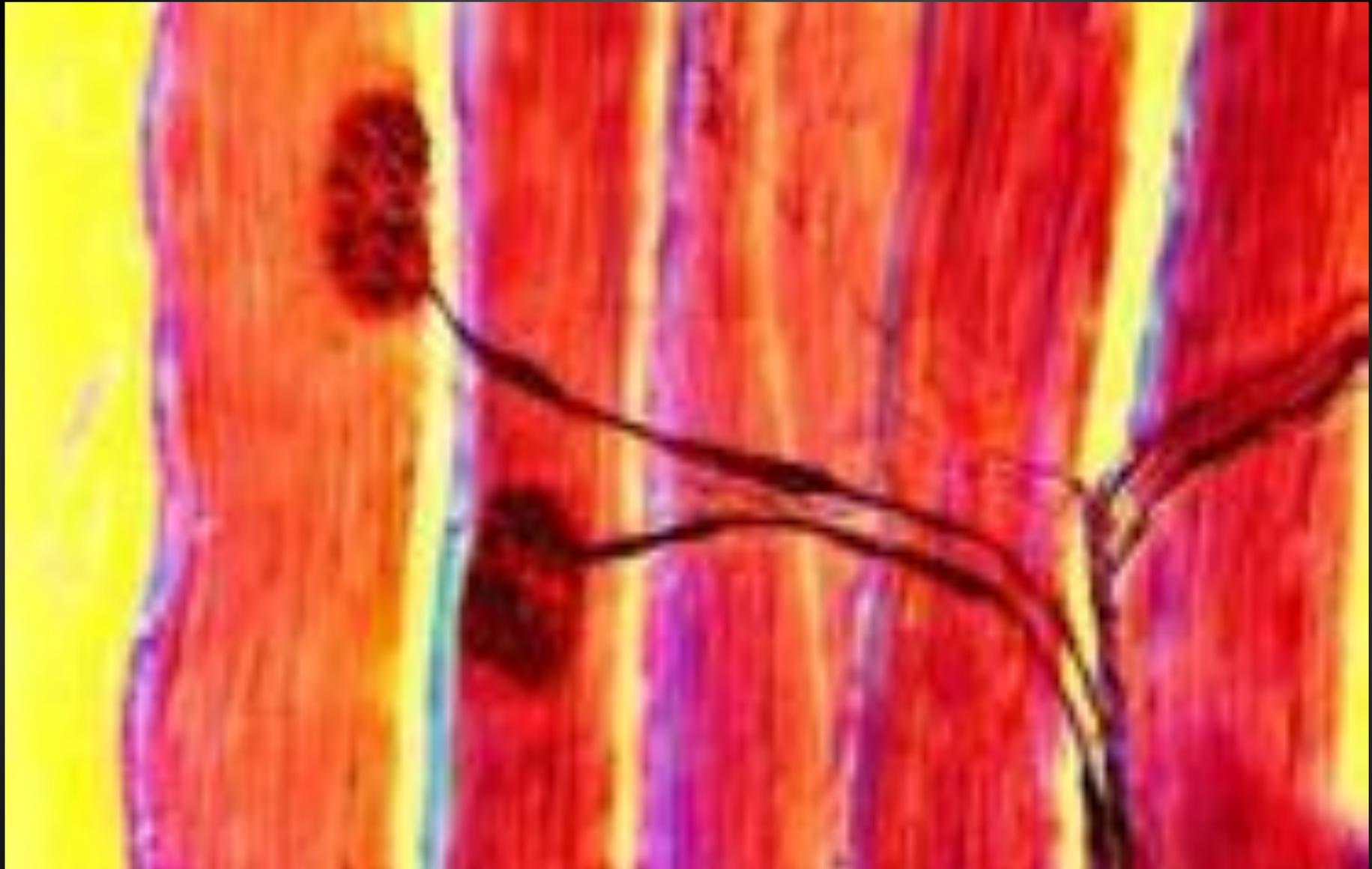
You need 1 ½ - 2 1/2 hours of REM  
You need 8 hours of total sleep to get it



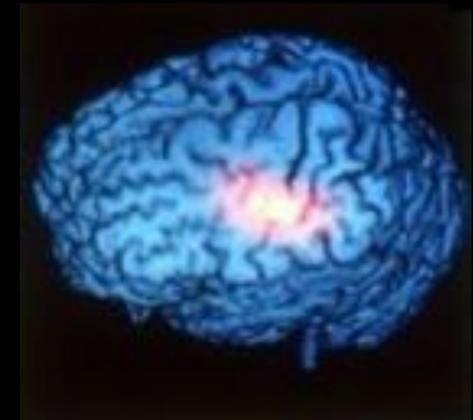
## NEURONAL REPAIR

Improper amounts of sleep may cause those same neuronal pathways to become so depleted of energy or flooded with byproducts of cellular activity that they malfunction.





Neuro-Muscular Junction



**Movement Memory**  
**Firing Patterns**  
**Biomechanics**  
**Efficiency**



# Skill Development



Perfection  
Innovation  
Efficiency



Life of  
Athlete

# SLEEP



Chronic sleep loss results in a 30-40% decrease in glucose metabolism.

No Fuels    No Energy    No Performance



**4-6 HOURS**

**40-54 MINS**

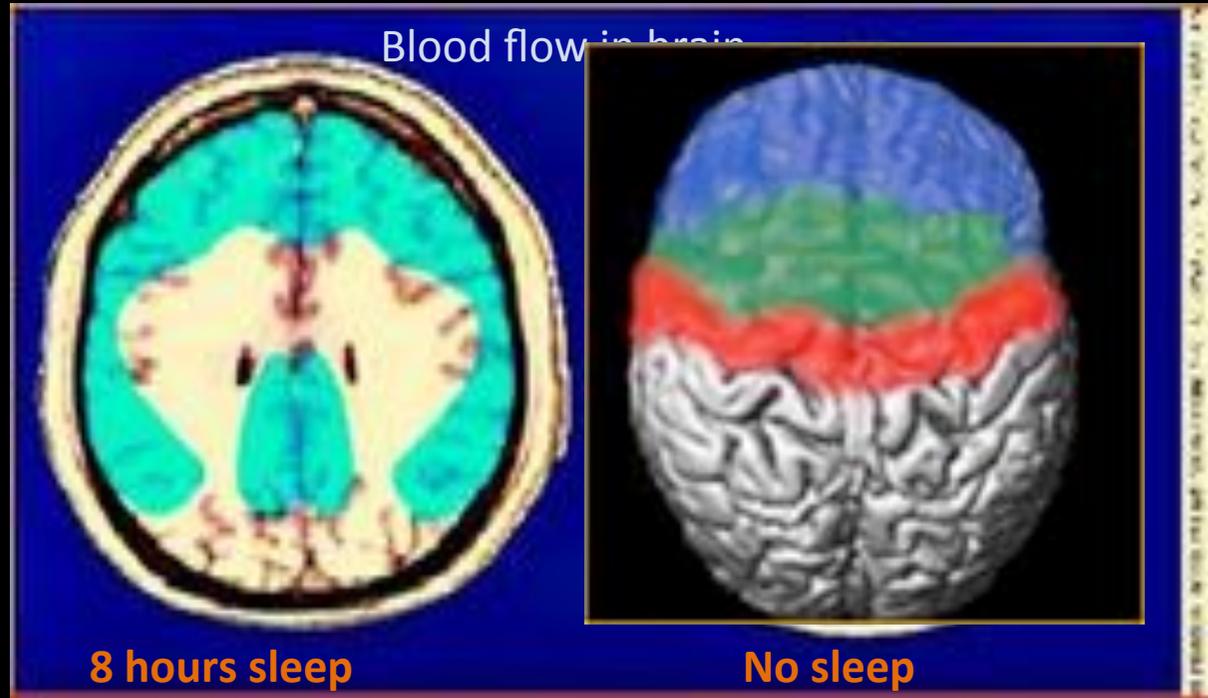
**TOTAL SLEEP**

**ACCUMULATED REM**

**8 HOURS**

**1 ½ - 2½ HOURS**

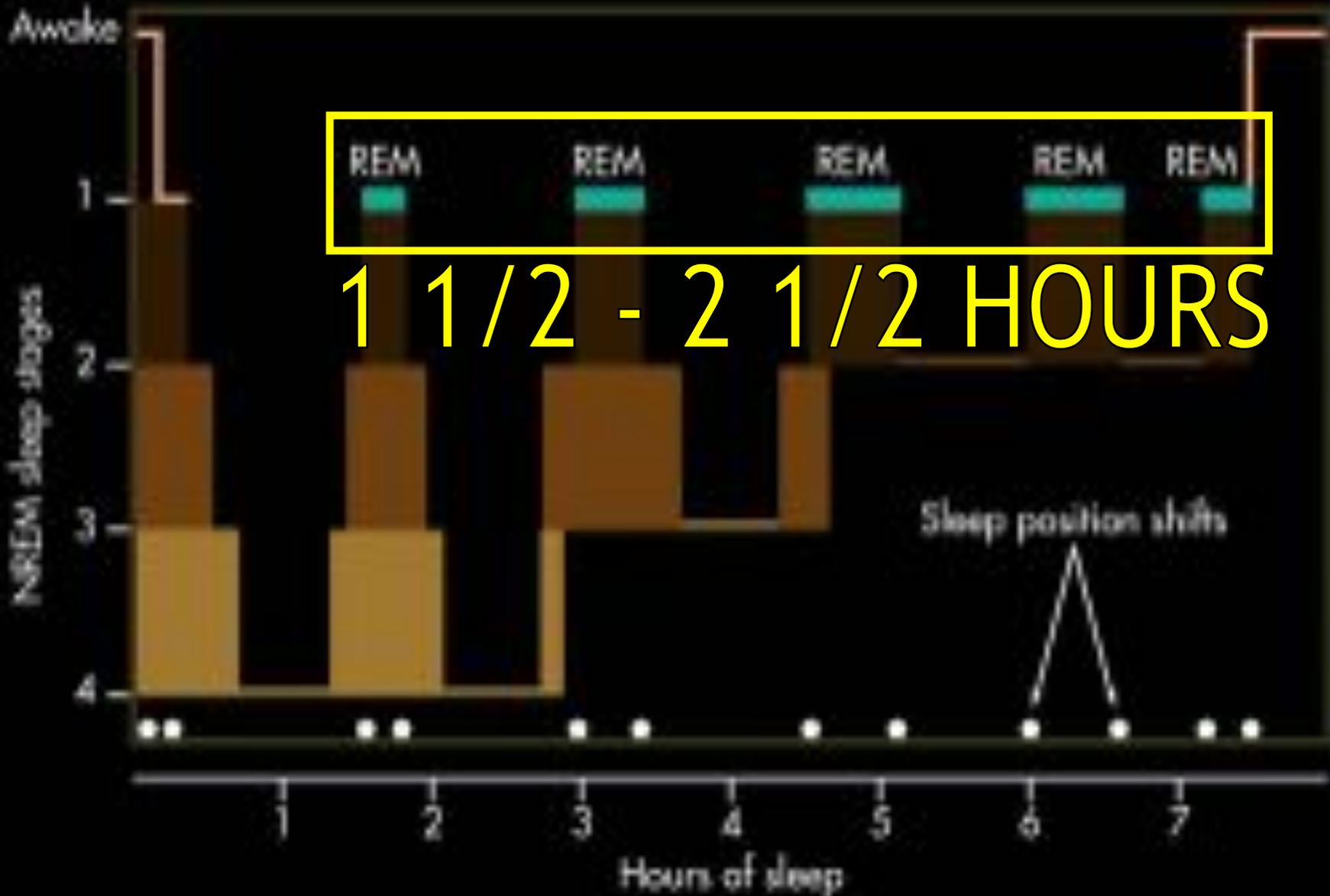
# Sleep No Sleep



## Blood Flow in Brain

Nasa

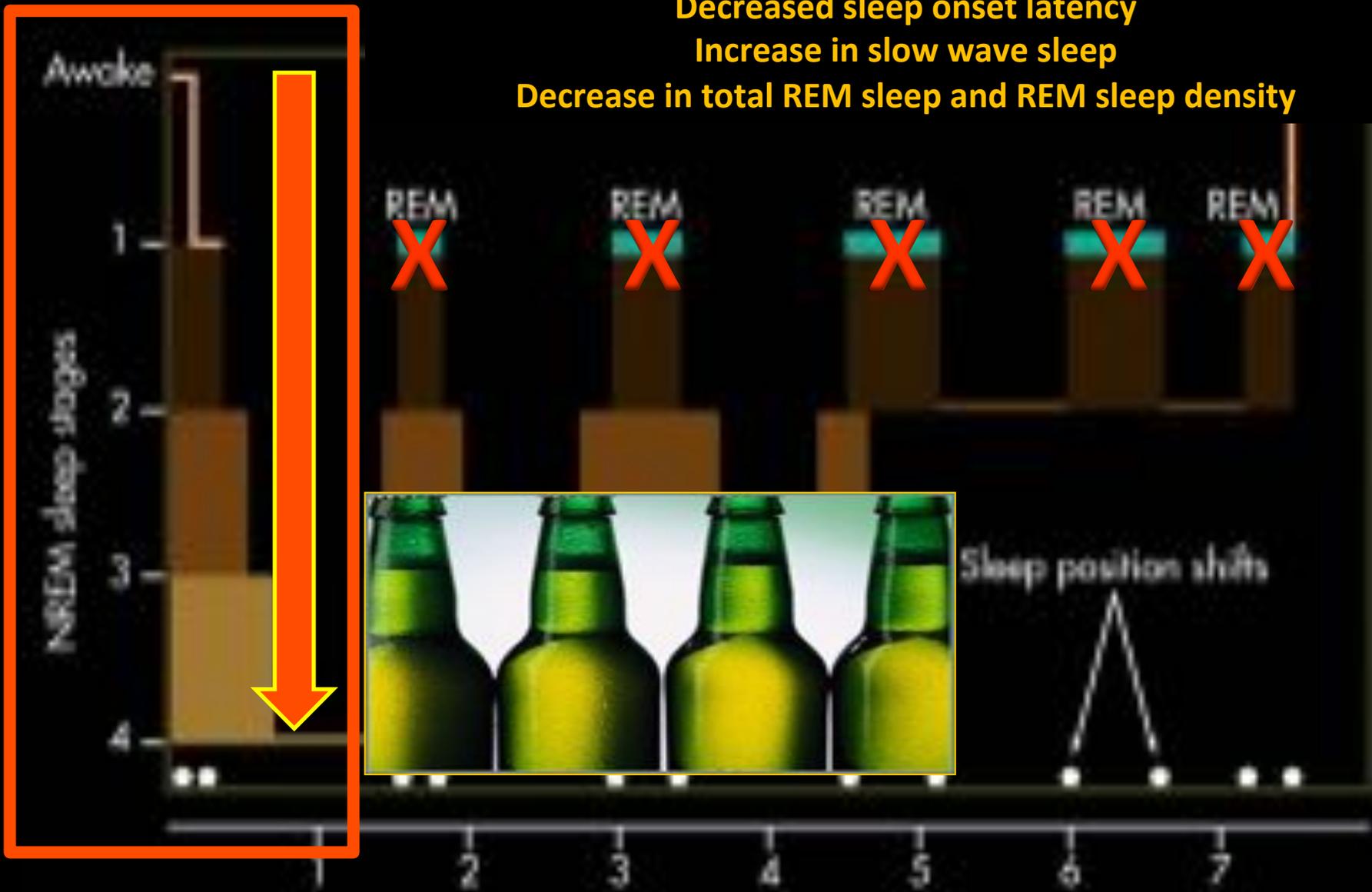




**8 HOURS OF SLEEP**

Decreased sleep onset latency  
Increase in slow wave sleep

Decrease in total REM sleep and REM sleep density



Transition to deep sleep  
Lost REM

# REM and Alcohol Use

You are asleep but your CNS is not recovering!



You wake up the next day with an exhausted brain and central nervous system. Your alcohol levels are decreased. Your level of focus is decreased. Your attention span is decreased. Your ability to process information is decreased. Your reaction time is 25% slower. Time to exhaustion is decreased. Perception of fatigue is higher!

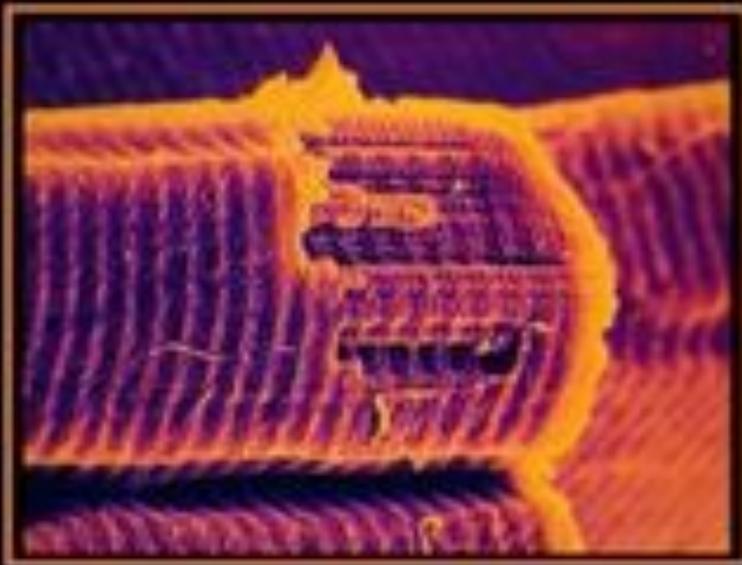
Life of an Athlete  
 mood performance project





**8 HOURS OF SLEEP**

# Sleep and GROW



Sleep is a critical component in the muscle building process and should not be overlooked. Your muscle tissue repairs itself and grows during rest periods but sleep is more important than waking rest periods.

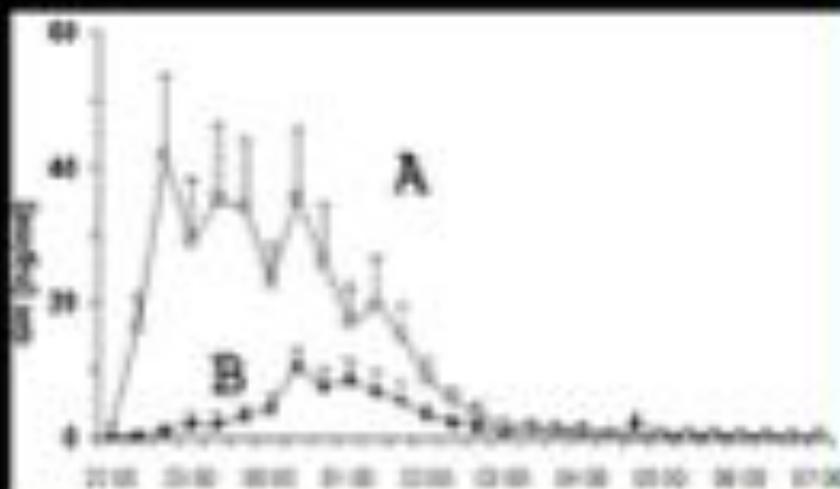
Here's why:



Life of an Athlete  
Human Performance Project

The release of growth hormone reaches its peak during deep sleep  
Your metabolic rate slows which is perfect for muscle tissue repair and growth  
Increased blood flow to the muscles

## HGH Release at night



A. sleep from 10pm. - 6am.

B. Sleep from 12am. - 8am.

early... Lots of HGH

used during the earlier hours of the later hours. Thus, sleep schedules are:  
 A (8 hours of sleep from 10 pm to 6 am) or GH release than B (8 hours of sleep from 12 am to 8 am). The above diagram shows pulses corresponding to the four sleep stages during an average good night's sleep.



Life of an Athlete  
Human Performance Project

# I-net Generation





ATHLETE TIME  
MANAGEMENT  
VERSUS  
TECHNOLOGY

Life  
Athlete

STRESS  
TIME LOSS  
CNS FATIGUE  
RECOVERY DELAYS  
METABOLISM CHANGES  
LOSS OF FOCUS

Technology has increased significantly the sedentary hours per week for all populations including athletes.





Visual Cortex Energy Drain 

During an athletic  
competition,

YOUR EYES PROCESS  
MORE THAN

120  
MILLION  
BITS OF  
INFORMATION  
EVERY SECOND.



READ



# INTERNET

## Rest means Rest...

The CNS can rest and reboot critical energy when the brain function is minimal...

**Nearly 2/3 of brains activity**



# Biggest Drain



Tracking/following  
moving objects

Depth between  
objects

Speed/Velocity  
objects travel

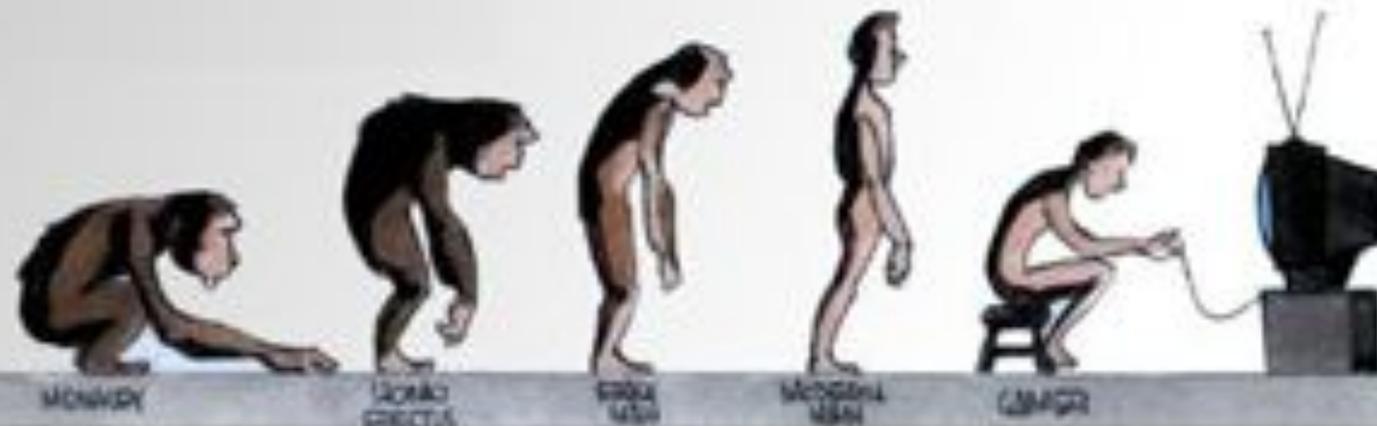
The visual cortex drains much of the CNS  
energy during the waking hours.



**VIDEO**



**GAMES**



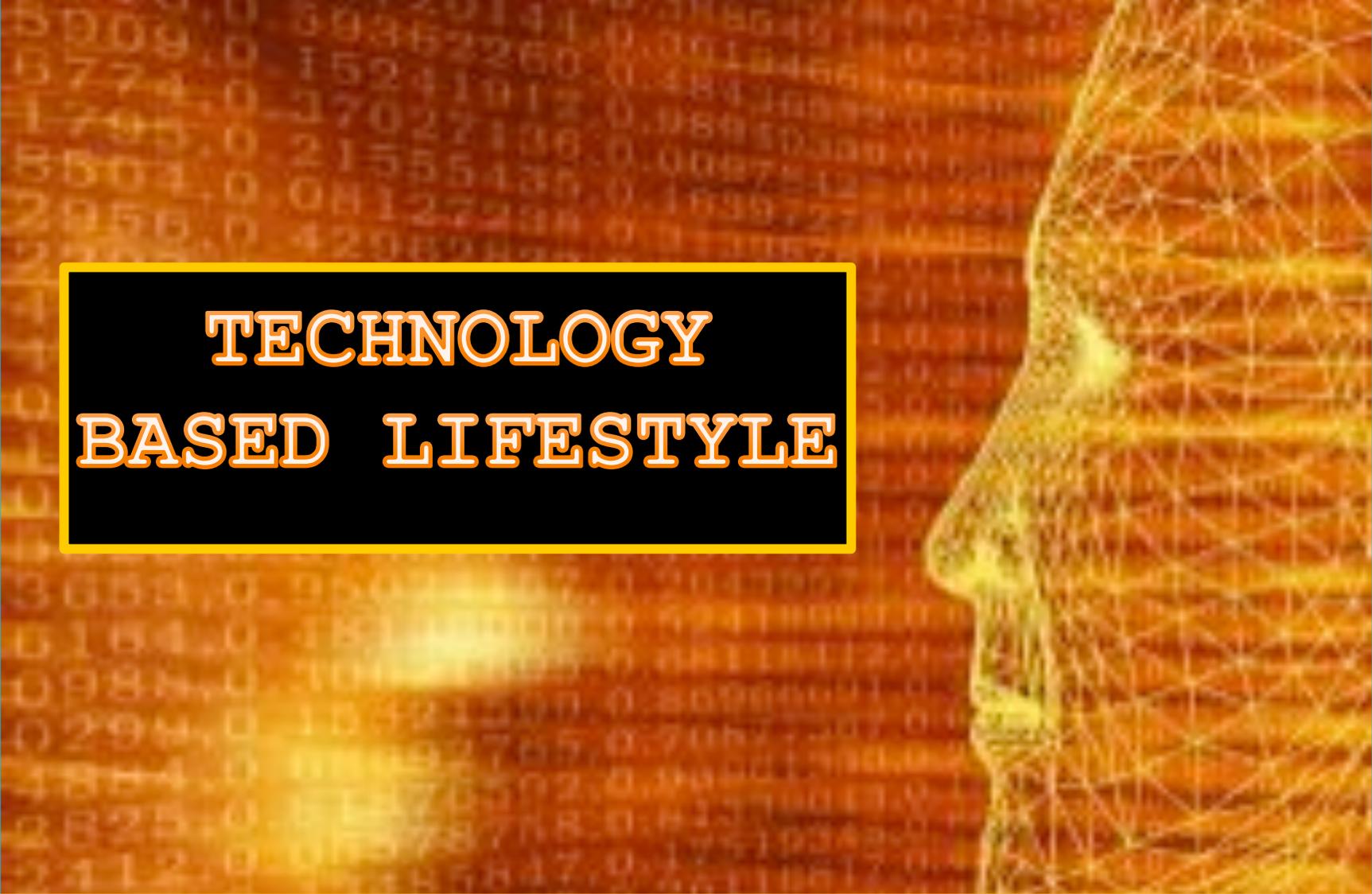


Studies conducted at London's Hammersmith Hospital found that dopamine levels in players' brains doubled while competing in video games.

"I really only play Xbox," "I have been playing a lot of Call of Duty recently. I find myself playing like 30 hours per week. People don't know it's [me]. It is fun, I am very competitive in everything I do."

Michael Phelps



The background of the slide features a wireframe human head profile on the right side, rendered in a golden-yellow color. The background is a dark orange-brown gradient with faint, glowing binary code (0s and 1s) and various alphanumeric characters scattered throughout, suggesting a digital or data-driven environment. A black rectangular box with a yellow border is centered on the left side of the image, containing the text.

# TECHNOLOGY BASED LIFESTYLE

Is not conducive to optimal training,  
recovery, adaptation or performance.

# Tech creates problems



## Blue Light Disturbances

Blue light from a screen all day, blue light from your computer screen at midnight - it makes no difference to our circadian rhythm. It's all the same to our bodies, because the millions of years since light meant daylight, not late night texting or channel flipping on TV and PC's the blue light specifically that appears to confuse our sleep patterns the most. Computer screens, iPhones, TV or iPad use late into the night disturb your entire physiological processes, keep that you need for sport!

The adverse effects of night-time light on sleep and circadian rhythm can be reduced by replacing blue-enriched light with red or orange-enriched warm light after sunset.

Using these devices in total darkness when the problem was worse!

Get a hint as your body can get into a Bio-Rhythm...

It is essential to establish a regular bedtime and wake time. The interval between these two times must allow a person to reach enough sleep. Athletes need more sleep. A typical high school or college athlete would need more than nine hours in bed.



Life of an Athlete  
Human Performance Project



# Brain Stimulation



## BLUE LIGHT IS EVIL FOR ATHLETES

Blue light is believed to not benefit – in the smallest amount. When we're exposed to levels of anything to cause you the impact of what we would have experienced for the bulk of our evolutionary history, probably with blue light regulated our secretion of melatonin, the sleep hormone. Exposed to blue light, we lower the production of melatonin, and we stay alert and awake in the absence of blue light, melatonin production ramps up, and we get sleepy. That system worked quite well for a long time. Reddish light from fire was the primary source of nighttime illumination for little to no effect on melatonin production, as they weren't disrupted when we relied on fire. These days, though, we're subject to a steady barrage of blue light. During the day, blue light (natural or artificial) isn't a problem because we're supposed to be awake. But at night, when we're "supposed" to be getting ready to sleep, we tend to get an flood of blue light emanating appliances, and our sleep suffers for it. We maximize our release of melatonin and stay alert and stimulated rather than becoming sleepy. Use of blue light often delays in a bad way for athletes who want to sleep and recover and release GH and get GH to about the 100 and boost the your recovery or competitive behavior.



Life of an Athlete  
Human Performance Project

Delays brains transition from  
wake state to sleep



A dimly lit room, likely a bedroom, with a television on a stand in the background. The television screen displays the text "Blue Light" in a blue, outlined font. The room is dark, with a blue glow emanating from the TV and reflecting on a coffee table in the foreground. A bed with blue bedding is visible on the right side of the frame.

Blue Light

**Prevents Brain Shutdown**





## Blue Light Tips for Athletes

Exposure to blue light is problematic, and there are some simple steps you can take to mitigate its late-night effect on your sleep.

Keep electronics usage to a minimum or completely eliminate blue light exposure. TVs, laptops after dark.

Go to sleep earlier.

Use f.lux/light.

Keep your room as dark as possible and your sleeping quarters pitch black.

Install F.lux (totally free) on your computer to cut down on blue light emissions.

If you want to try a somewhat serious experiment, you could even wear orange safety glasses at night.

Do not use blue light devices in total darkness (see pic)

Blue light keeps you awake and throws off your circadian rhythm.



Life of an Athlete  
Human Performance Project

# Limit blue light at night





**Avoid Blue Light  
and total darkness**





f.lux options



Life of an Athlete  
Human Performance Project

Change to PINK





## Blue Light Reducing Computer Glasses

Blue light acts differently on the retina than the rest of the light color spectrum. Ever look at a blue LED and noticed a haze around the light? Staring at it gives you a headache, doesn't it? Dubois, why? Your eyes are straining to try and bring that fuzzy spot into focus, and it just isn't!

Exposed to blue light, we limit the production of the melatonin sleep hormone, and remain awake and alert. In the absence of blue light, however, melatonin production increases and we get tired.

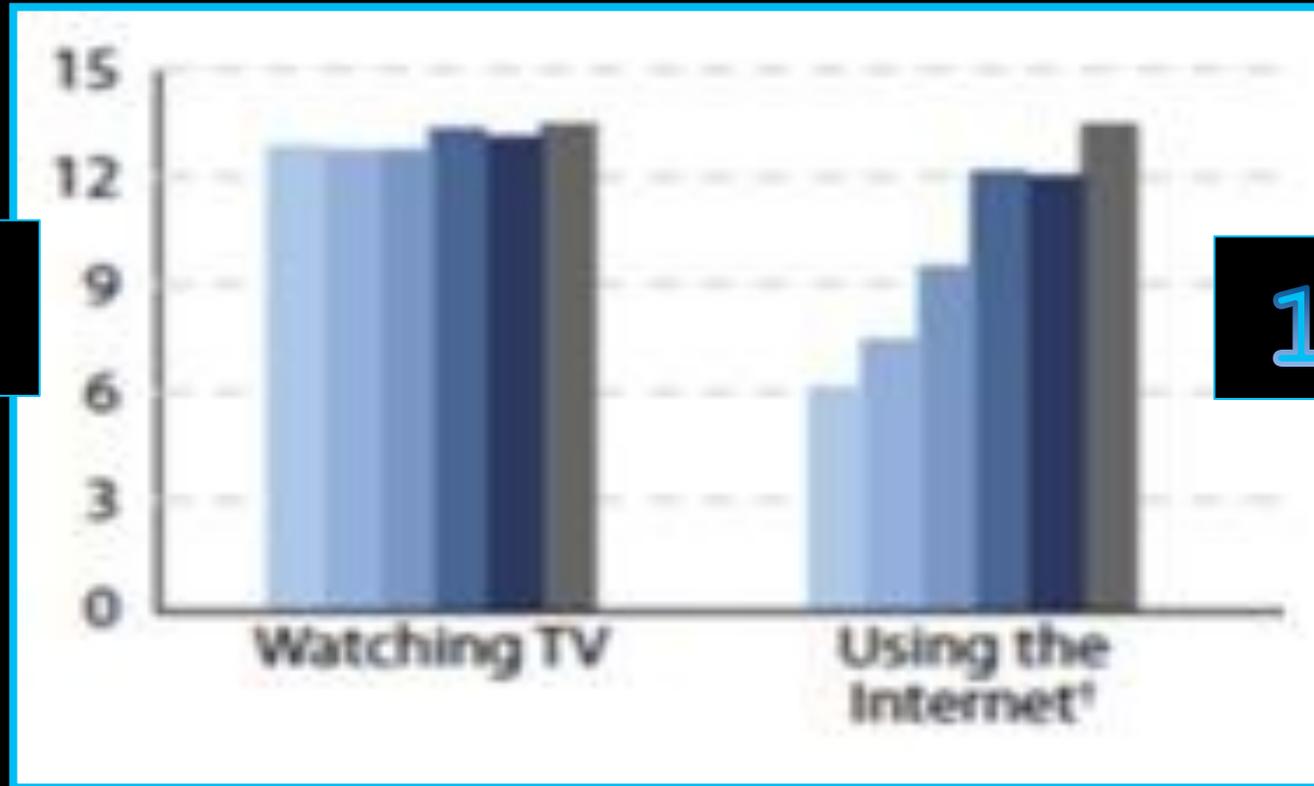
Getting enough sleep is a task that challenges many athletes, but doing what you can to help your body rest naturally can greatly improve the quality of the sleep that you are able to get. By avoiding blue light in the evening and right before bed, you can help your body produce the optimal amount of melatonin and you can fall asleep in a natural way. Additionally, you will reap all of the benefits that a healthy sleep cycle provides, which is pivotal to recovery in all body systems. Optimal training requires sufficient sleep.

# Filters



13 HRS

13 HRS



5%

121%

INCREASE IN TV AND INTERNET TIME IN LAST FIVE YEARS

26 HOURS PER WEEK





+10-15-20 Hours





## High level populations can use blue light to advantages!

Just like blue light wavelengths can be detrimental to falling asleep, it can also help the brain stay stimulated under CNS fatigue conditions or help speed up the waking reflex in those who need to get highly functional after sleep. HPT in upstate NY is developing these blue light glasses to help with sleep disorders but they also have application for stimulation. Blue light could be utilized shortly after awakening to shorten the grogginess and cathesbs many experience prior to a morning workout. When we consider that morning is now the optimal time for high level training, there is huge applications. see John Underwood, Director of the Human Performance Project.



Life of an Athlete  
Human Performance Project



# facebook

wasting athletes time since 2004

# Stimulants

There is no way  
to make up for  
the deficits of  
lost sleep with  
stimulants



**ENERGY DRINKS**





## Use of Stimulants for CNS Fatigue

Clearly any athlete that is suffering from serious CNS fatigue or Neural Fatigue NF knows that it will be a long painful training session. Many use energy drinks or stimulants or the original coffee or espresso. This is a huge mistake! The athlete will quickly experience an energy spike or surge within ten to twenty minutes and then rapidly sink into even greater deficits of NF. The only way to overcome NF is rest and in particular REM sleep. Power naps less than 30 minutes have been shown to elicit a 30% increase in alertness (NASA says 26 minutes), but it will not overcome NF. So suffer through the session and head to bed early. It is no different than waiting for your body to recover from the poisoning of alcohol. You are at the mercy of the timeline for return to normalcy!



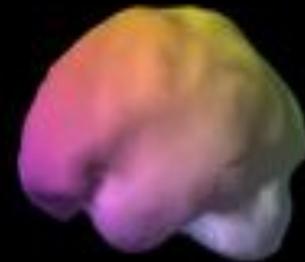
Life of an Athlete  
Human Performance Project



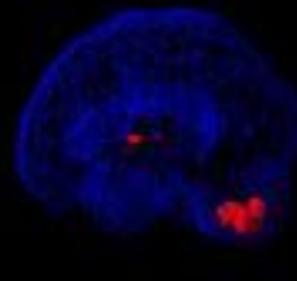


**What's this?**

# DAMAGE



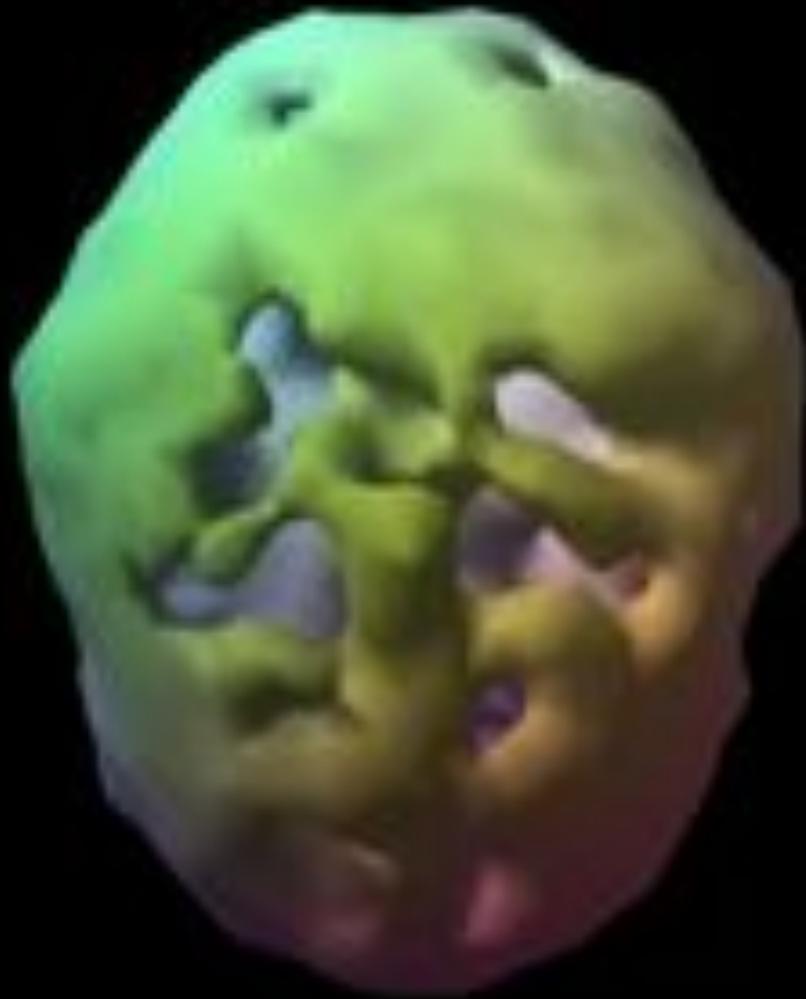
Single Photon Emission Computerized Tomography



# ACTIVITY

# SPECT





We now have  
indisputable  
evidence of  
systemic  
damage and  
cumulative  
damage.

**BRAIN SCIENCE ADVANCES**

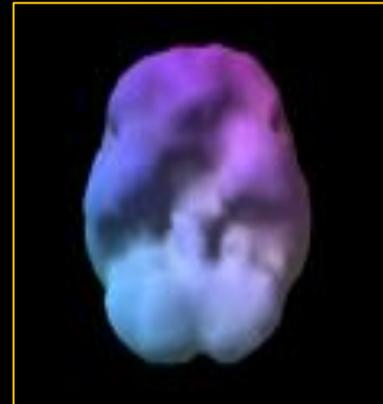


**TOP**

**FRONTAL**

**BOTTOM**

**SIDE**



**NORMAL  
HEALTHY**

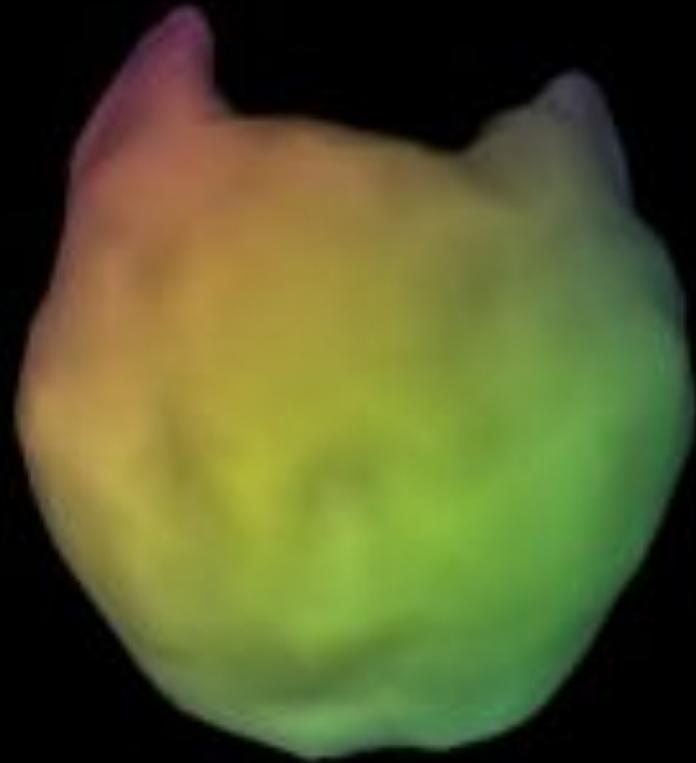
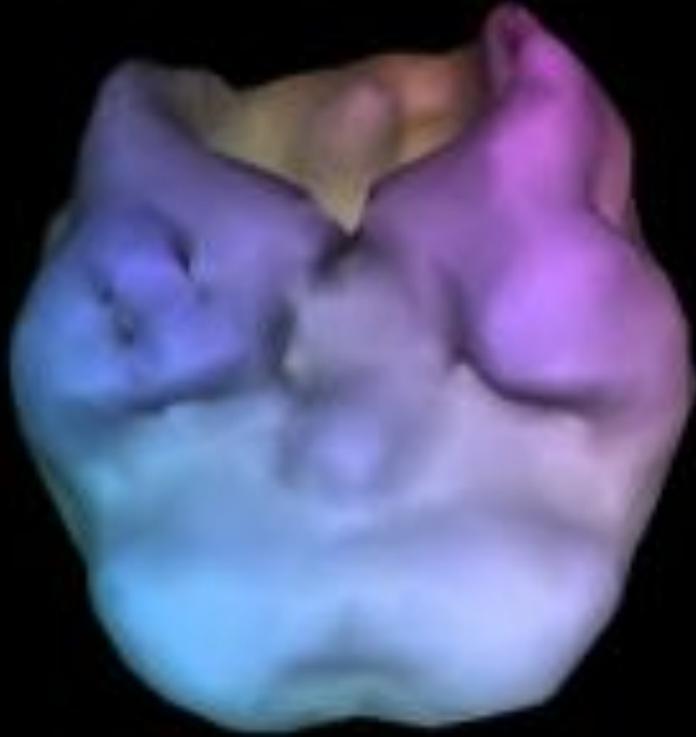




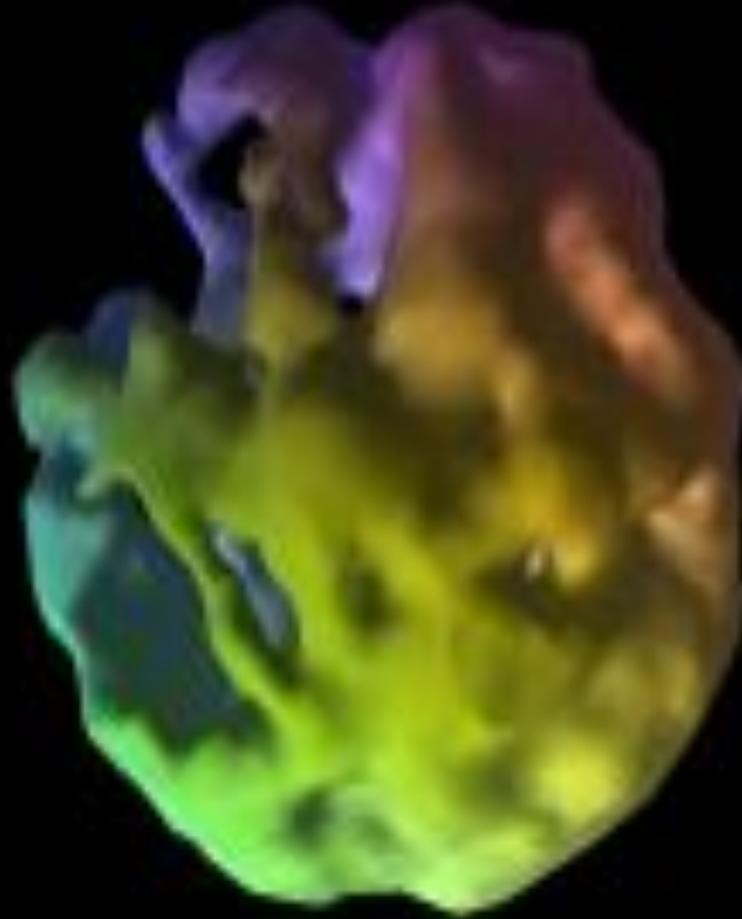
**NORMAL HEALTHY**



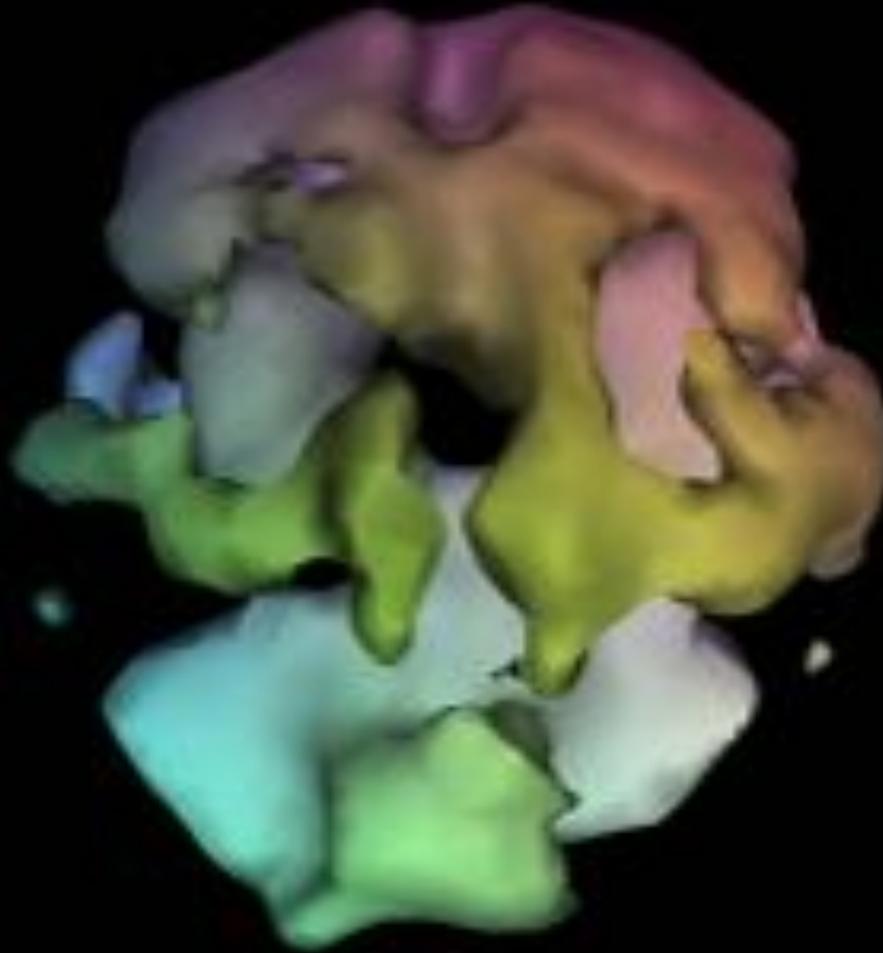
# Severe Brain Injury



# Stroke

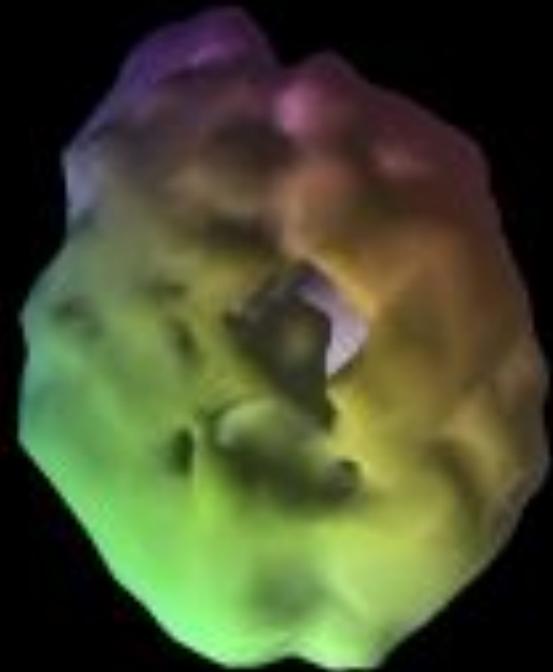


**Alzheimer's**



**Brain Degeneration**

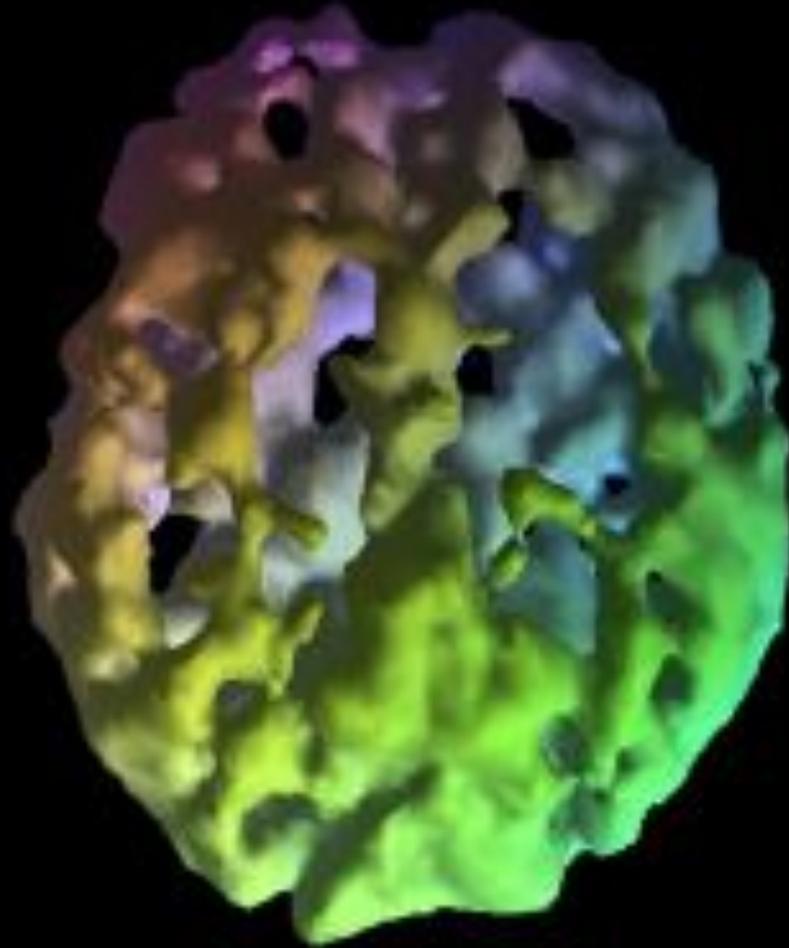
# NFL NHL BRAIN INJURY STUDIES



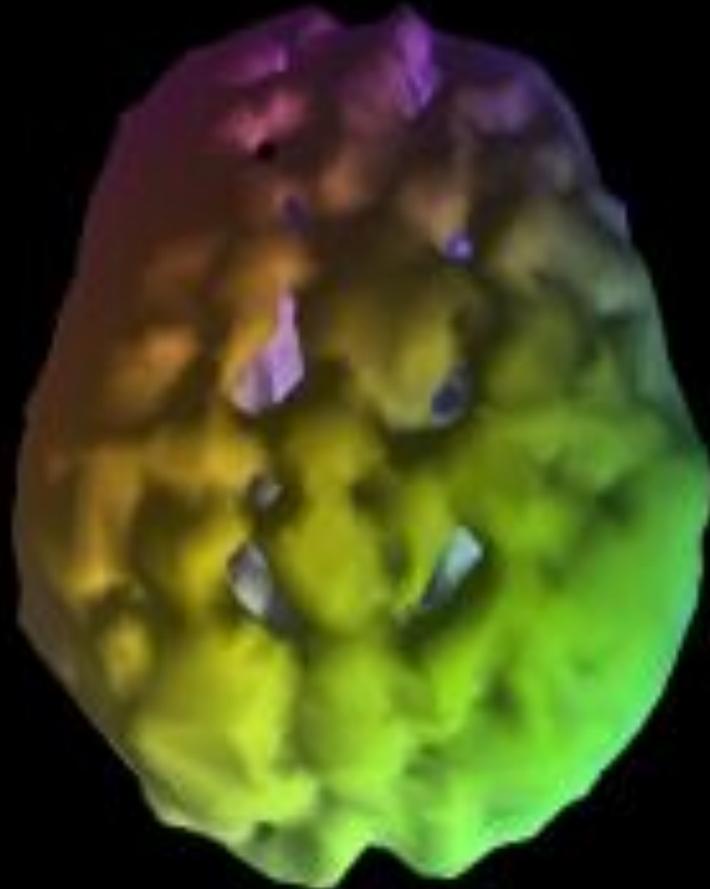
# MULTIPLE HEAD INJURIES



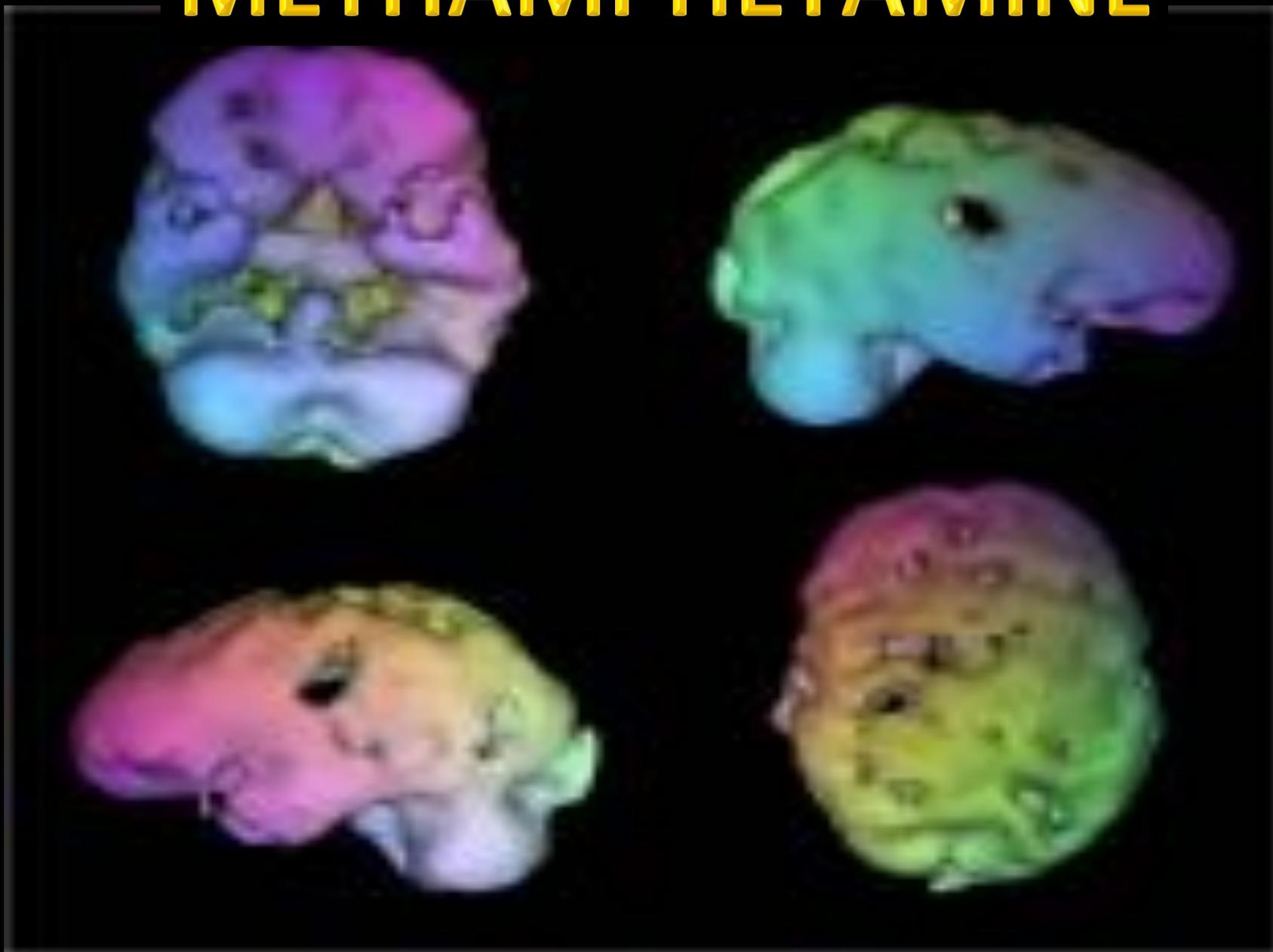
# HEROIN



# COCAINE



# METHAMPHETAMINE





# SOCIAL DRUGS





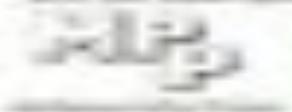
"Marijuana helps me relax, without affecting my athletic."

# Michael Phelps

14 Times Olympic Gold Medalist

**Marijuana: Inspiring successful Americans since 1776.**

*See the full story on marijuana, the most common drug used by...*



WORLD PICTURE EXCLUSIVE

# PHELPS GOES BONG

Olympic gold medal winner caught with cannabis pipe



14 OLYMPIC GOLD MEDALS  
37 WORLD RECORDS.  
2 AWESOME LUNGS.

Unlike heavy tobacco smokers, heavy marijuana smokers exhibit no obstruction of the lung's main airway. This indicates that people who use these substances may breathe easier.

Don't let the government fool you

AMERICAN MARIJUANA

## SMOKING MARIJUANA

## WASTES POTENTIAL

Researcher: Smoking marijuana causes a 10% decrease in lung capacity. This is a significant finding for athletes who rely on their lungs for peak performance.

WASTING WHAT A WASTE.





# Social Drugs



National Study of  
Substance Use Trends  
Among NCAA College  
Student-Athletes

**Alcohol 83%**  
**MJ 22%**



# Pure Performance Project

John Underwood

Director,

American Athletic Institute



# Substance Use Categories

Alcohol

Marijuana

Amphetamines

Anabolic Steroids

Cigarettes

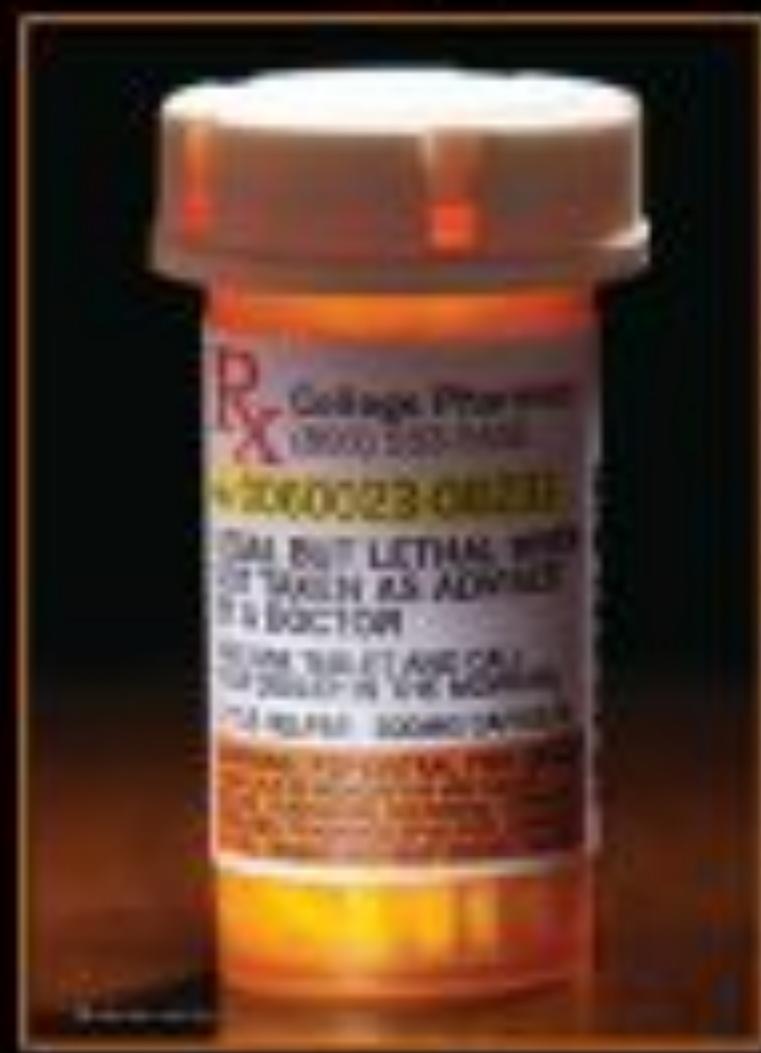
Snuff Tobacco

Cocaine

Ephedrine



# RX drugs and Athletes



Although athletes are young and generally healthy, they use a variety of non-doping classified medicines to treat injuries, cure illnesses and obtain a competitive edge. Athletes and sports medicine physicians try to optimize the treatment of symptoms related to extreme training during an elite athlete's active career. According to several studies, the use of Rx medication is more frequent among elite athletes than in the general population.

# Substance Use

1985

1997

2001

2005

2009

2012

National Study of  
Substance Use Trends  
Among NCAA College  
Student-Athletes



The NCAA salutes

**440,000**

student-athletes

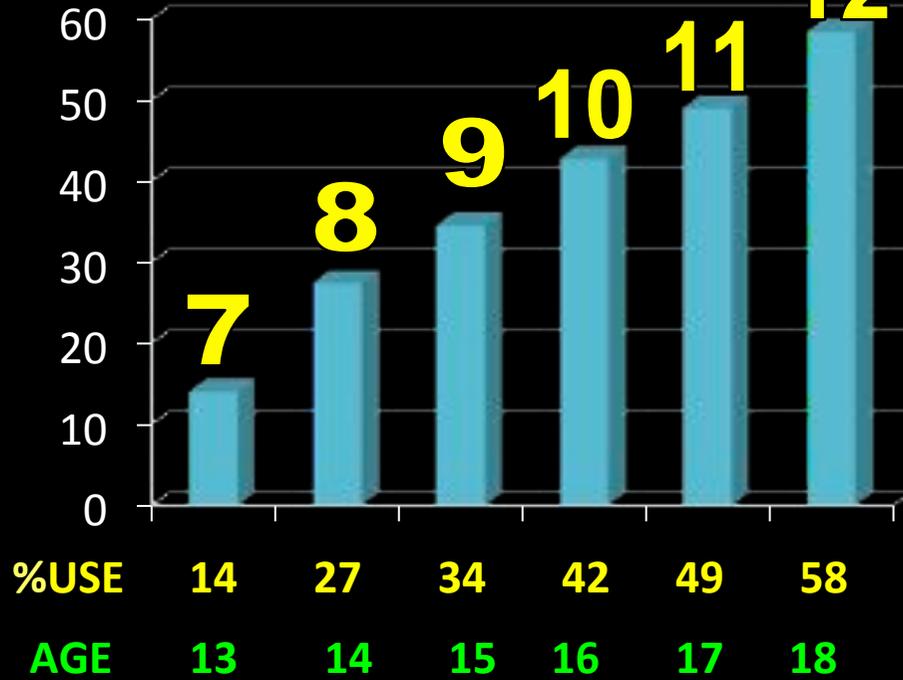
participating in

**23** sports at

**1,200** member institutions

# JR. ATHLETES REPORTING ALCOHOL USE DURING SPORT SEASON

## 12 GRADE



**ALCOHOL USE  
ATHLETES**



**Middle School – High School**



## Junior Level

### Athlete Use of Marijuana

#### Age Grade % Using

13	7	3%
14	8	9%
15	9	13%
16	10	17%
17	11	19%
18	12	20%



### MARIJUANA USE ATHLETES



# Brain Activity Alcohol

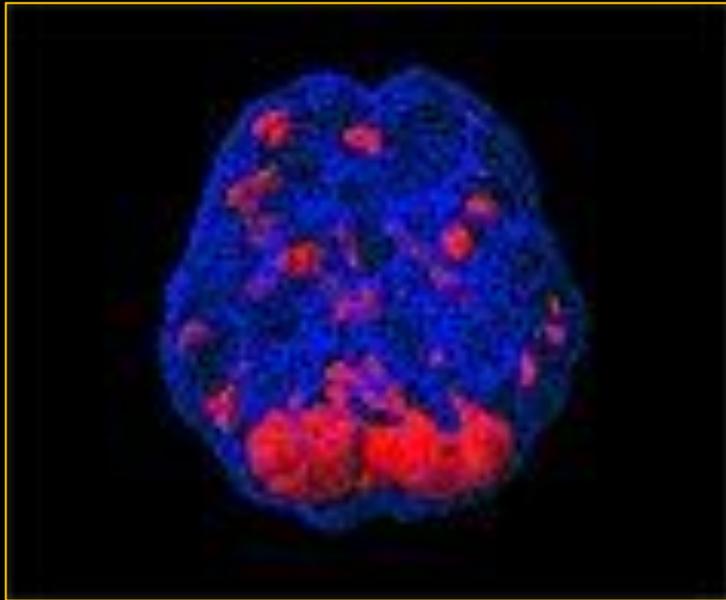


**Not under  
influence**

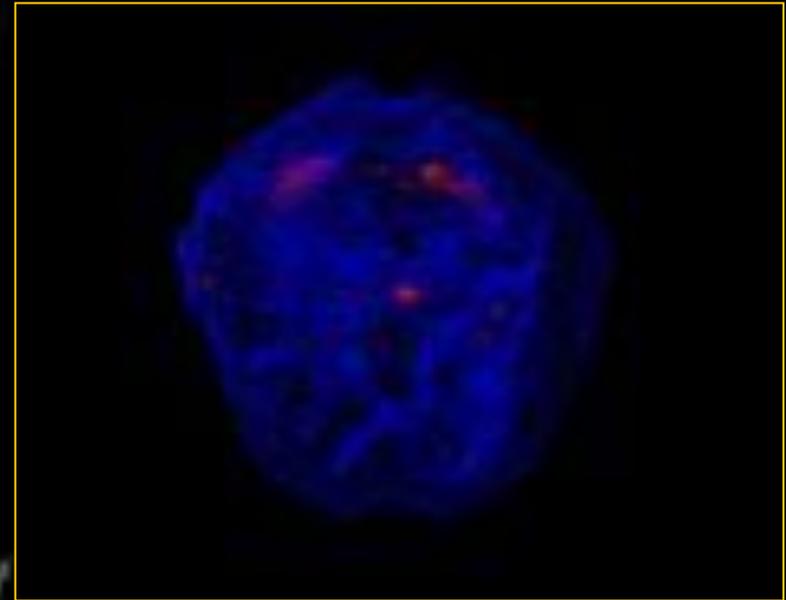
**Intoxicated**



# Brain Activity Marijuana



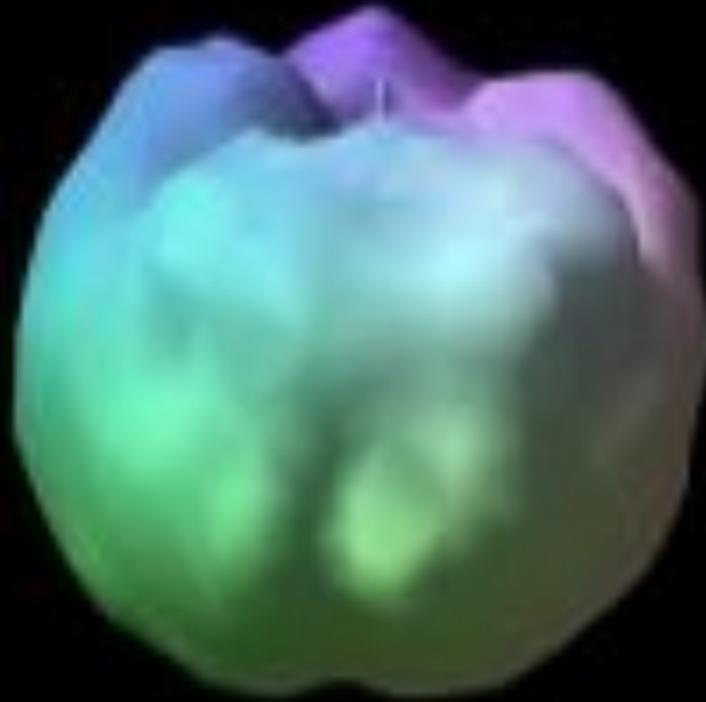
**Not under  
influence**



**Stoned**

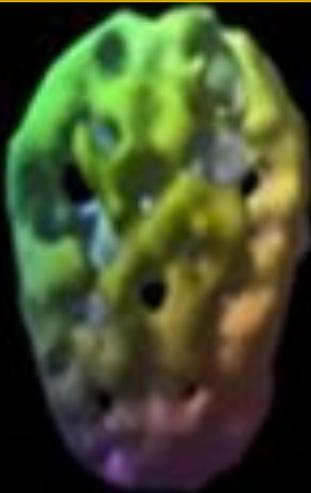
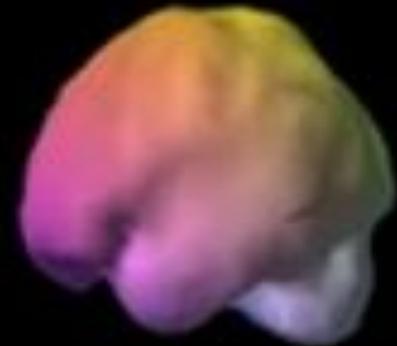


Healthy



Marijuana

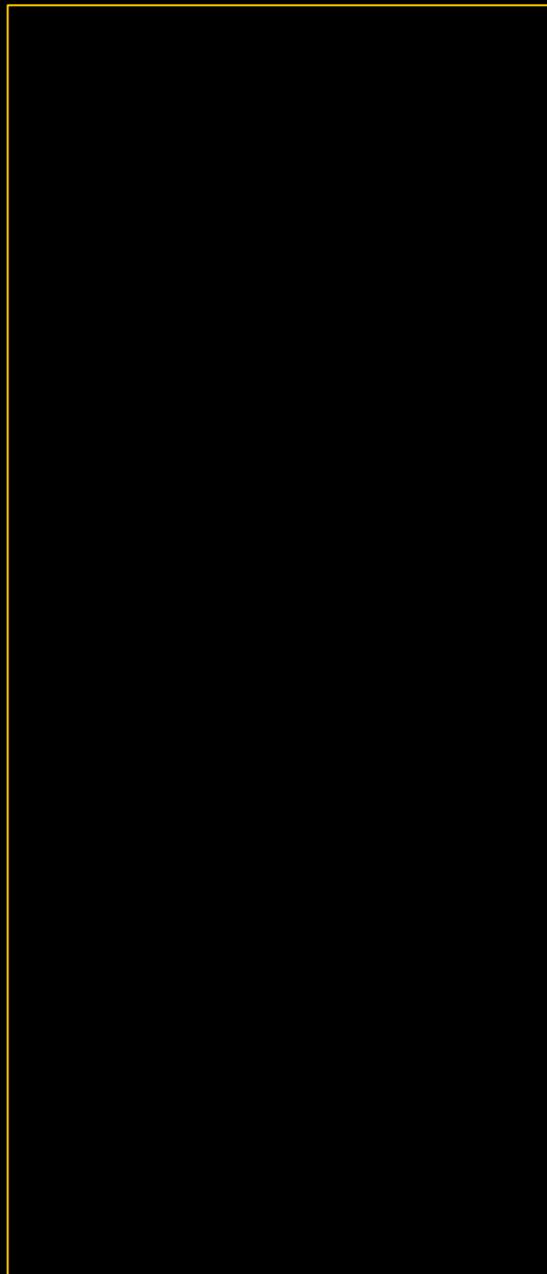


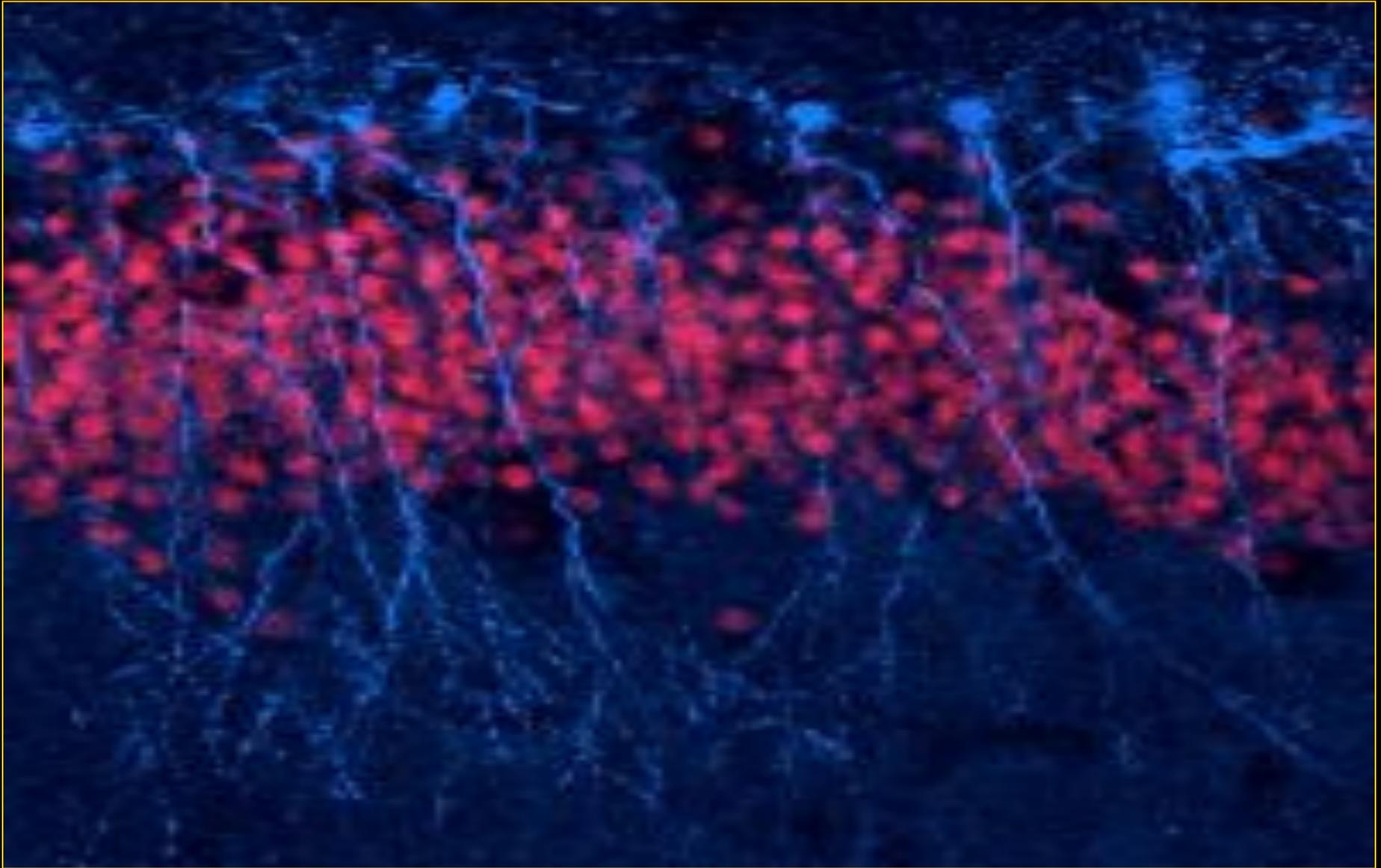


Take your chances



Alcohol no alcohol one year later





Neuroplasticity new brain cells replace damaged areas



# Positives and Negatives

EVERY CHECK IN THIS COLUMN  
WILL HELP YOU MAXIMIZE  
YOUR PERFORMANCE:

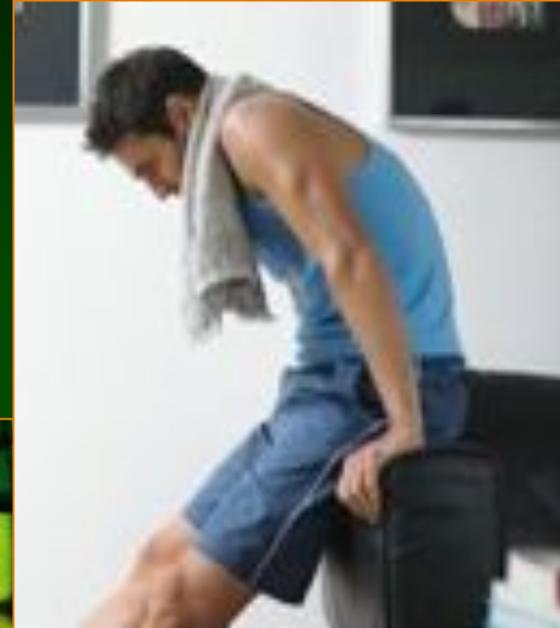
- ✓ Elevate Blood Glucose
- ✓ Rested (8+ hours of sleep)
- ✓ **Post Training** Nutritional Recovery
- ✓ Non-weight Bearing
- ✓ Rest
- ✓ Refuel
- ✓ Rehydrate
- ✓ Sleep

Maximum Results for your effort!

A SINGLE CHECK IN THIS  
COLUMN AND IT IS ALL  
UNDONE

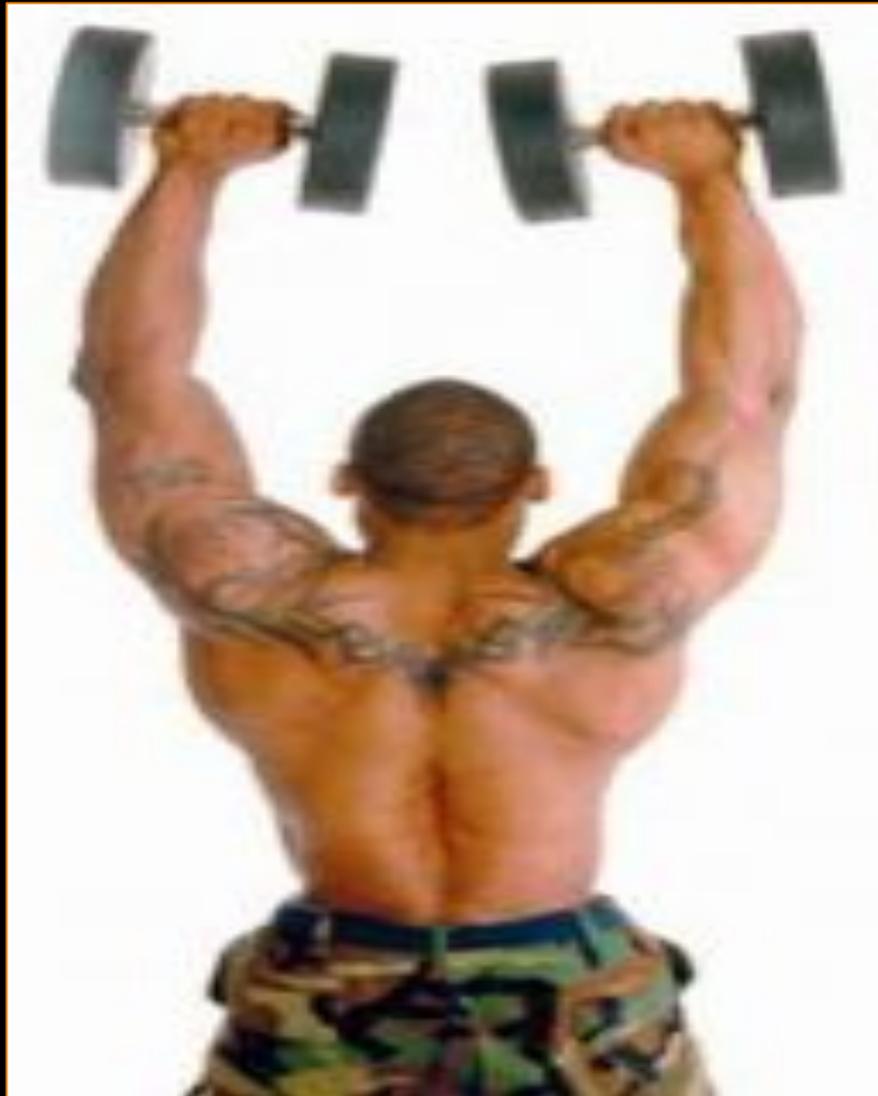
Marijuana  
✓ Alcohol





# ALCOHOL EFFECTS PHYSICAL/MENTAL





For 24 hours  
after heavy  
drinking, it is  
impossible to  
have any  
training effect  
take place

24 HOURS

DEFICITS





There are  
effects from  
any amount of  
alcohol.  
Even one  
drink!

**PHYSICAL**  
**COGNITIVE**



The hangover is just the beginning...



M T W R F S S





**ALCOHOL UNKNOWNNS**

Alcohol is converted to acetaldehyde by the enzyme alcohol dehydrogenase, and then from acetaldehyde to acetic acid by the enzyme acetaldehyde dehydrogenase. Acetaldehyde (poisonous) is between 10 and 30 times more toxic than alcohol itself.



Life  
Athlete



10x 20x 30x

ALCOHOL > ACETALDEHYDE



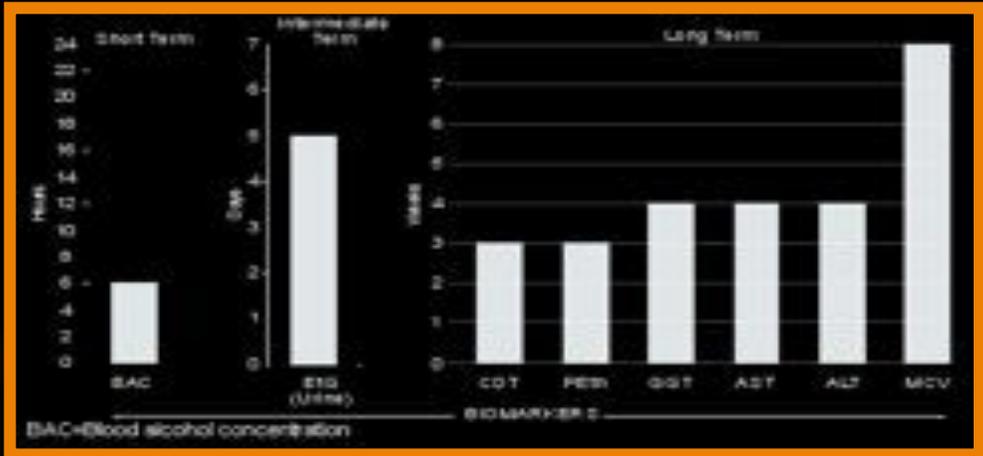


The smallest of  
measures

IN URINE



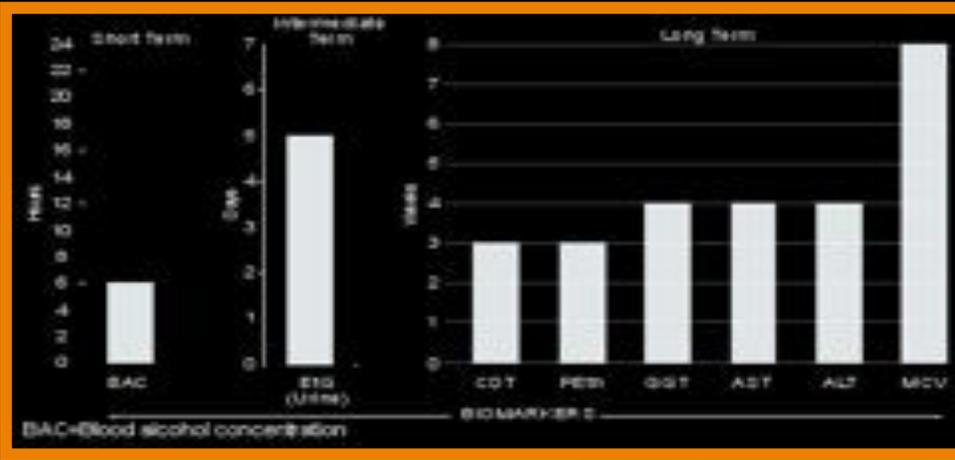
(0.02%) non-oxidative pathway produces ethyl glucuronide (EtG), which is excreted in the urine.



## Windows of Assessment for Various Alcohol Biomarkers

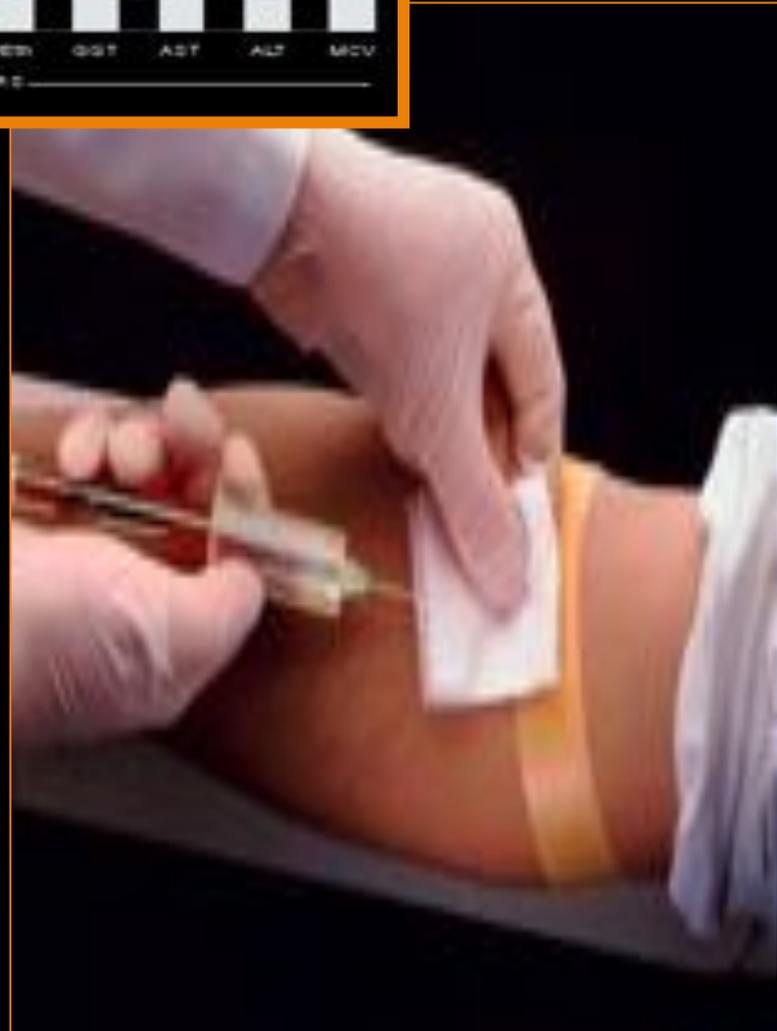
**4-5 DAYS**  
**80 HRS.**





**IN BLOOD**

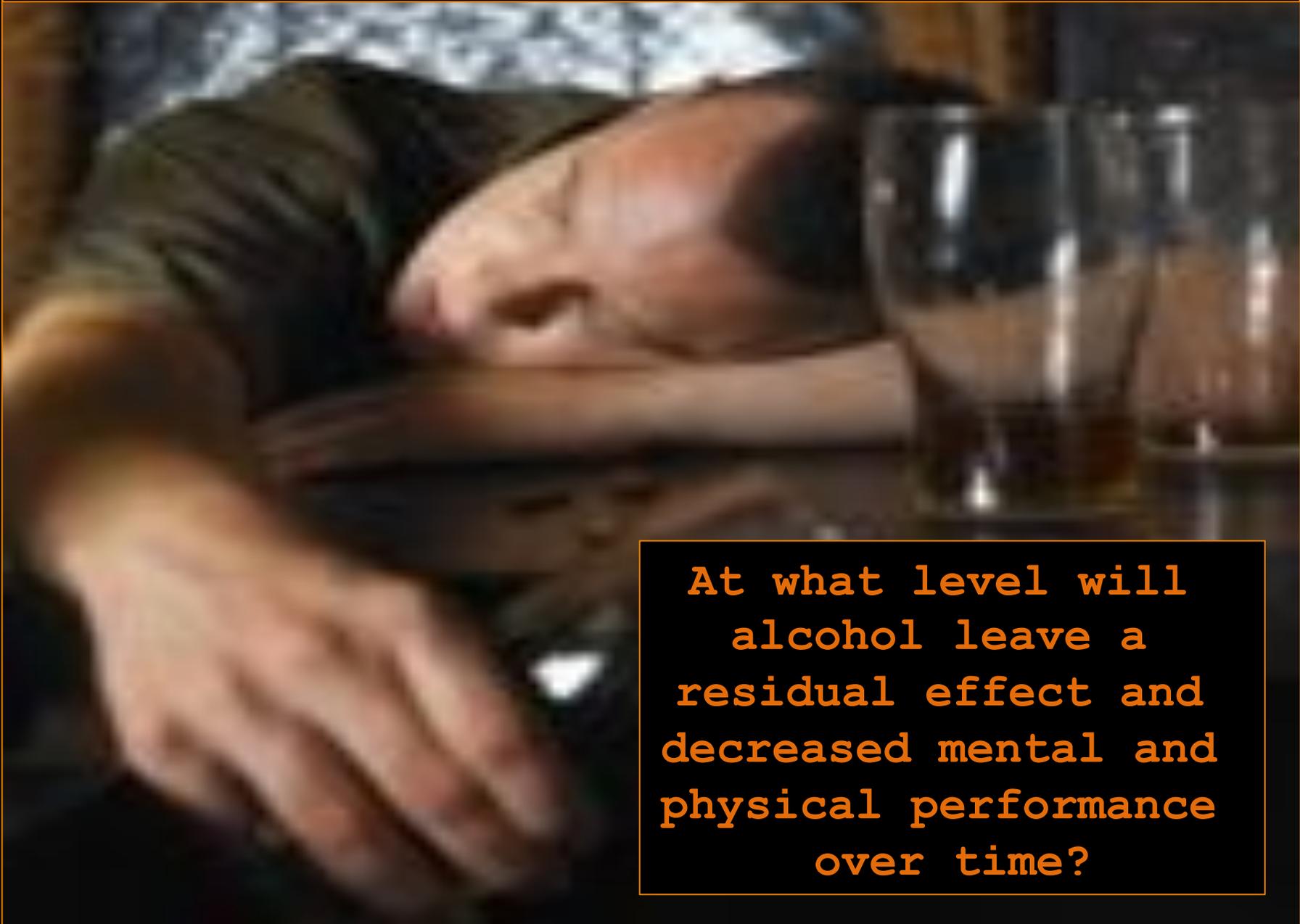
**3-8 WEEKS**



The more you drink the more you impair brain, body and CNS function.



## DECREASED MENTAL PHYSICAL PERFORMANCE



At what level will alcohol leave a residual effect and decreased mental and physical performance over time?



Effects of alcohol begin at 1-2 drinks  
Effects increase dramatically at 3-4 drinks  
Effects at 5-6 drinks have serious residual effect

**RESIDUAL EFFECTS**

RED GREEN BLUE 12 35 50



Minimal Residual





The residual effect of alcohol or a hangover has been shown to reduce performance by an average of 11.4% in elite athlete populations.

<11.4%

PERFORMANCE POTENTIAL



# Muscle Function



Ethanol is a very small molecule. Because of its size and polarity (charge), it can readily enter (diffuse without the concomitant expenditure of energy in the form of ATP) through the cell membrane of skeletal muscle.

In the process, ethanol can disrupt the molecular configuration of the fatty acyl groups of the phospholipids of the skeletal muscle. Ultimately, this could interfere with several processes including the entry of calcium ions into the nerve terminal or an increased binding of calcium to the sarcoplasmic reticulum of the muscle.

Calcium is the cation (a positively charged ion) which is involved in the control of the rate of release of neurotransmitter into the synapse (the area between the nerve and the muscle) and plays the most important role in muscle contraction and relaxation.

Thus in summary, alcohol is not a fuel for muscle contraction and alters fuel metabolism to increase lactate production and decrease lactate degradation. Furthermore, disrupts the molecular configuration of skeletal muscle and compromises its ability to perform muscle contraction. ( Balon/Underwood 2004)







Cardiac Output  
Stroke Volume  
Cardiac Arrhythmias

**HEART FUNCTION**



< O<sub>2</sub>

> CO<sub>2</sub>

< VE



# LUNG FUNCTION



# Blood Glucose Levels

The body has trouble making more glucose because it is expending its energy metabolizing the alcohol. Both of these effects of alcohol can cause severe hypoglycemia low blood glucose levels for 6 to 36 hours after a binge drinking episode.





.08

.07

.06

.05

.04

.03

.02

.01



Alcohol consumption produced marked effects on visual functions, producing a mean of 80% impairment in the 0.08% group. In general, the effects of impairment were distributed in a dose-dependent manner. Many different measures of visual function were included in the battery, including visual acuity, visual evoked potentials, eye movements and visual search. Visual search was the most sensitive to the effects of alcohol, with a 50% reduction in performance at 0.08% BAC, a finding which is consistent with earlier studies. On the other hand, visual evoked potentials were the least sensitive to alcohol, with a 20% reduction in performance at 0.08% BAC. In general, visual search and visual evoked potentials were the most sensitive to alcohol, with a 50% reduction in performance at 0.08% BAC. In general, visual search and visual evoked potentials were the most sensitive to alcohol, with a 50% reduction in performance at 0.08% BAC.

# ALCOHOL AND VISION



# Alcohol and Vision

NEWMAN and FLETCHER, who measured seven aspects of visual function in 50 subjects before and after alcohol administration. Blood alcohol levels ranged from 58 to 218 mg. The tests and results follow:

Decreased levels were seen in:

Sensitivity to Light	
Target Tracking	Gaze Recovery
Visual Acuity	Eye Coordination
Distance Judgment	Depth Perception
Lateral Visual Field	Gaze Persistence

Ability to:

- Track and follow moving objects...
- Determine depth between objects...
- Determine the speed or velocity of a traveling object...

Open your eyes!





# TRAINING HORMONES



Life  
Athlete

# TESTOSTERONE

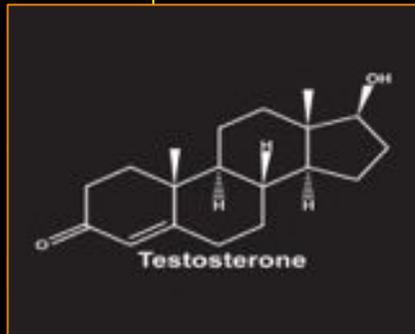
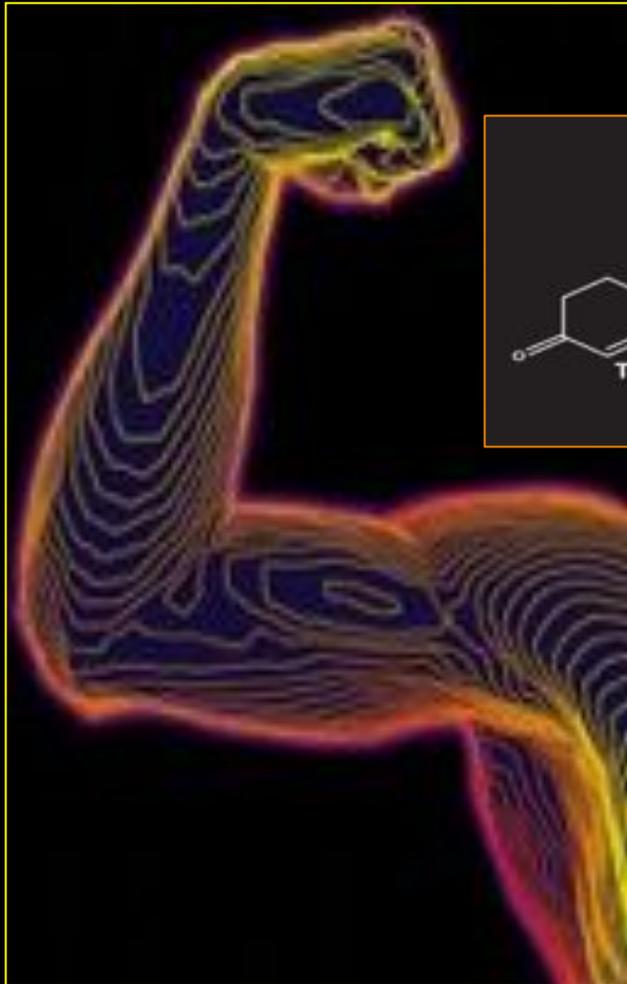
Studies of athletes drinking beer show that alcohol directly suppresses testosterone levels.

The more you drink, the more it gets.

And it's not just at the time you are drinking.

The biggest hit comes later, and spills into the following days...





Heavy maximal level training followed by excessive alcohol consumption can result in hormonal disruptions for up to 96 hours (4 days)

**TRAINING EFFECT**  
**RECOVERY**  
**PERFORMANCE**

**THE 96 HOUR HOLE**



(12-20 hours after the start of drinking) the testosterone level was only about half what it was...

It happens fast



**TESTOSTERONE**



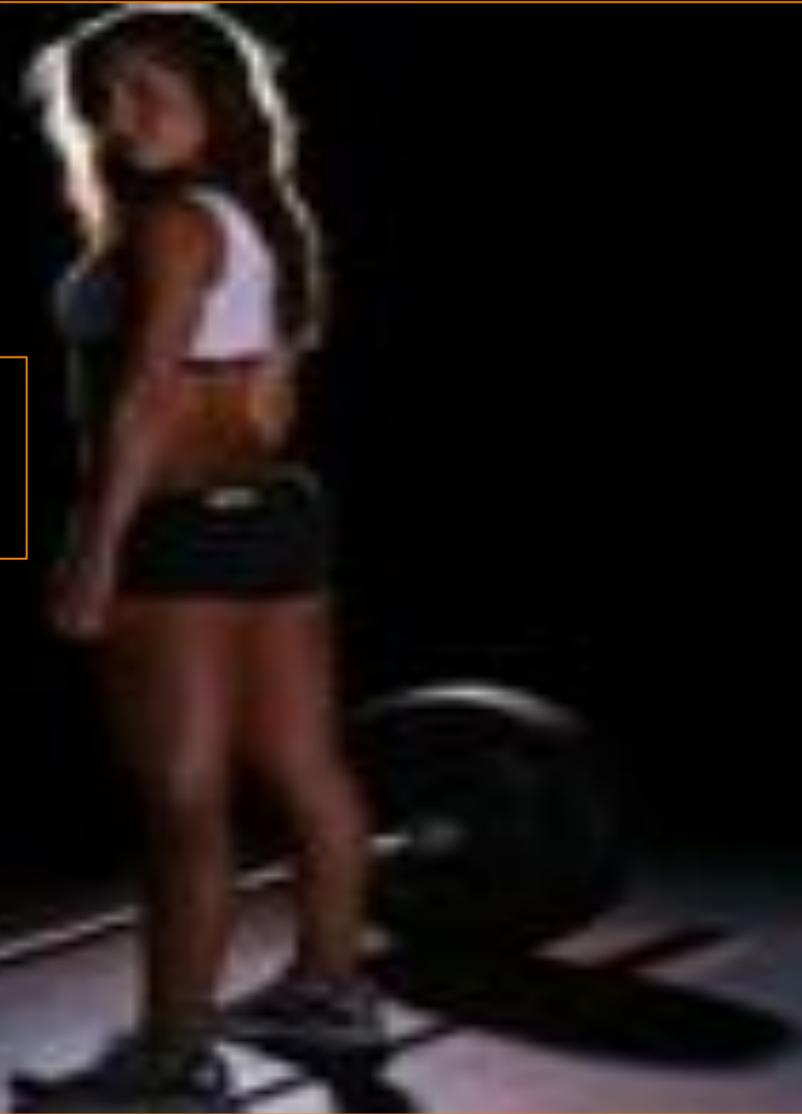
Some males who drink heavily & regularly have testosterone levels similar to female levels.

**Alcohol And Testosterone**



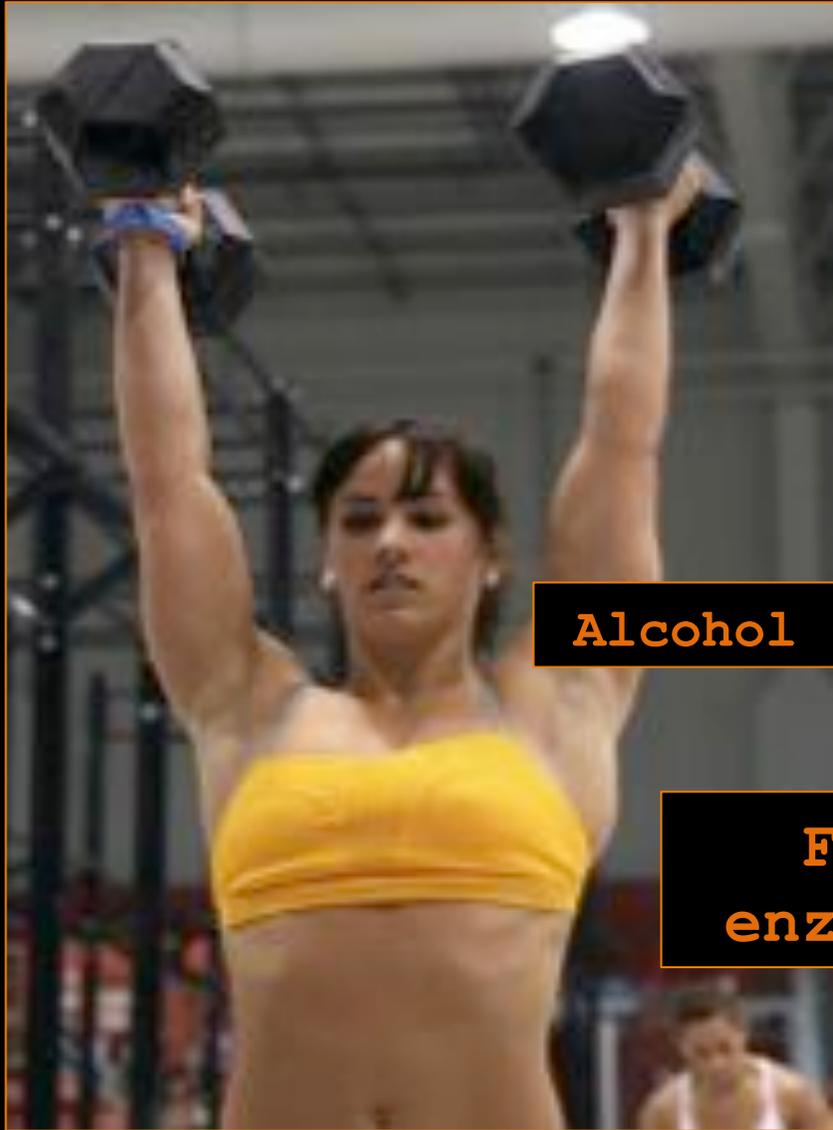
Females have 1/10th  
of the training  
hormones of men.

Training effect is  
much more fragile



Female Training Effect





Alcohol stays in the female body longer

Females have less of the enzymes to breakdown alcohol

Alcohol > affects on females



# Alcohol and Sickness

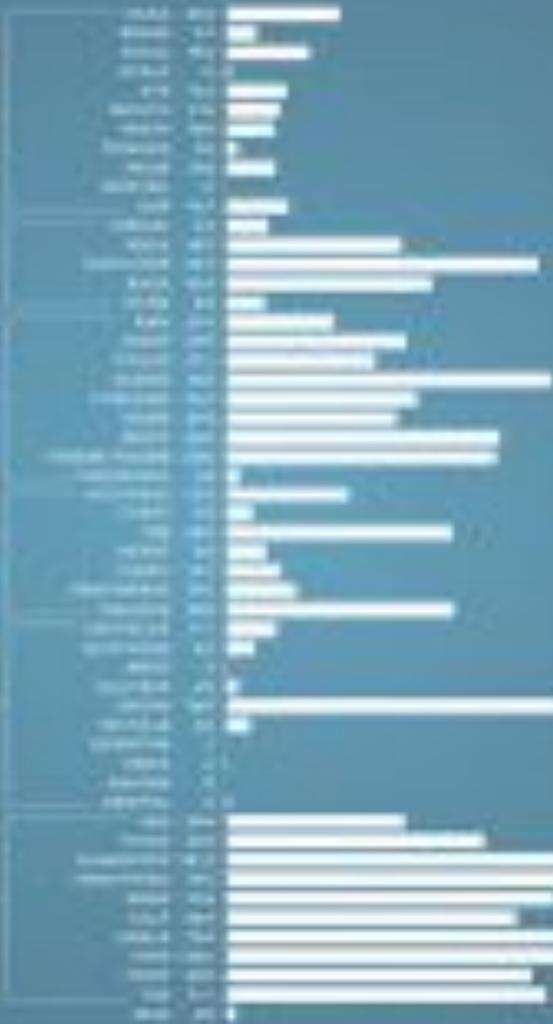
Life  
Athlete



The impairment of cellular  
immune response can be  
attributed to acute alcohol use...

## Sickness





# INJURIES

**Injury rate for  
drinkers is 54%**

**Injury rate for  
non drinkers is  
23%**

NCAA Injury Study

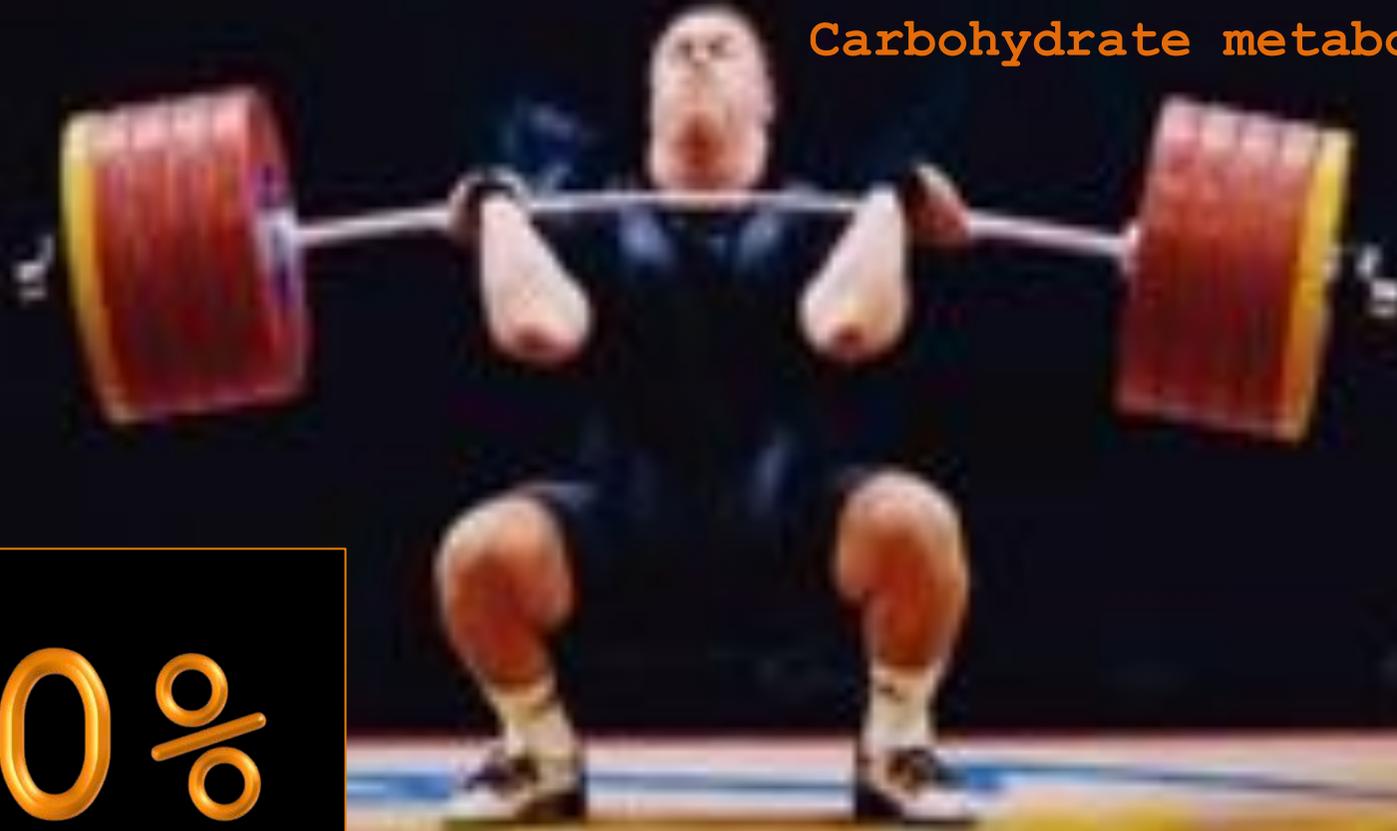


**HGH**

Maintains muscle mass  
Repairs muscle fiber  
Fat metabolism  
Carbohydrate metabolism

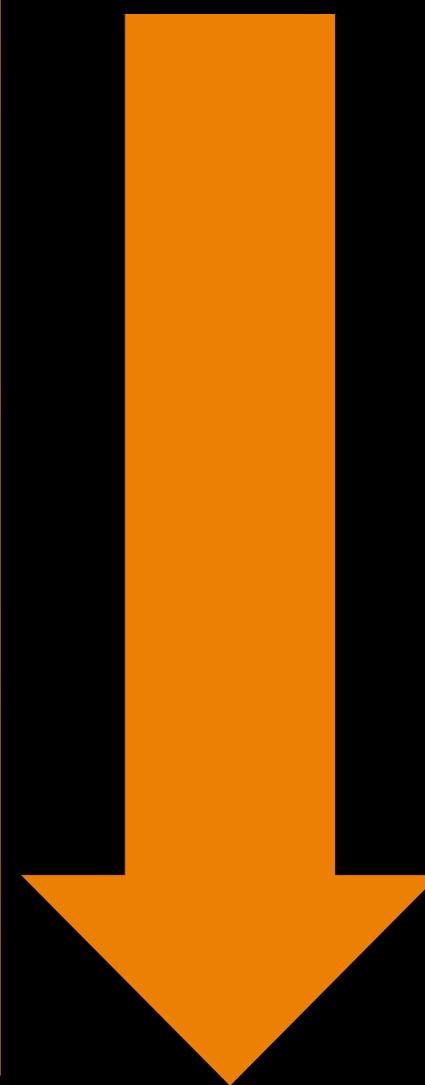


**70%**



**Human Growth Hormone**





**STRENGTH / POWER**





<11%

EXPLOSIVE POWER





< 8%

POWER ENDURANCE



# Drunks Can't JUMP



## Static CM Jumps

Subject	1	2	3	4	5	6	7	8	9	10	11	12	13
1	0.12	0.15	0.18	0.21	0.24	0.27	0.30	0.33	0.36	0.39	0.42	0.45	0.48
2	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.32	0.34
3	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.32
4	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30
5	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28
6	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26
7	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.13
8	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12
9	0.00	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11
10	0.00	0.00	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
11	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
12	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08
13	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07



Static Jump

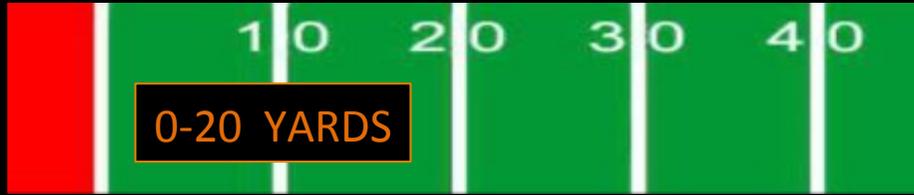


Dynamic Movement Jump

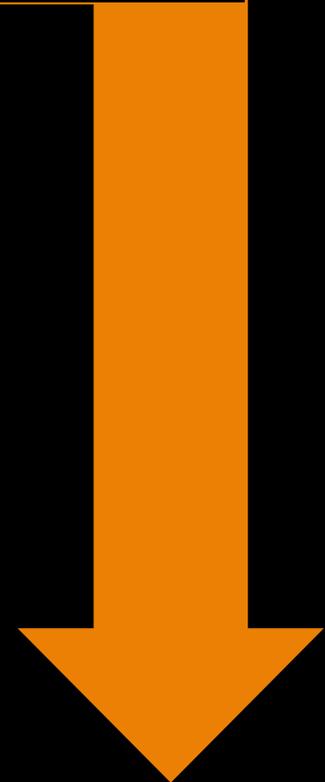
7 of 13 subjects >

This is data on 13 subjects measuring static jumps and movement jumps in the laboratory. Each row and column shows the performance of a subject on a particular day. The subjects were 13 years old and were not professional athletes. The subjects were not trained in any sport. The subjects were not trained in any sport. The subjects were not trained in any sport. The subjects were not trained in any sport.



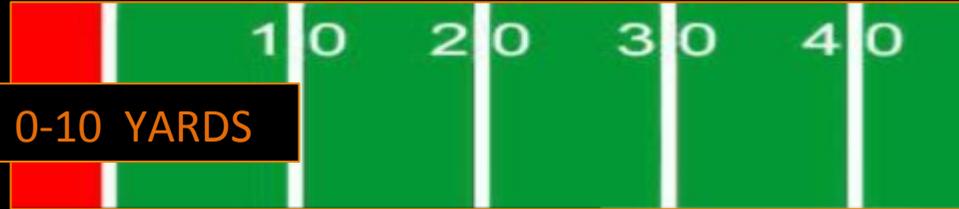


< 6%



ACCELERATION SPEED





< 8%

START UP SPEED



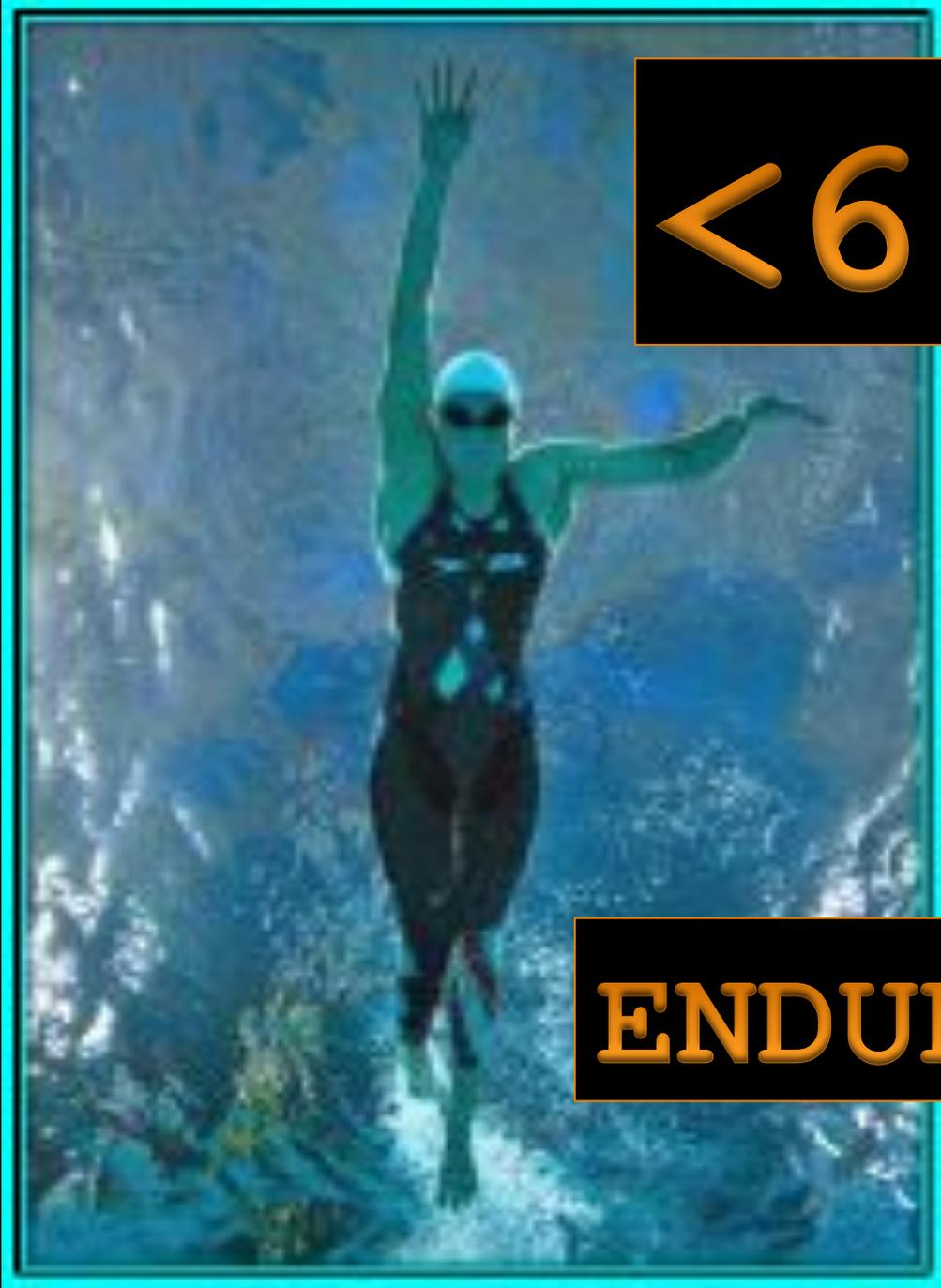
0-5 yds.



< 8%

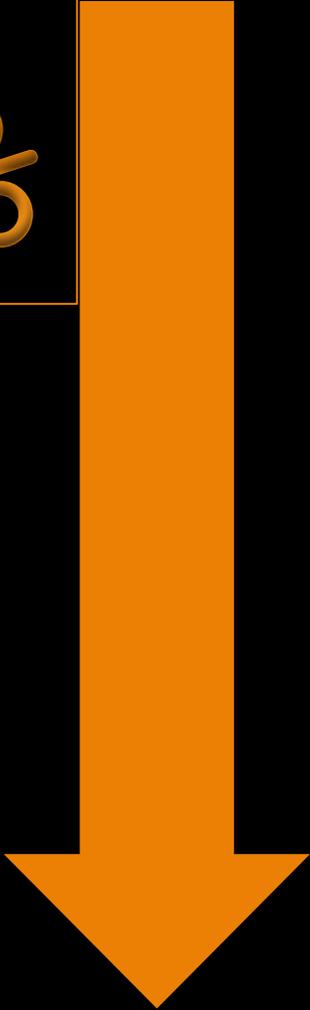
LATERAL SPEED





<6.96%

ENDURANCE





**FAT  
BURNING  
DECREASED**

**Alcohol  
greatly  
affects the  
amount of fat  
your body can  
and will burn  
for energy!**

**Just a mere 24g of alcohol consumption showed whole-body fat oxidation (the rate at which your body burns fat) decreased by 73%!**





**1X DRUNK = 14 DAYS  
LOST TRAINING EFFECT**

American Athletic Institute has studied the impact of alcohol on condition in elite athletes. Impact has shown significant projections in lost physiological condition that correlates to as much as 14 days of lost training effect...for each time drunk...

**WASTING YOUR TIME**



# Throwing away your hard work?



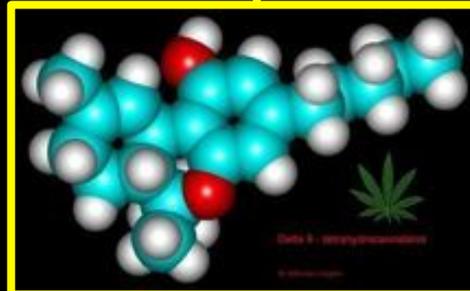
one night of drinking  
wipes out 2 weeks of training

American Medical Association survey, 2000



AMERICAN MEDICAL ASSOCIATION  
SURVEY OF PHYSICIANS' DRINKING HABITS  
AND PERFORMANCE

www.ama-assn.org



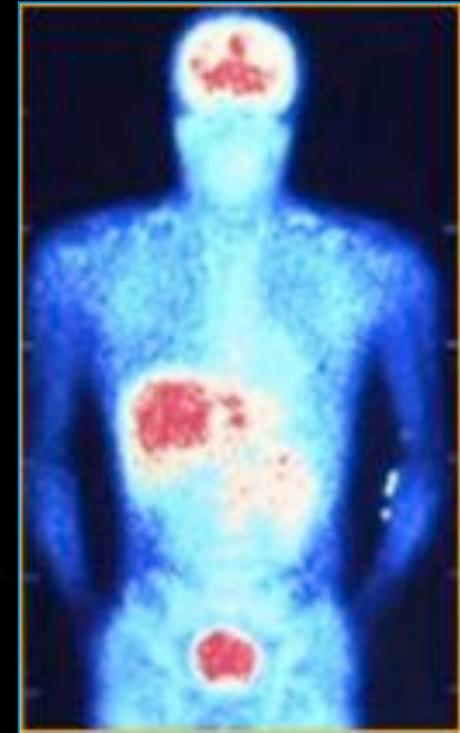
# The Effects of Marijuana on High Level Mental and Physical Performance

John G. Underwood  
Director American Athletic Institute

Life of Athletes



Global Athlete  
**MARIJUANA**  
Project



THC Deposit Sites

# Education



NCAA study released in January, 22.6 percent of athletes smoke weed...

College football players (26.7 percent) ranked the highest among major sports.

About half the team smokes, he estimates. "It's a team thing."





A recent study found that athletes claimed smoking marijuana prior to a competition helps them focus...

# FOCUS

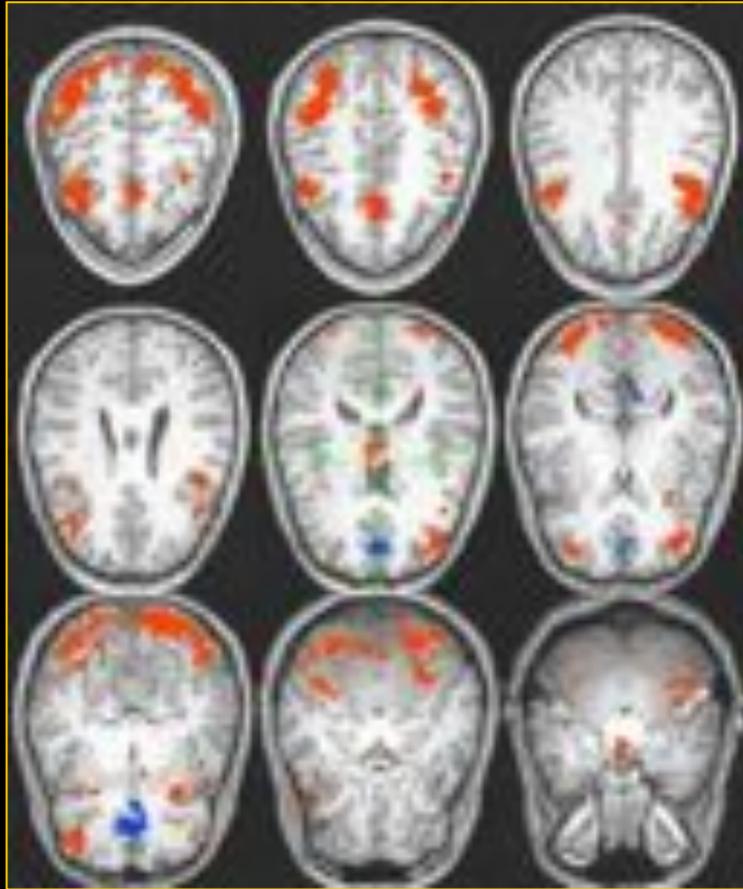




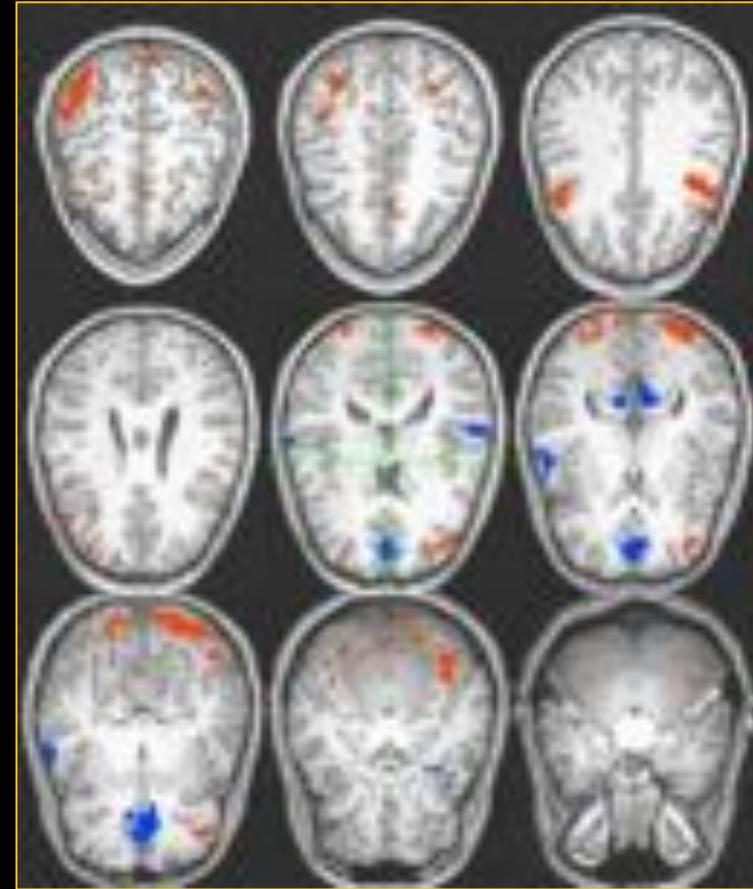
What research has been done worldwide that we can give our athletes to dispel this perception?

Effects of THC (1 mg) on activation on concept reaction to task

# Reaction to task formation



**Before**



**After**



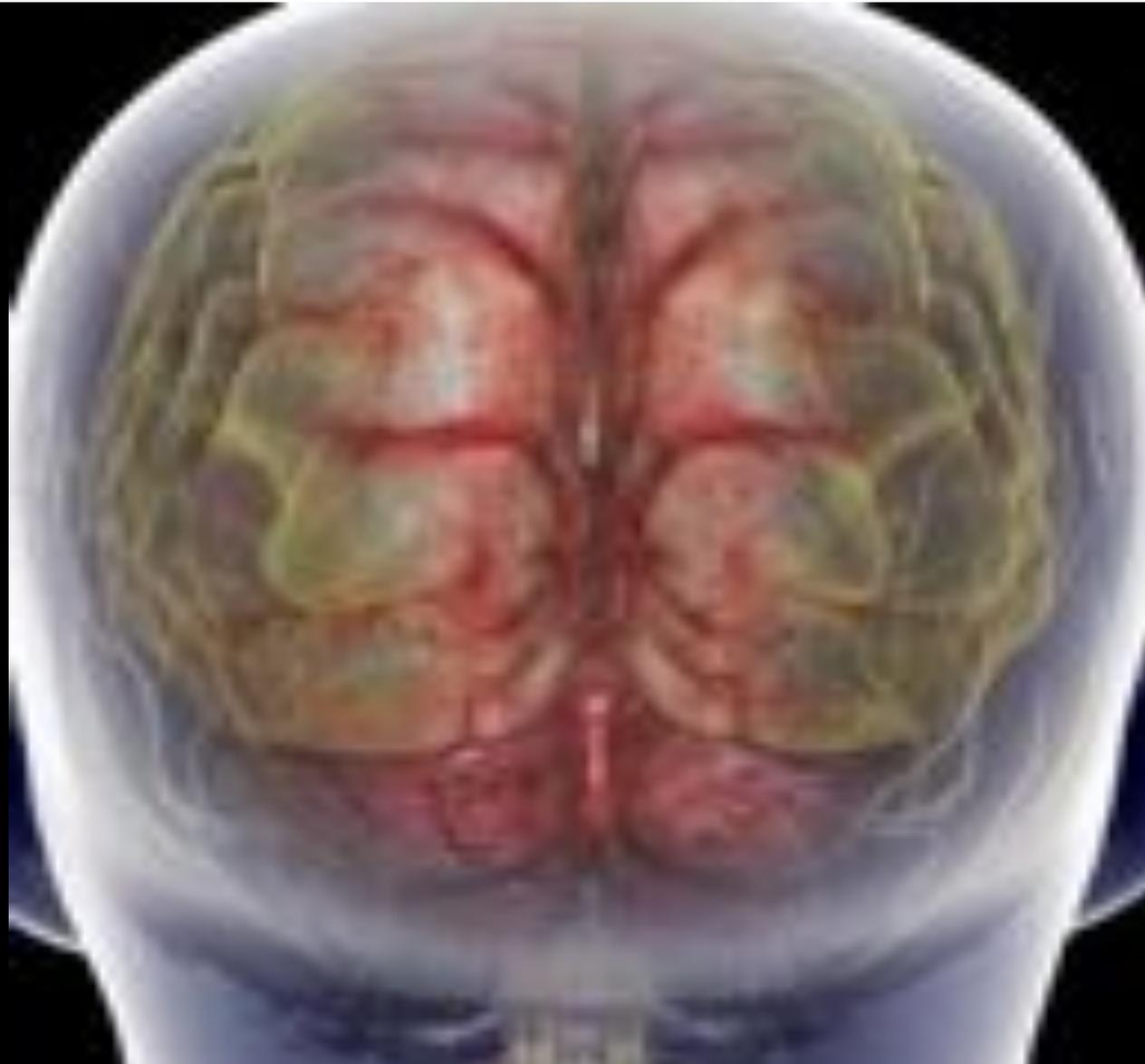
Oranges represent positive and blues negative activation



B

R

A



THC attaches to receptors in the brain and impacts learning, memory, reaction, movement and coordination.

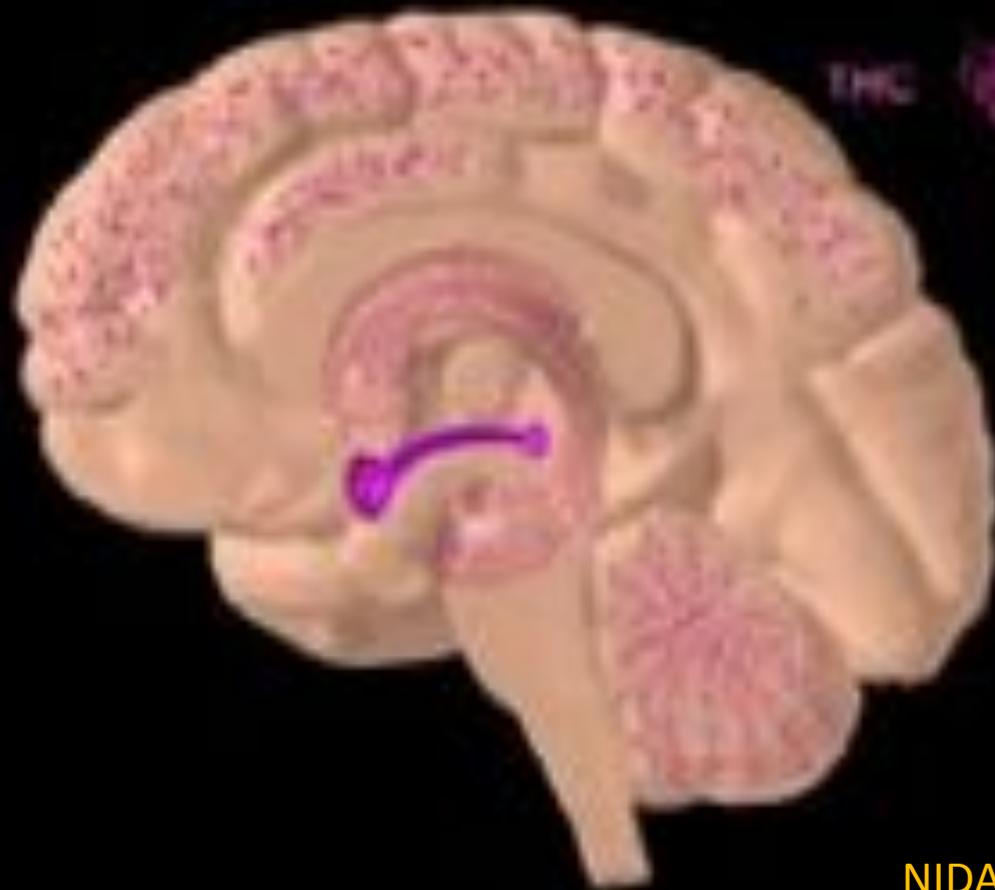
N



# Receptors

There are membranes of particular nerve cells in the brain that have special protein receptors called, cannabinoid receptors, that bind with the THC. When the THC binds to these nerve receptors, a series of chemical reactions occur that alter the function of those nerve cells.

# Deposit Sites



NIDA

# Cannabinoid Receptors *'hot-spots'*



MRI scan of cellular cannabinoid reception.  
(Image © BBC 2009 -

*Brain*

*Liver*

*Pancreas*

*Kidney*

*Skin*

*Prostate*

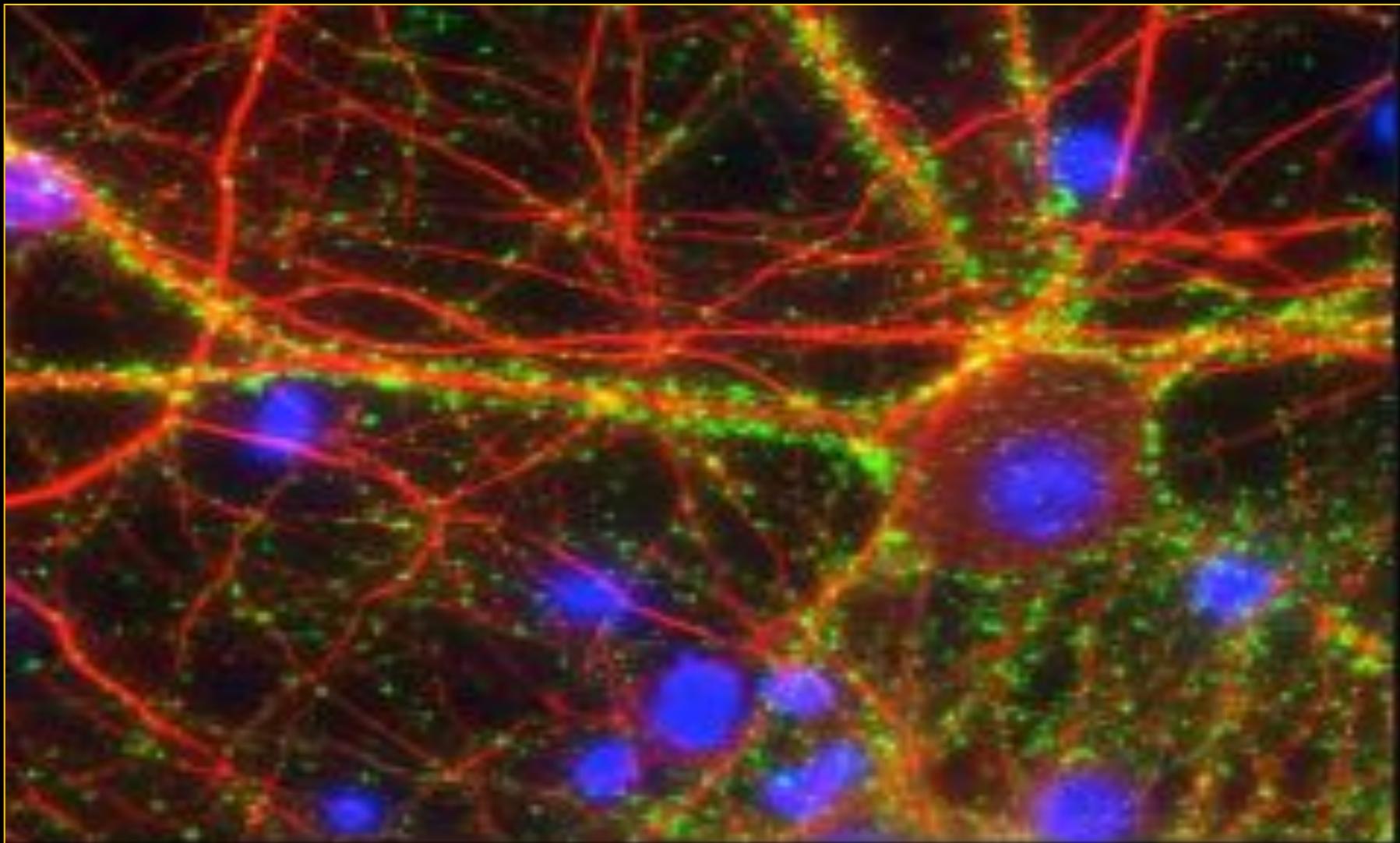
*Cervix*

*Testes*

**B**

**O**

**D**



**THC bound to receptor sites**

# Cannabinoid Receptors in Brain



**memory**

**cognition**

**reward**

**sensory perception**

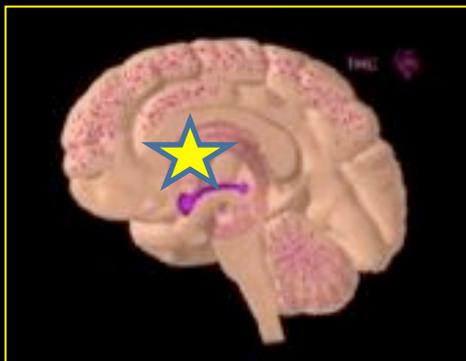
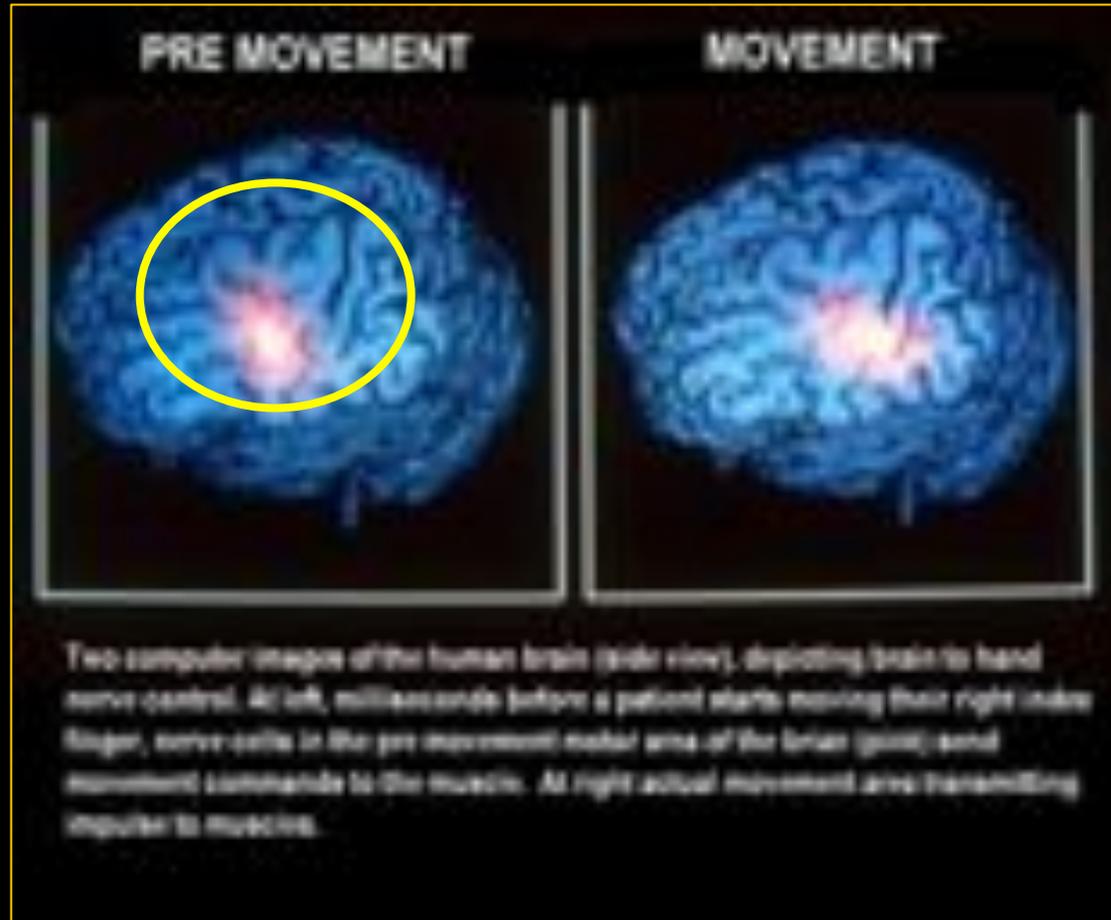
**emotions**

**motor control**

**movement memory**

**coordination**

# Pre Movement-Movement



LOCATOR

# Human Movement



Initiation of impulses for  
movement during finger  
tapping





# MARIJUANA SKILL IMPAIRMENT



**NON USER**  
**SIMPLE HAND SKILL**

Skill  
Recall  
Area



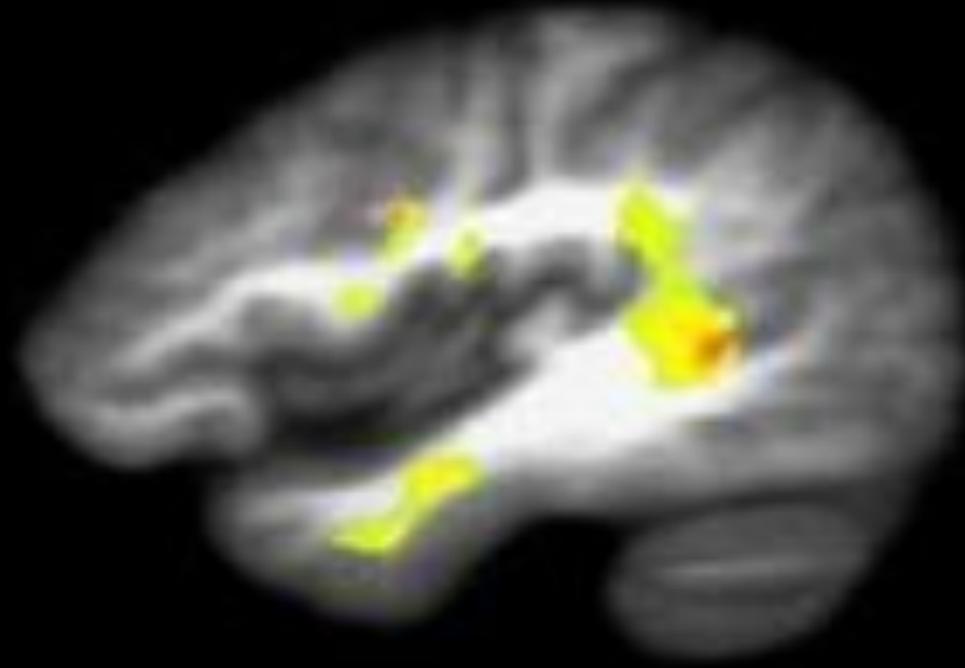
**MARIJUANA USER**  
**SIMPLE HAND SKILL**

Note: Subject not under influence during scan.

**POT OR NOT? YOUR CHOICE YOUR GAME**

# White matter matters

THINK



COMMUNICATE

CANNABINOIDS  
INCREASE THE SECRETION  
OF SOMATOSTATIN

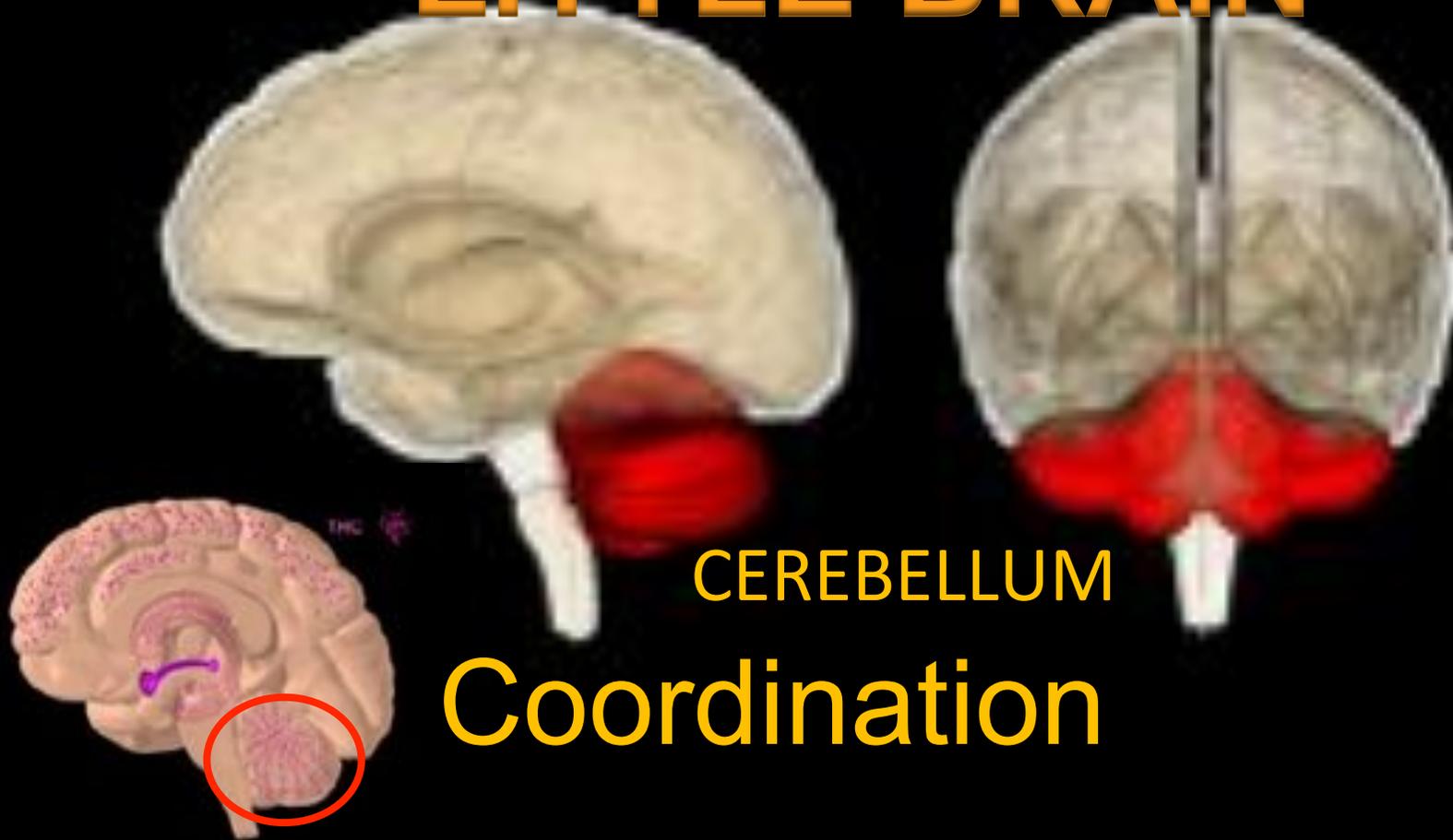
The hypothalamus also secretes a chemical called Somatostatin (SS). When it releases Somatostatin it travels to the pituitary which inhibits or stops the release of growth hormone into the blood.



SOMATOSTATIN BLOCKS HGH

Digital Athlete Mind Project

# LITTLE BRAIN

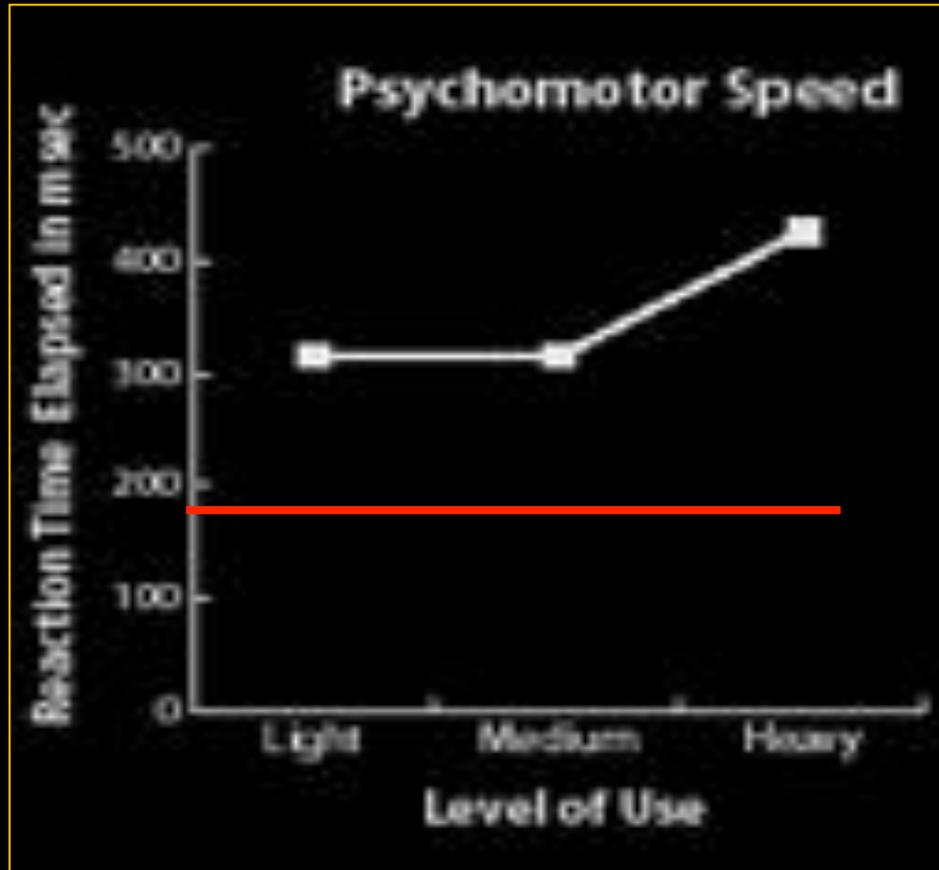


CEREBELLUM

## Coordination

- Equilibrium
- Balance
- Muscle tone
- Ability to perform rapid alternating movements

# WEED and REACTION



Average in the  
.300-.450msec range.



\*Highly functional trained athletes  
have faster reaction times



Life  
Athlete

Change the way you live  
and you will change the  
way you can compete...

STOP COMPETING  
WITH OTHERS.  
START COMPETING  
WITH YOURSELF.

