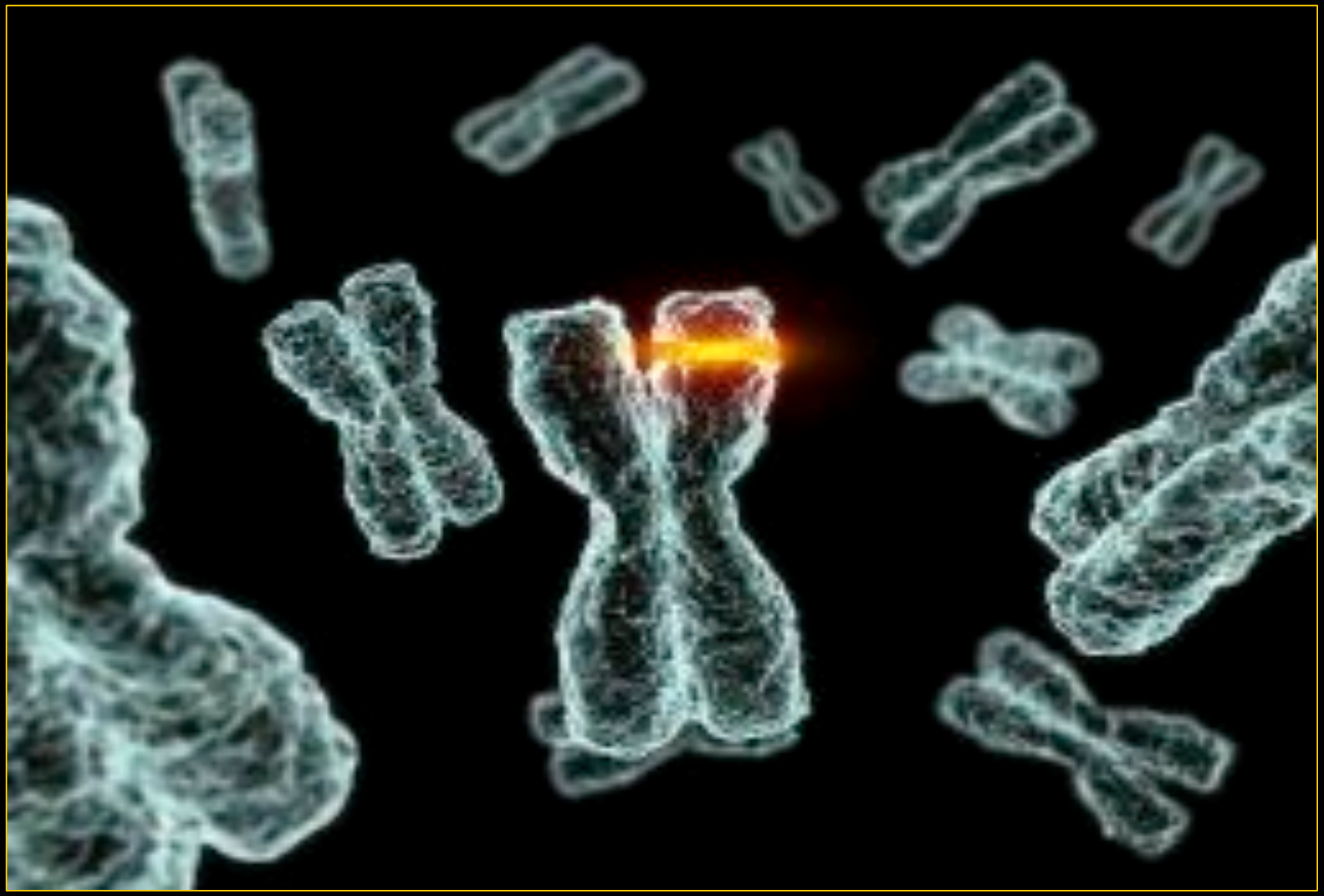
ASPC International Forum on ELITE SPORT

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

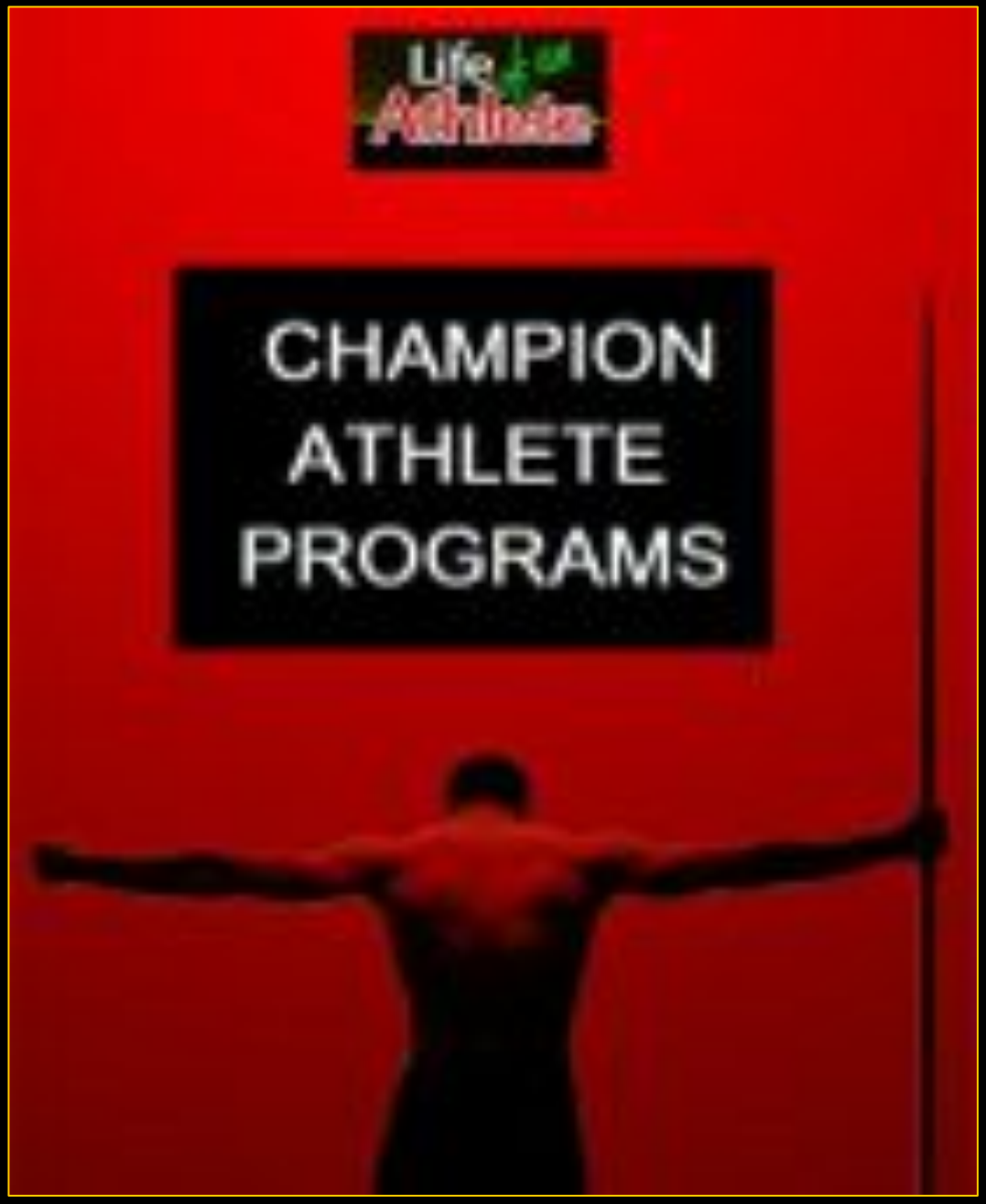
RECOVERY

Physiological Considerations for Recovery in Elite Hockey

John Underwood Director American Athletic Institute

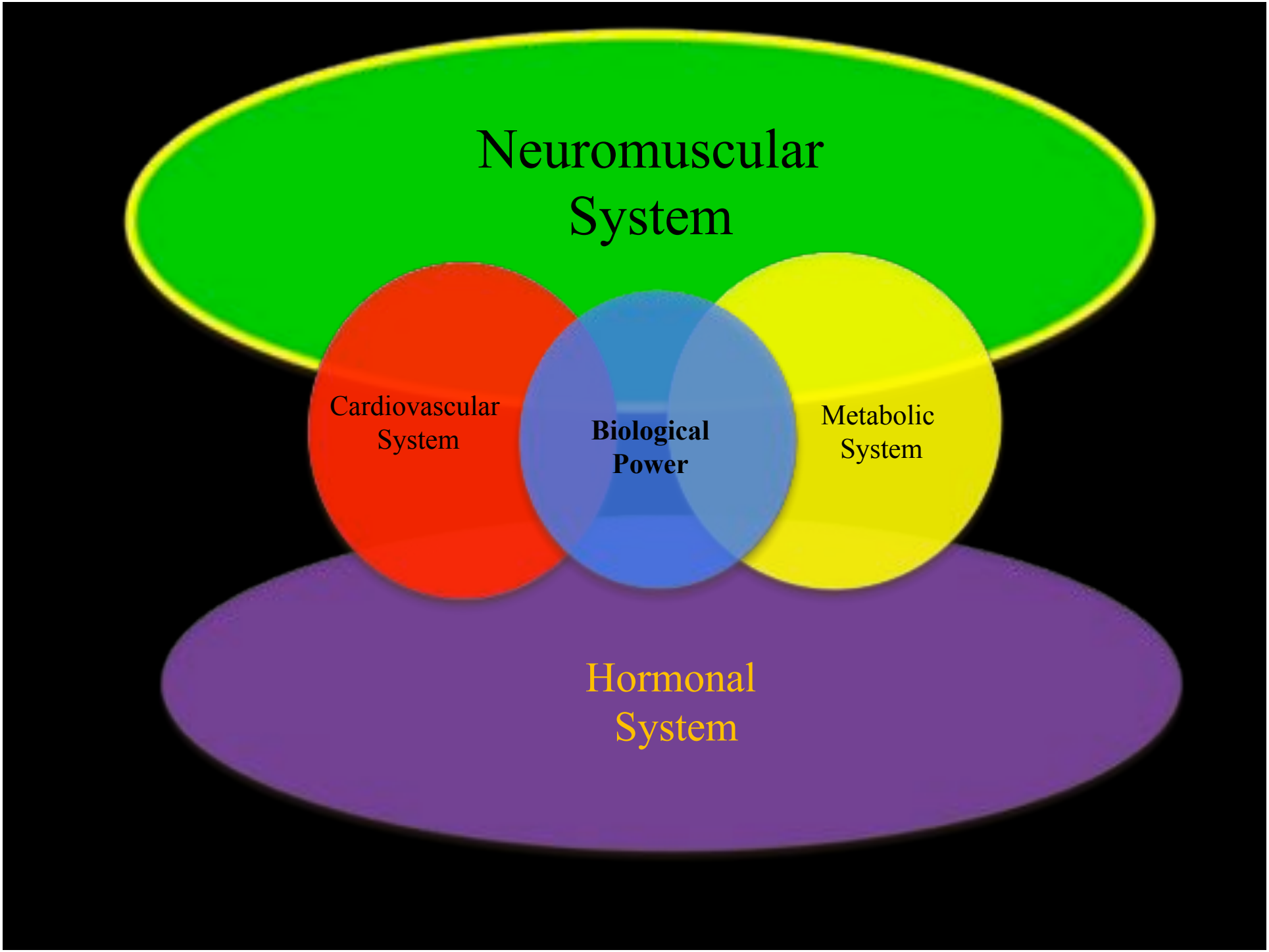
Understanding Recovery


OSU
OREGON STATE
BEAVERS
NCAA College Sport
OREGON
0

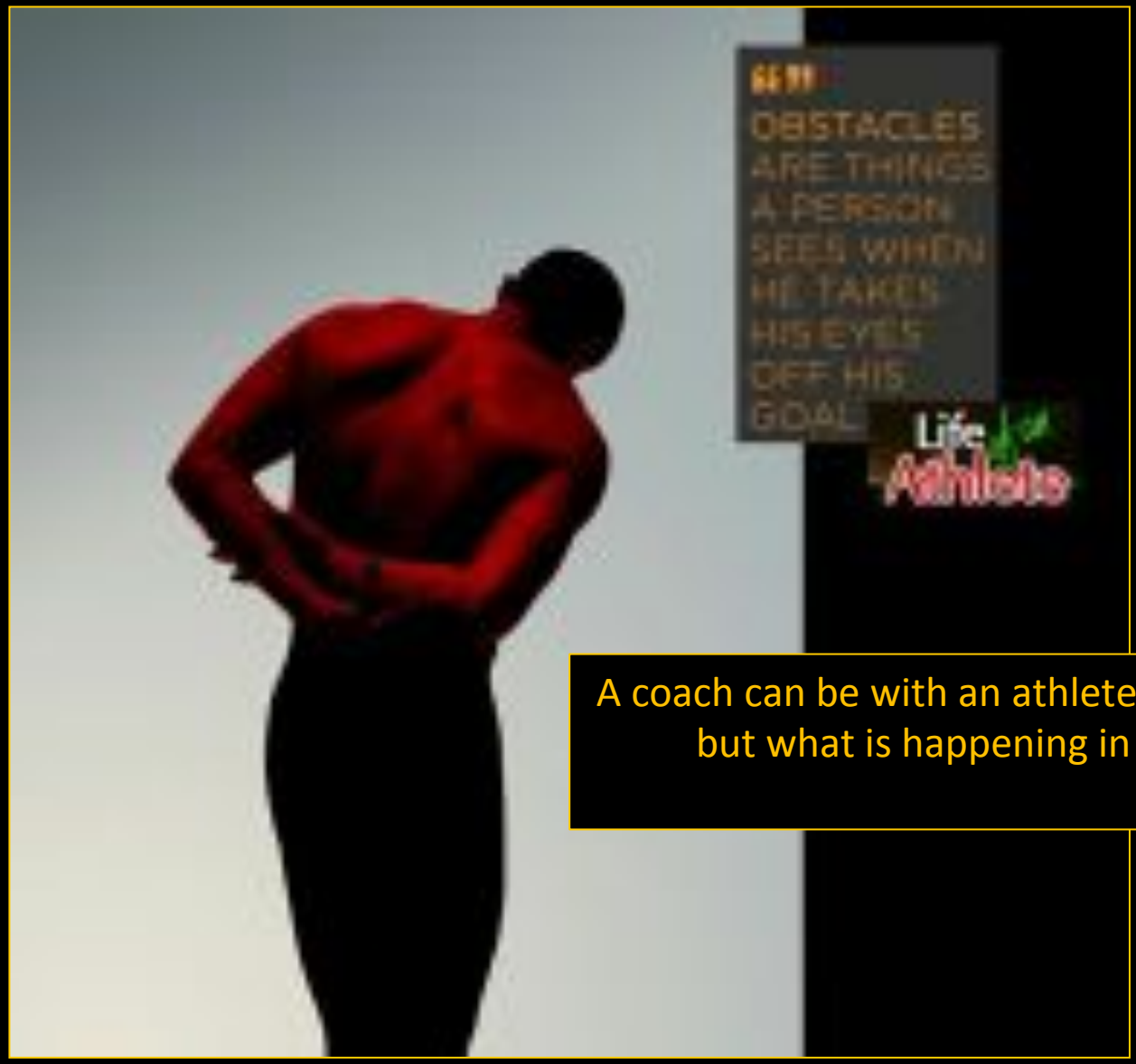


ATHLETE LIFESTYLE EDUCATIONAL MODULES

Figure 1 - The Gears of Training and Performance
(Mongeir, 1998)


Neuromuscular System
Cardiovascular System
Biological Power
Metabolic System
Hormonal System

Lifestyle matters… Lifestyle counts

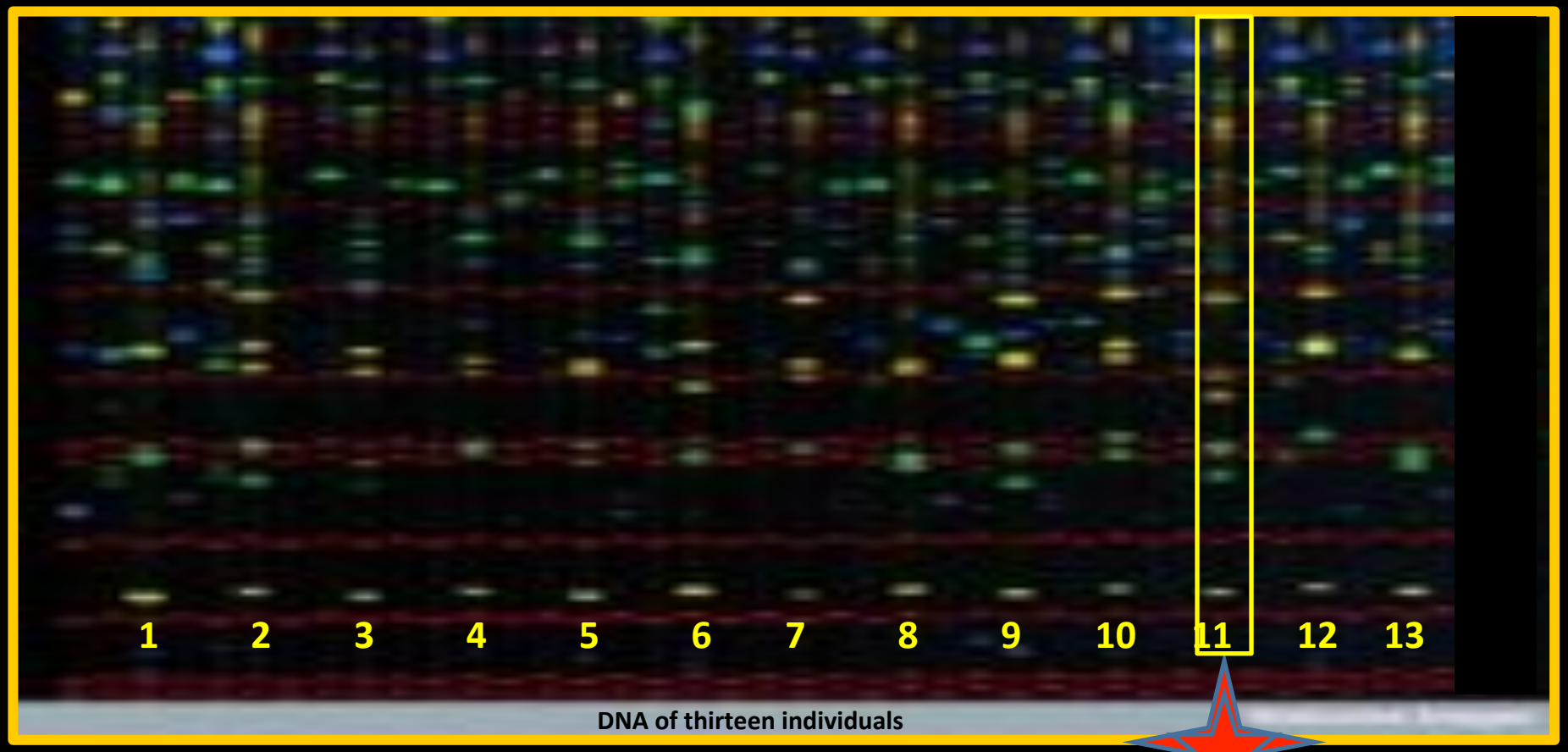


1%

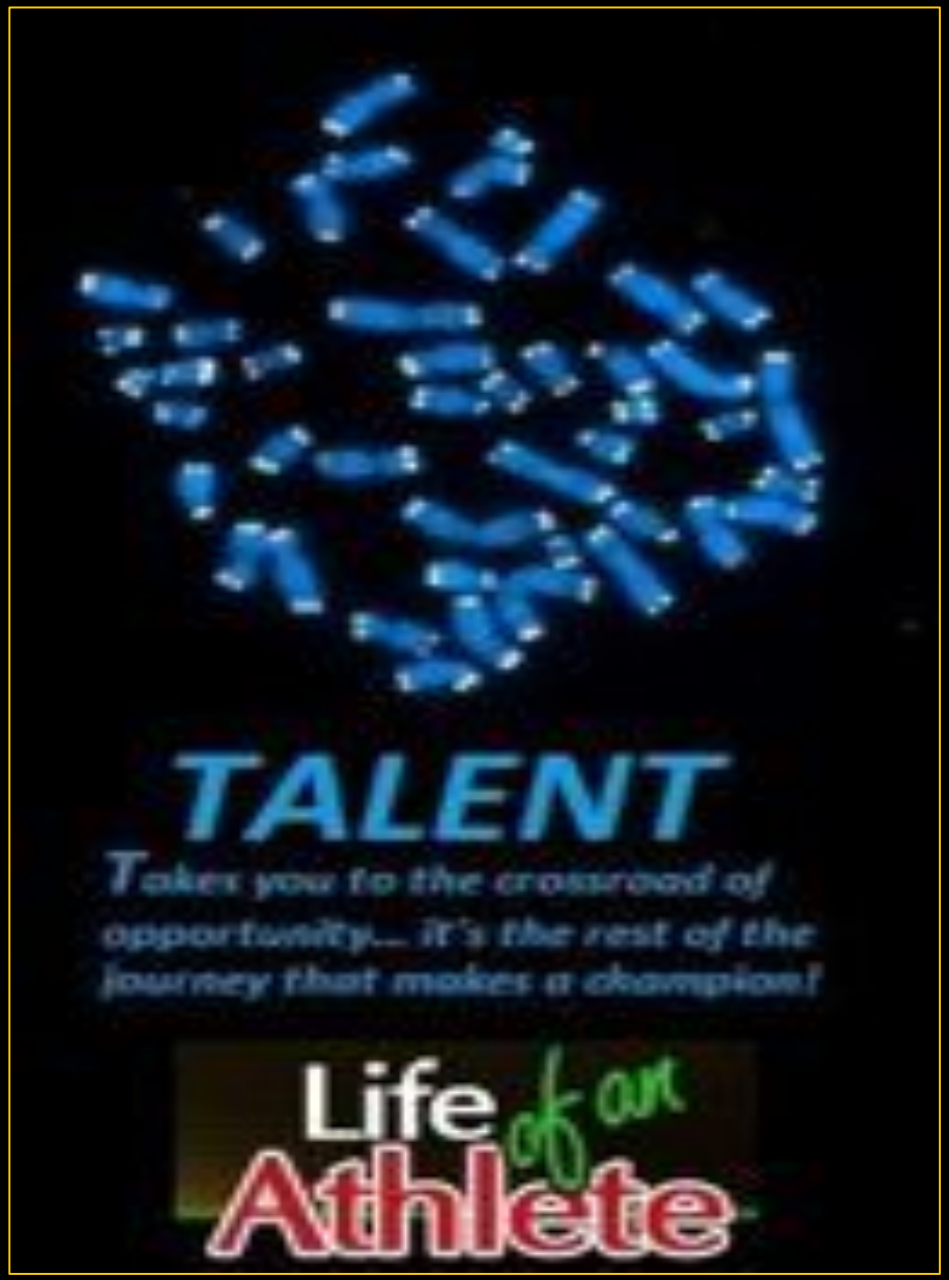
A coach can be with an athlete for three hours in a day…
but what is happening in the other 21 hours?

Joachim Cruz

ALL THAT MAKES YOU



8% TALENT



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

Performance Factors

LIFESTYLE

Inseason

Preseason

Inseason

Preseason

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

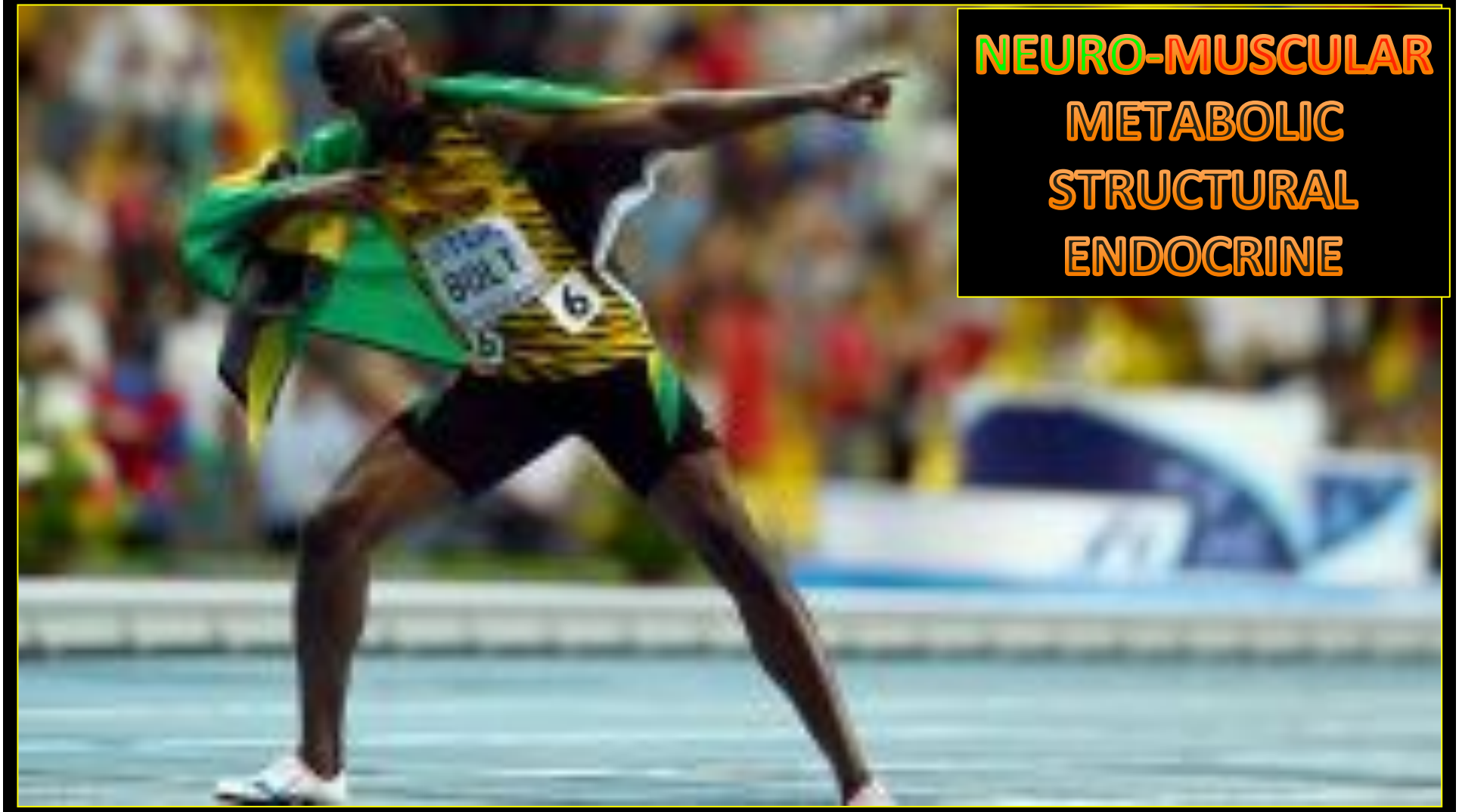
CIRCADIAN

RANDOM EVENTS

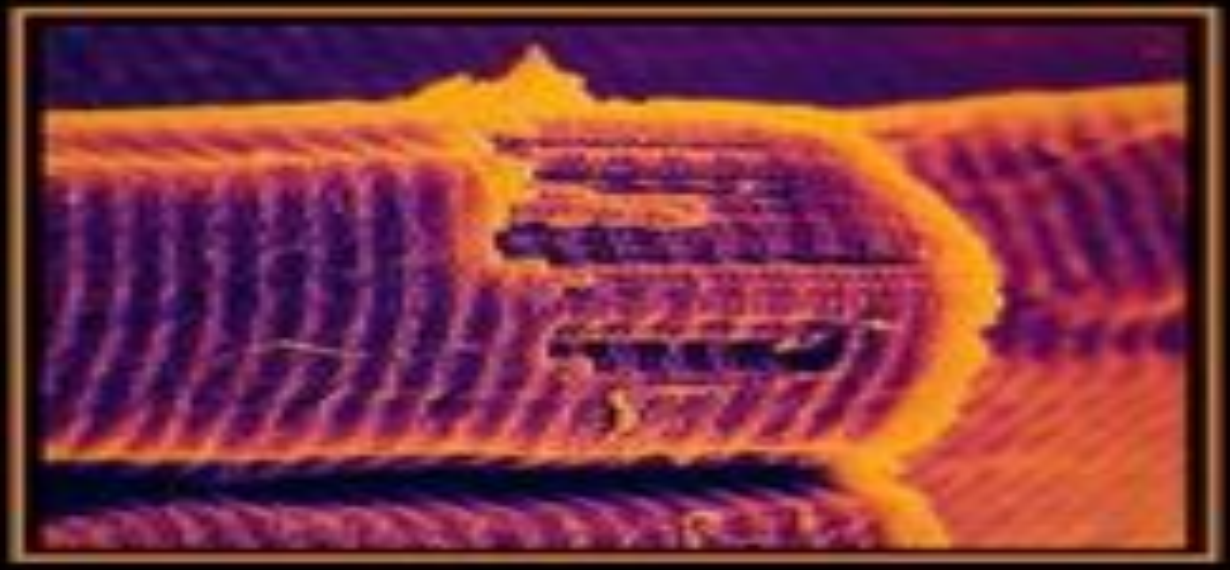
LIFESTYLE AND RECOVERY

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



Example Muscle Concerns



WARMDOWN
NUTRIENTS
COMPRESSION
HOT/COLD
MASSAGE
ELASTICITY/FLEX

Where has the same consideration been for CNS?

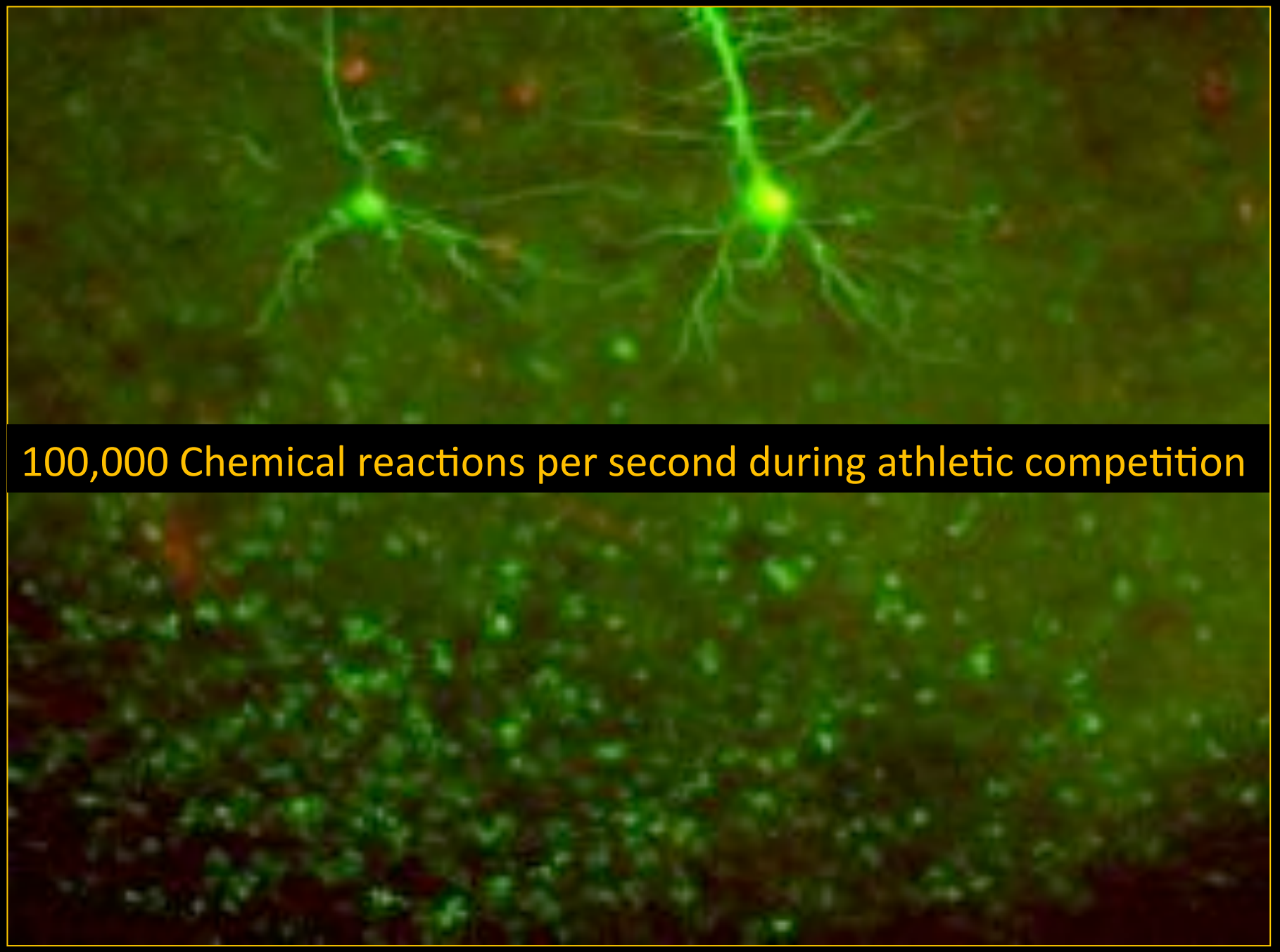
#1

The single biggest factor in optimal performance

CNS READINESS

The brain processes 400 billion points of data every second.

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

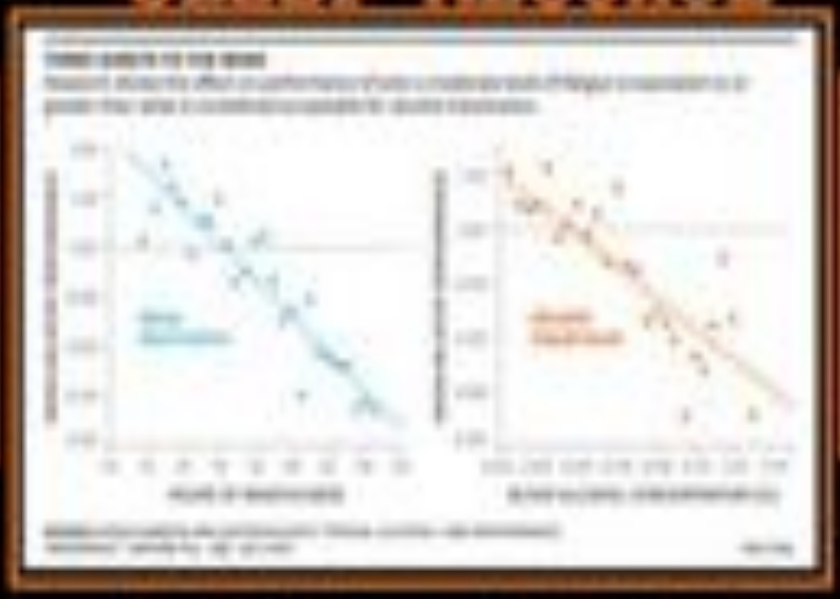
SOCIAL DRUGS

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


HighSchool
TODAY
New Mexico's
'Life of an Athlete'
Legal Issues
Athletic Facilities
Sports Medicine
Lifestyle
Strikes
Back
Sleep
Now Clearly a Predictor
of Performance
coaches
PLAN
the coach
THE
PARTY
is OVER
AWARENESS

Life of an Athlete
Human Performance Project

SLEEP ALCOHOL

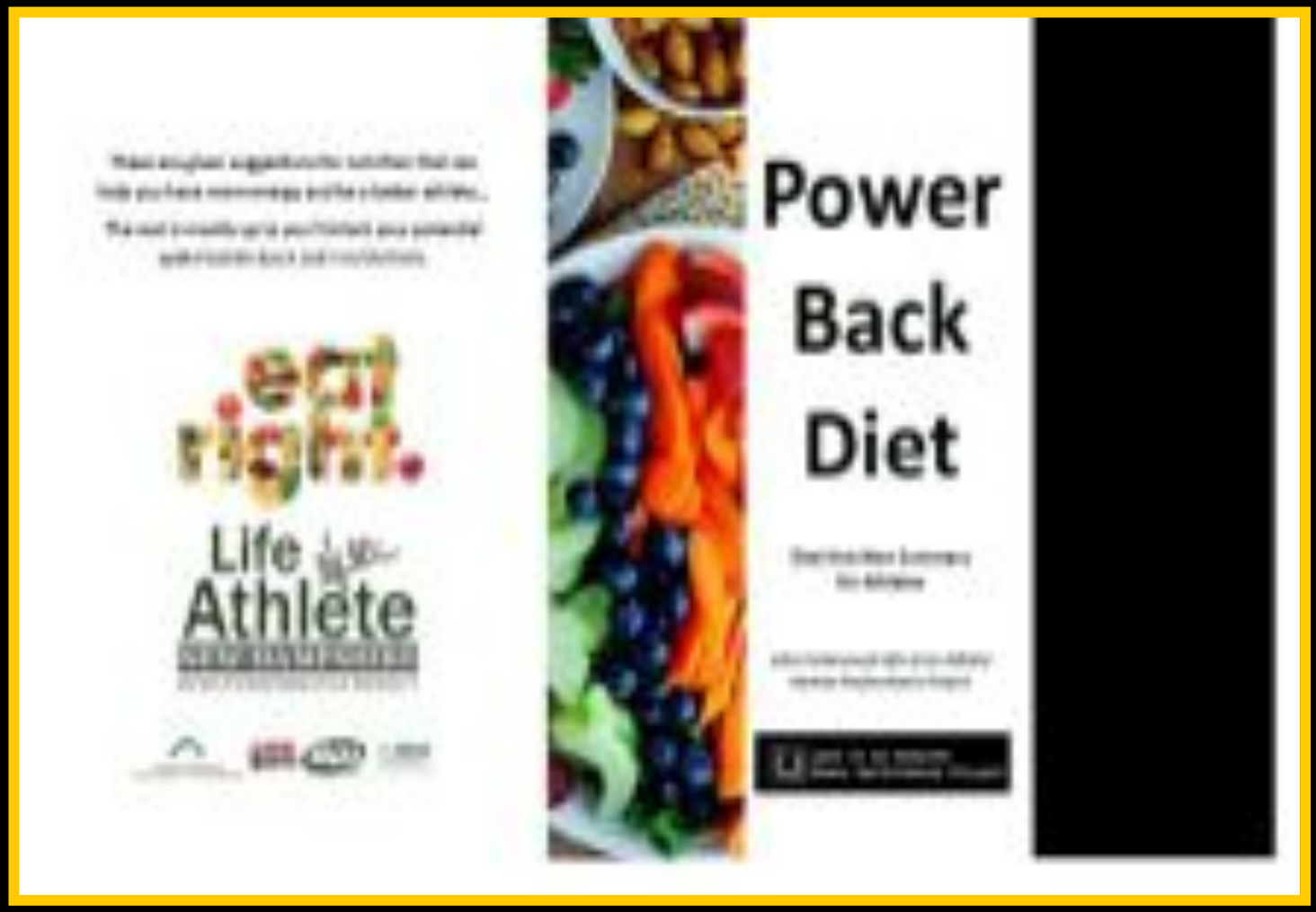


Lack of sleep and decreased performance

Alcohol impairment and decreased performance

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

Nutrition



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

FOOD CHOICE DETERMINES ENERGY LEVELS

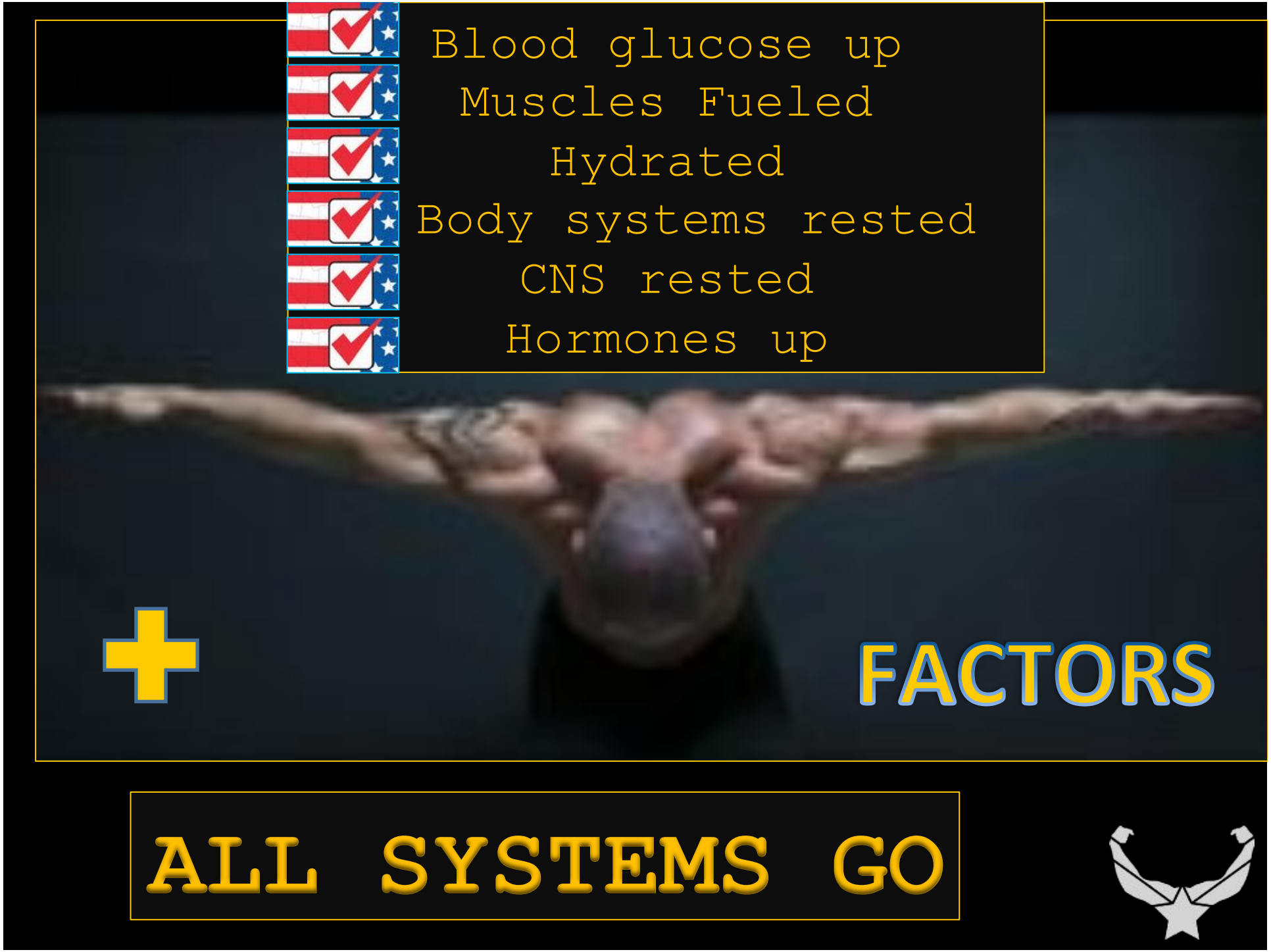
SOCIAL ISSUES 2013

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	70%
HOUR 8	20%
HOUR 24	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 .

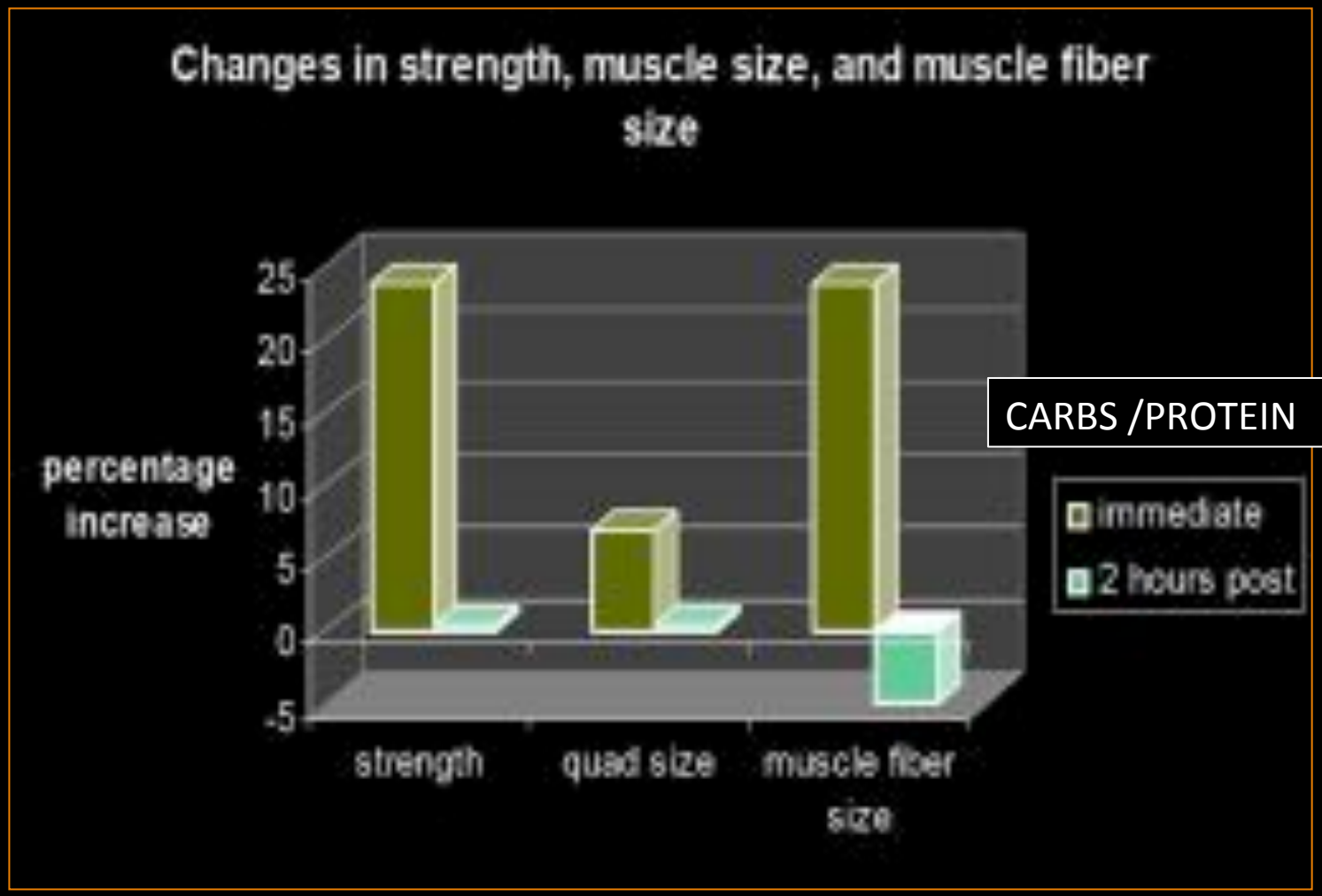
This is because all the nutrient transport and storage mechanisms become switched on thus increasing the body's absorption rates. The nutrients that are required are glucose (from Carbohydrate) and amino acids (from Proteins).

THE QUICKER THE BETTER

PROTEIN

Protein blunts negative effects
Accelerates positive factors in muscle

Fast Protein Critical



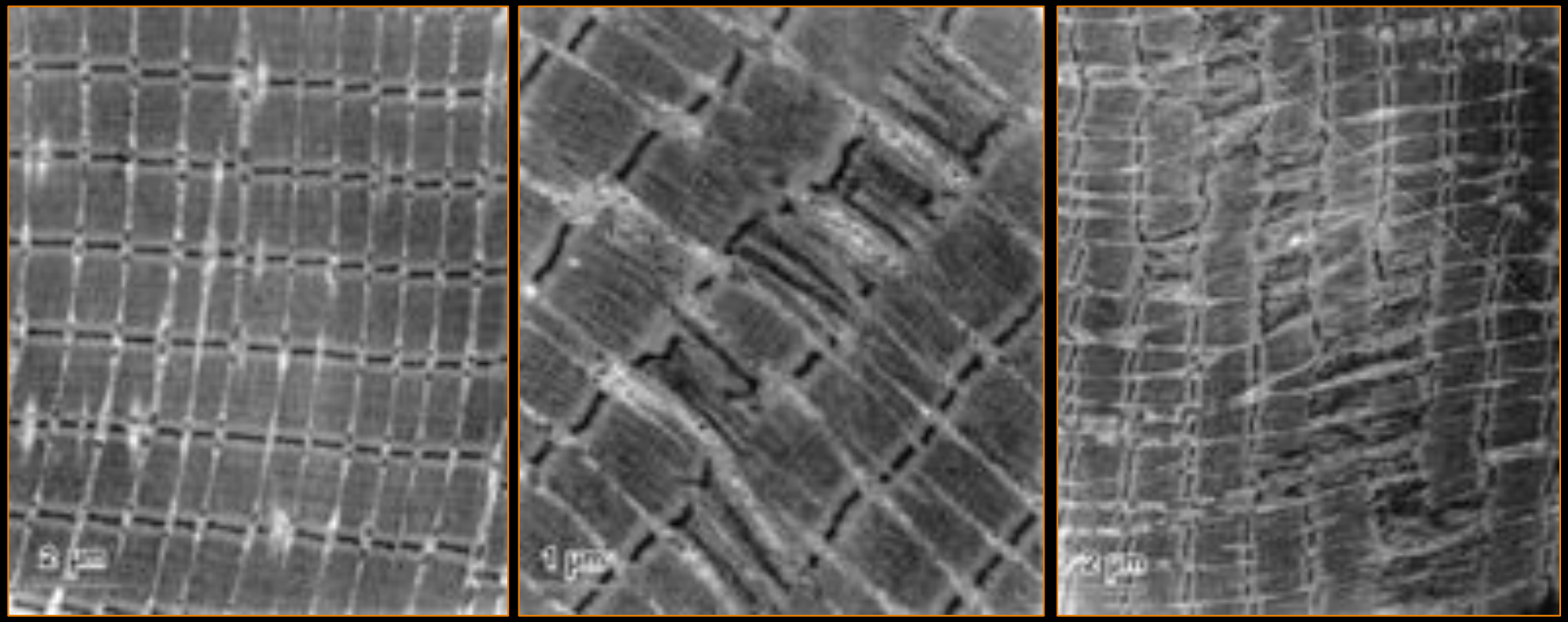
CARBS /PROTEIN

Don’t Wait

There is muscle damage from any kind of physical activity

The higher the intensity the greater the damage

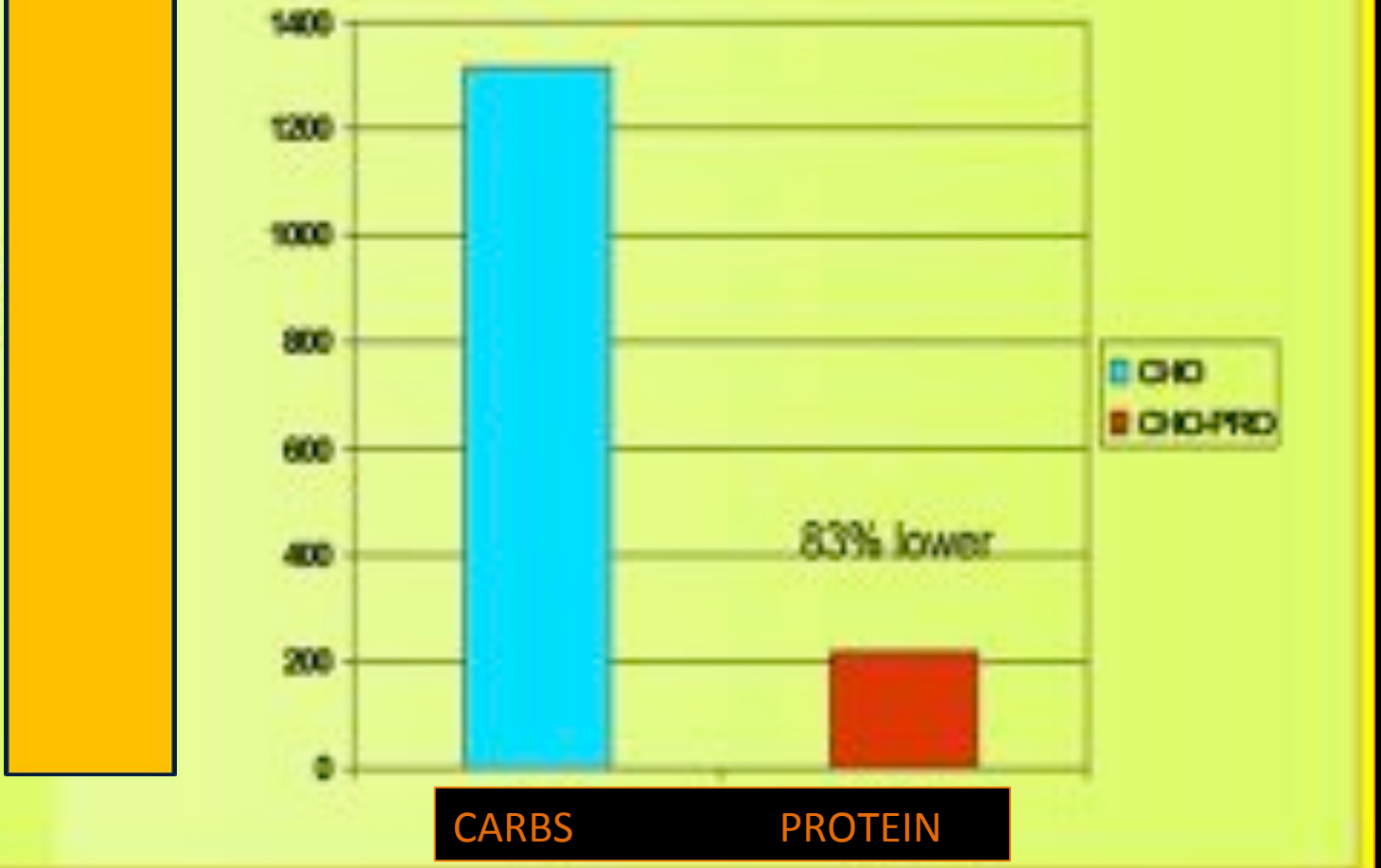
MUSCLE DAMAGE



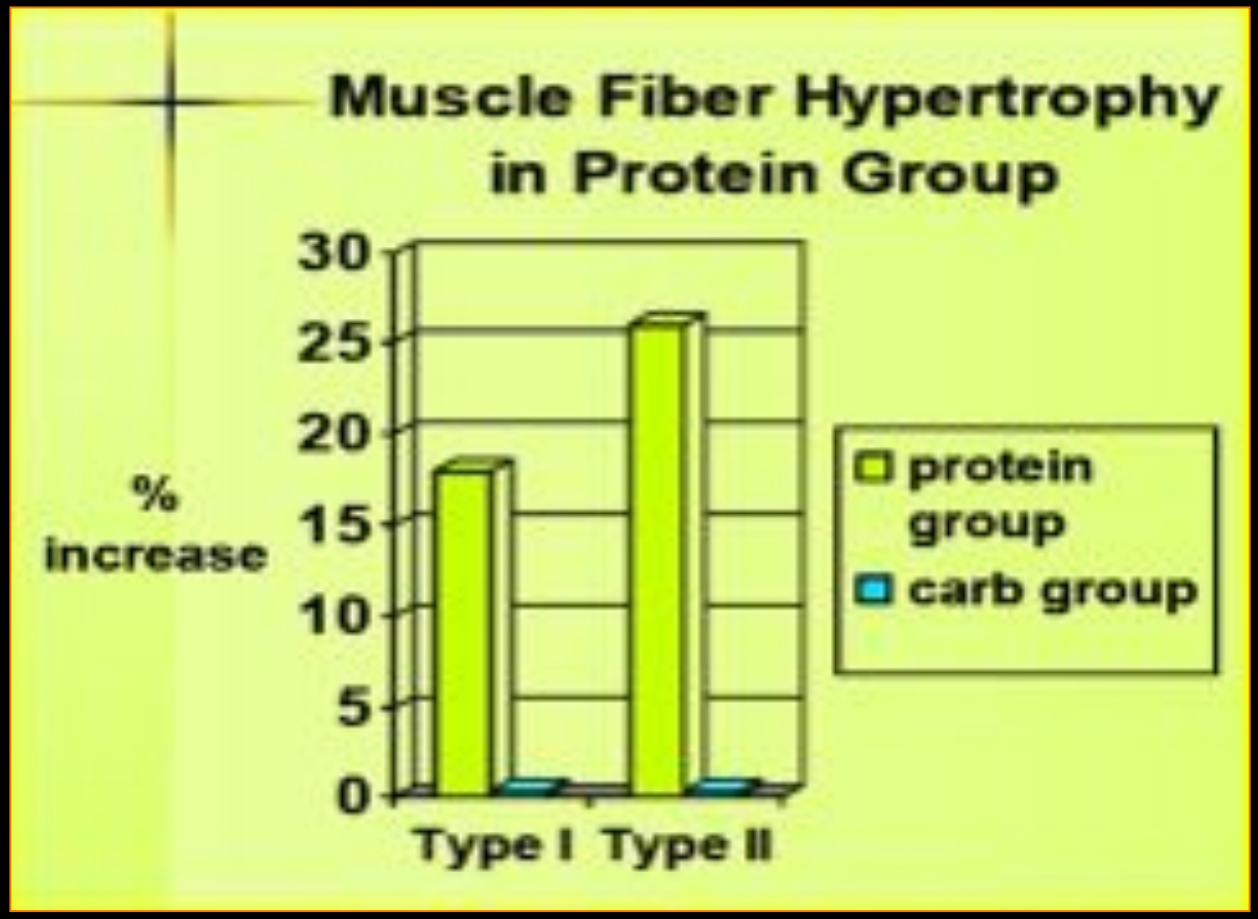
NORMAL MODERATE EXTREME

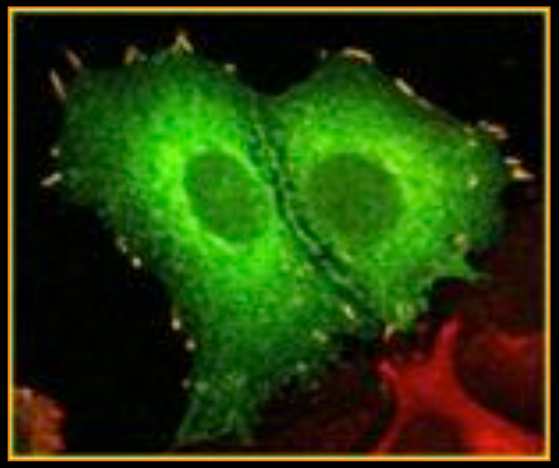
Muscle Damage

CARBS AND PROTEIN AFFECT ON MUSCLE DAMAGE



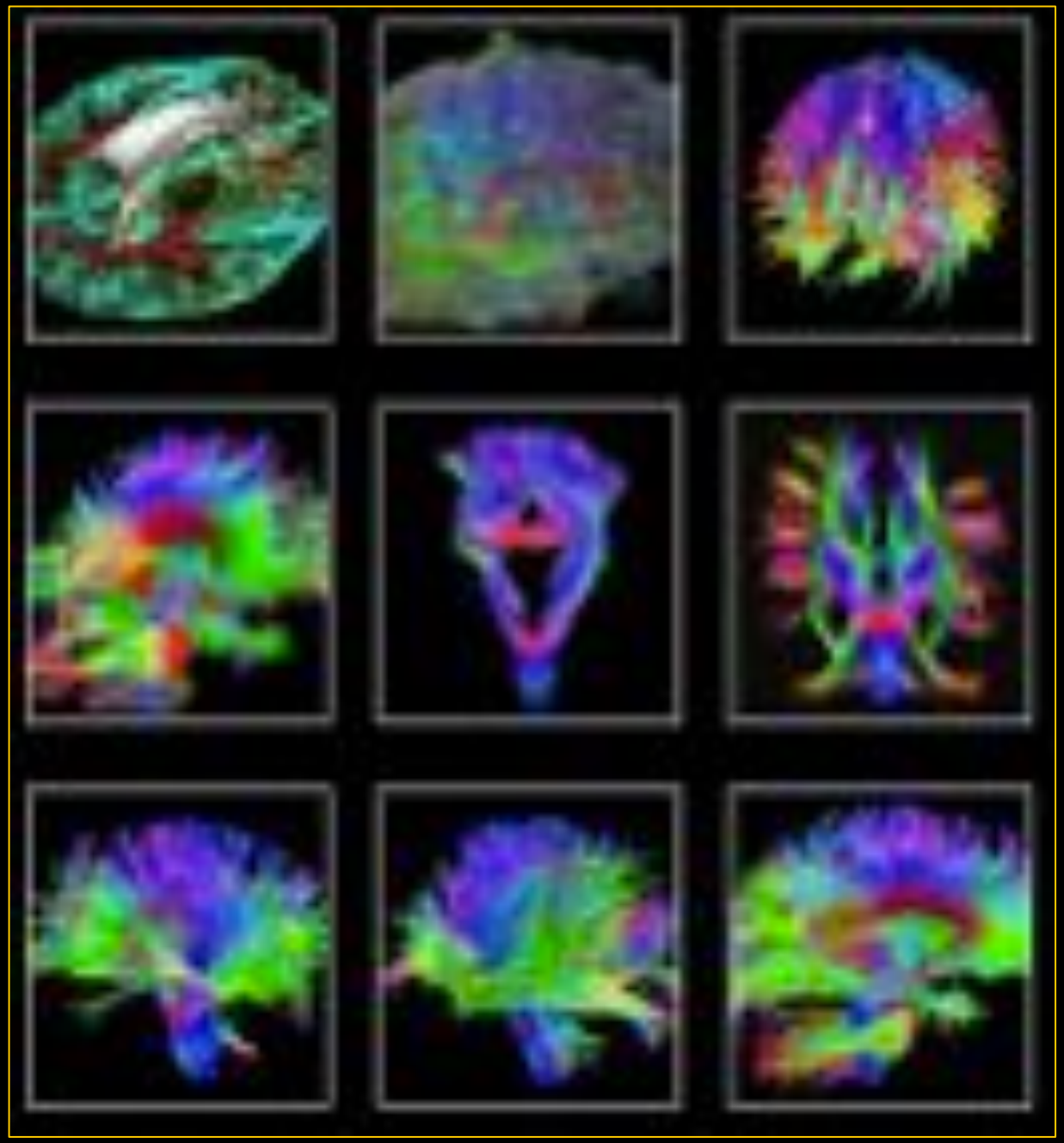
How sore do you want to be?

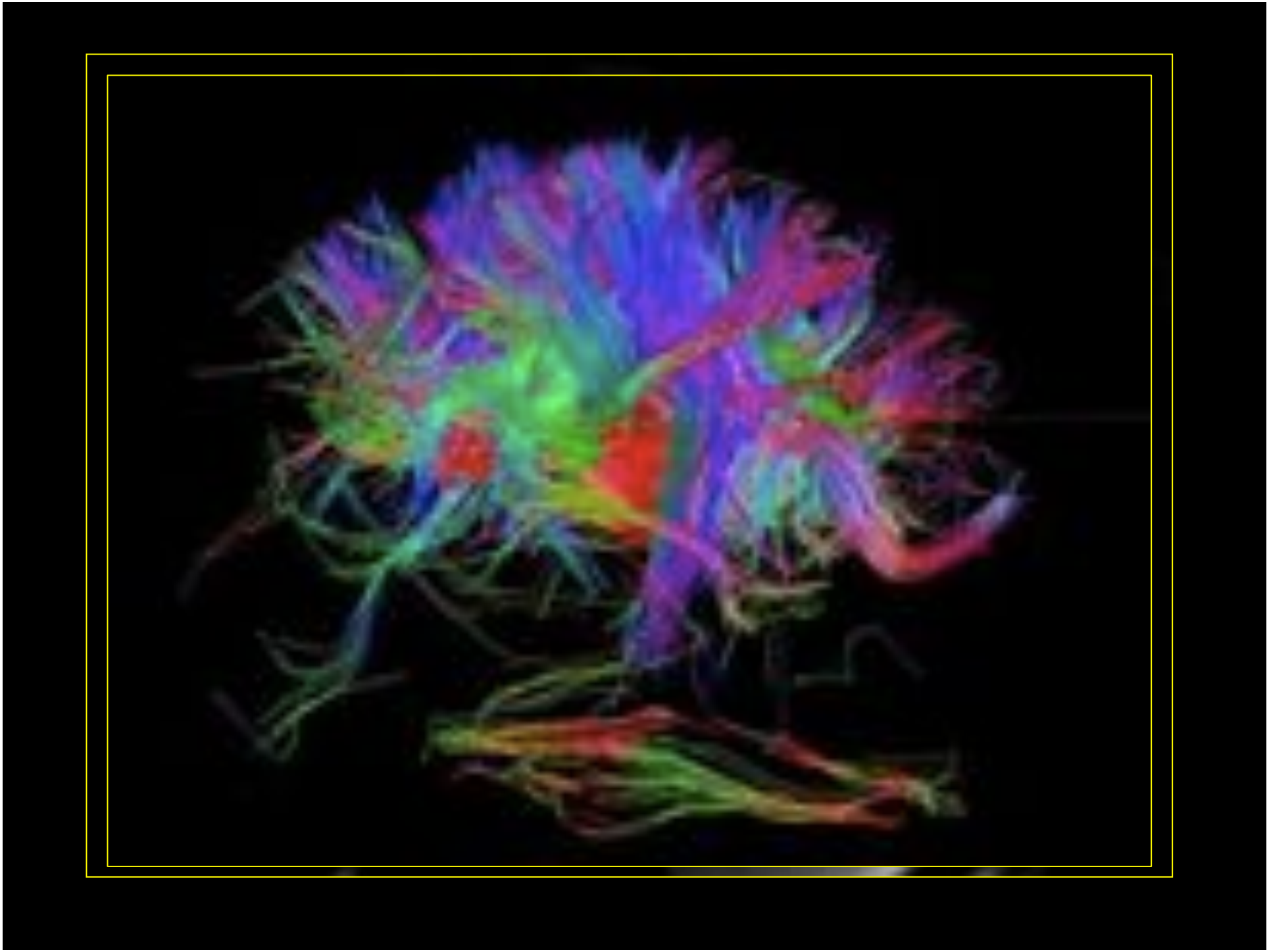


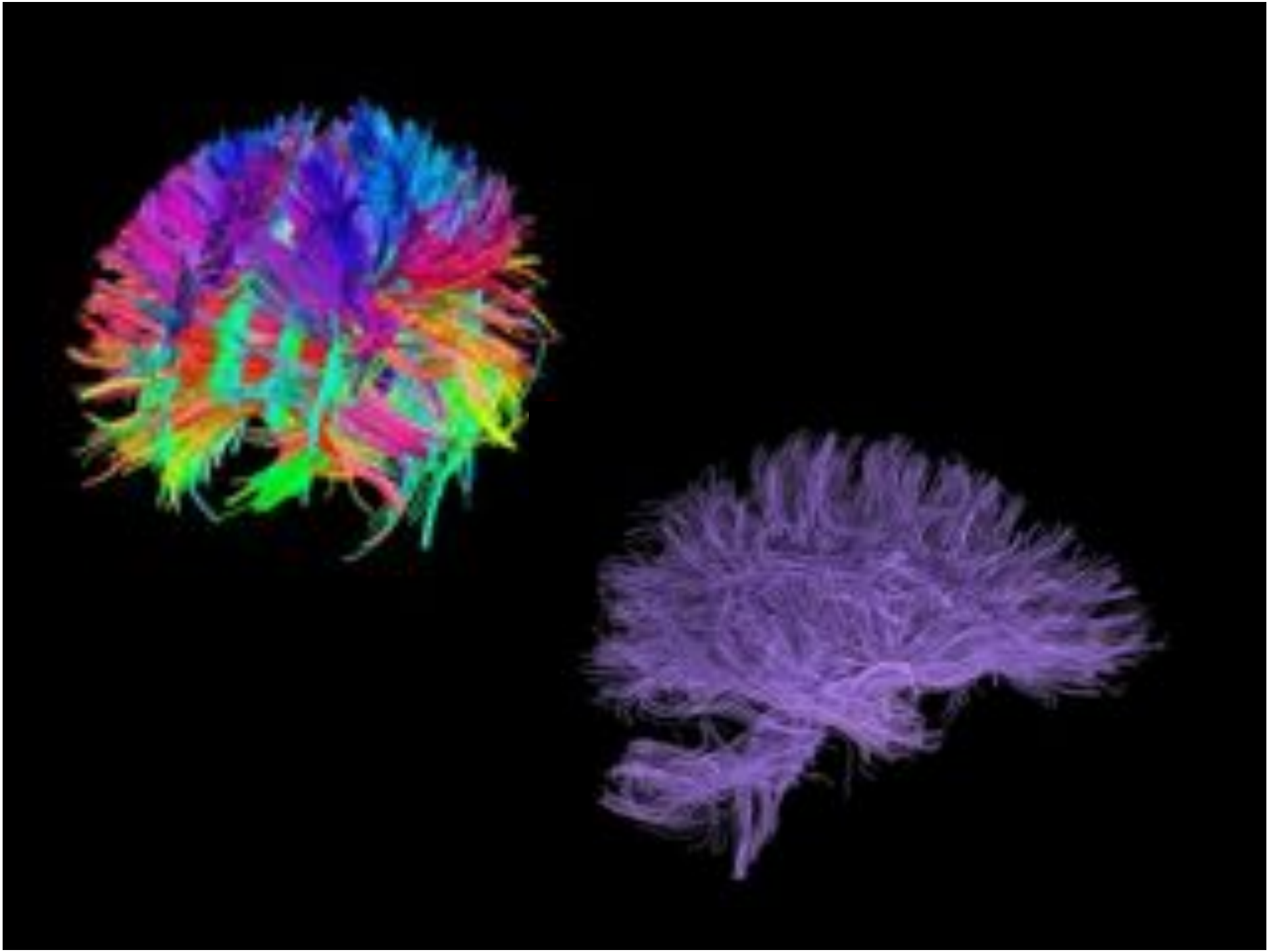


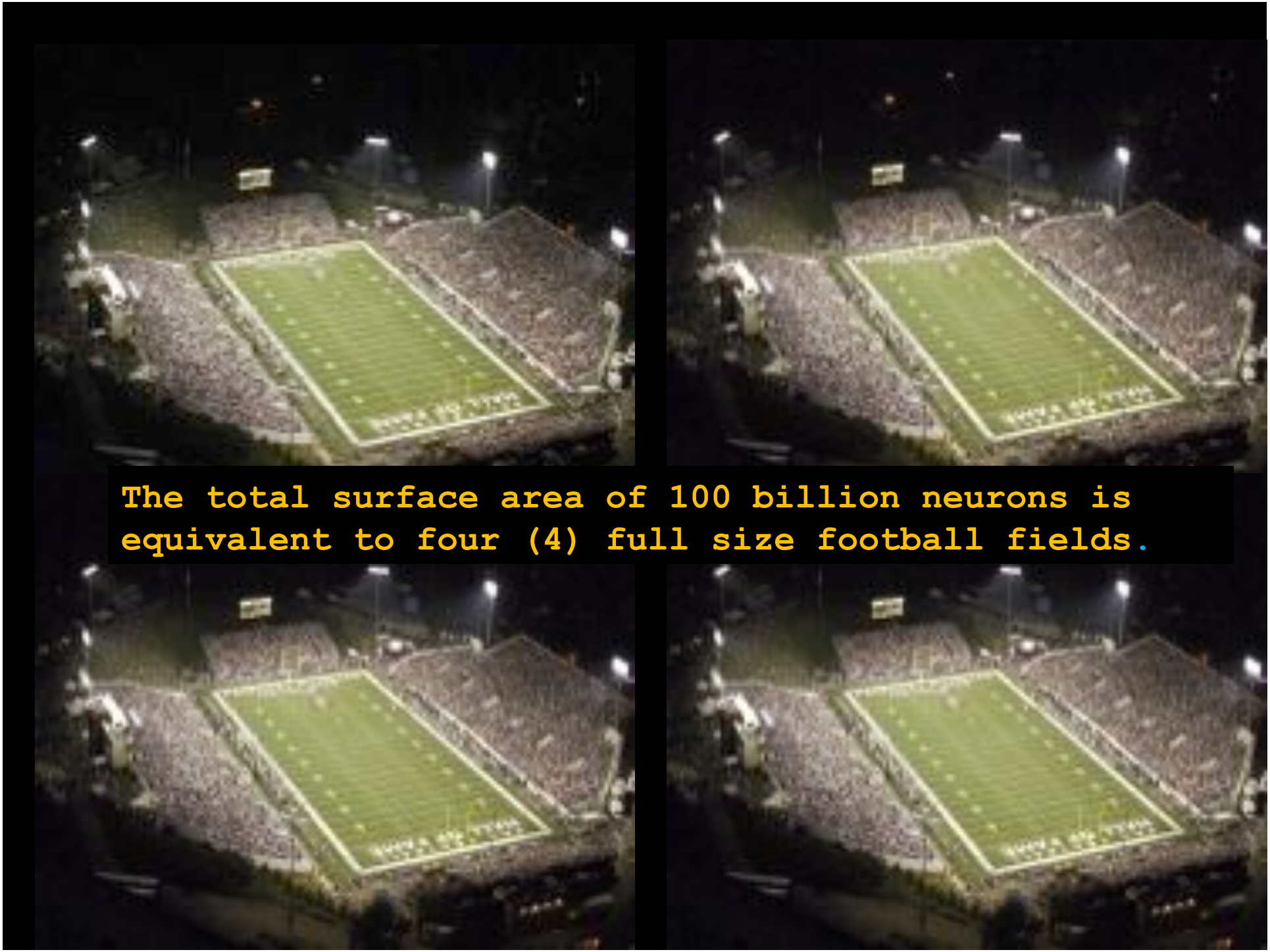
NEW MASS

Muscle Protein Synthesis

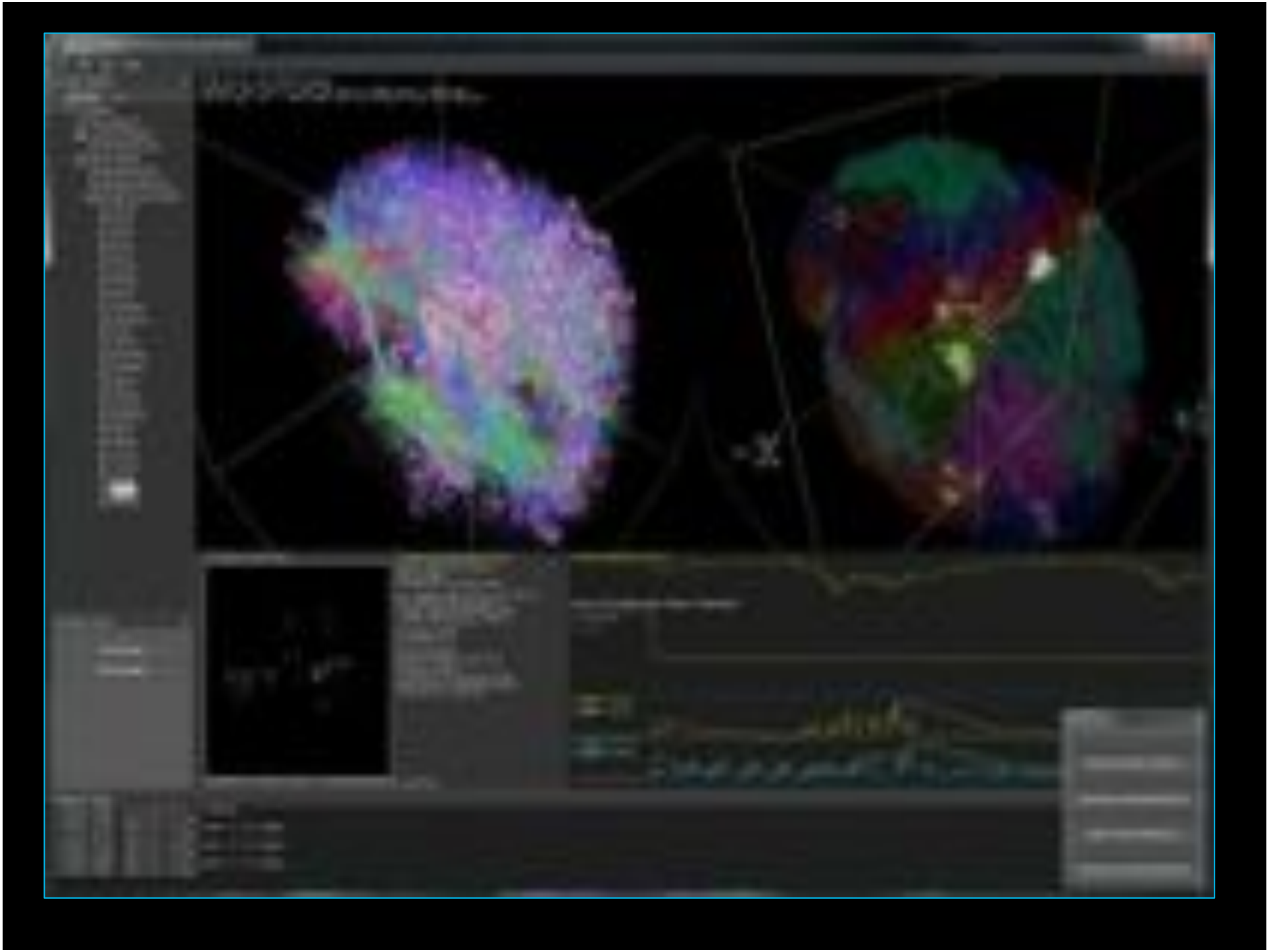


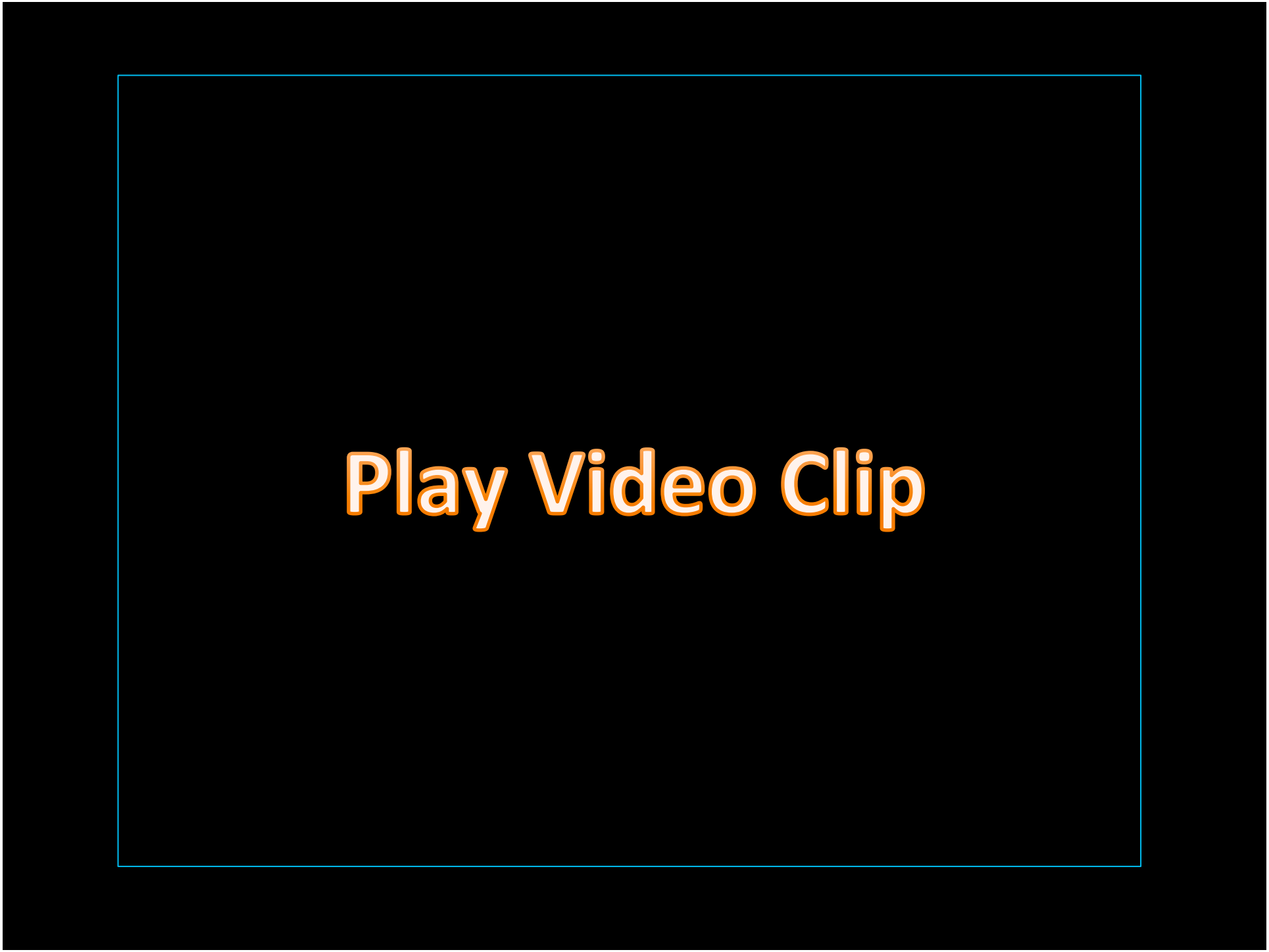






The total surface area of 100 billion neurons is equivalent to four (4) full size football fields.

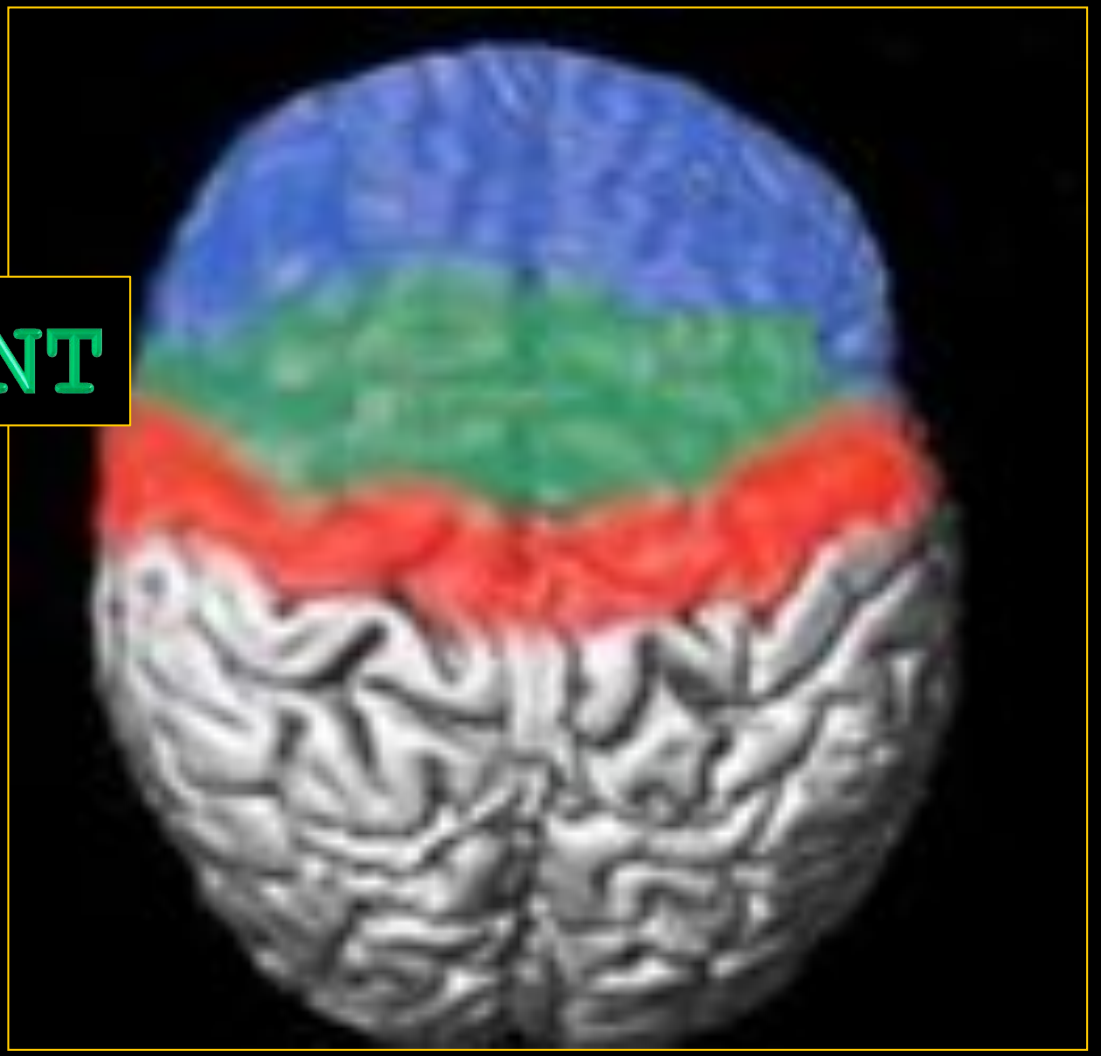



Play Video Clip

THINKING

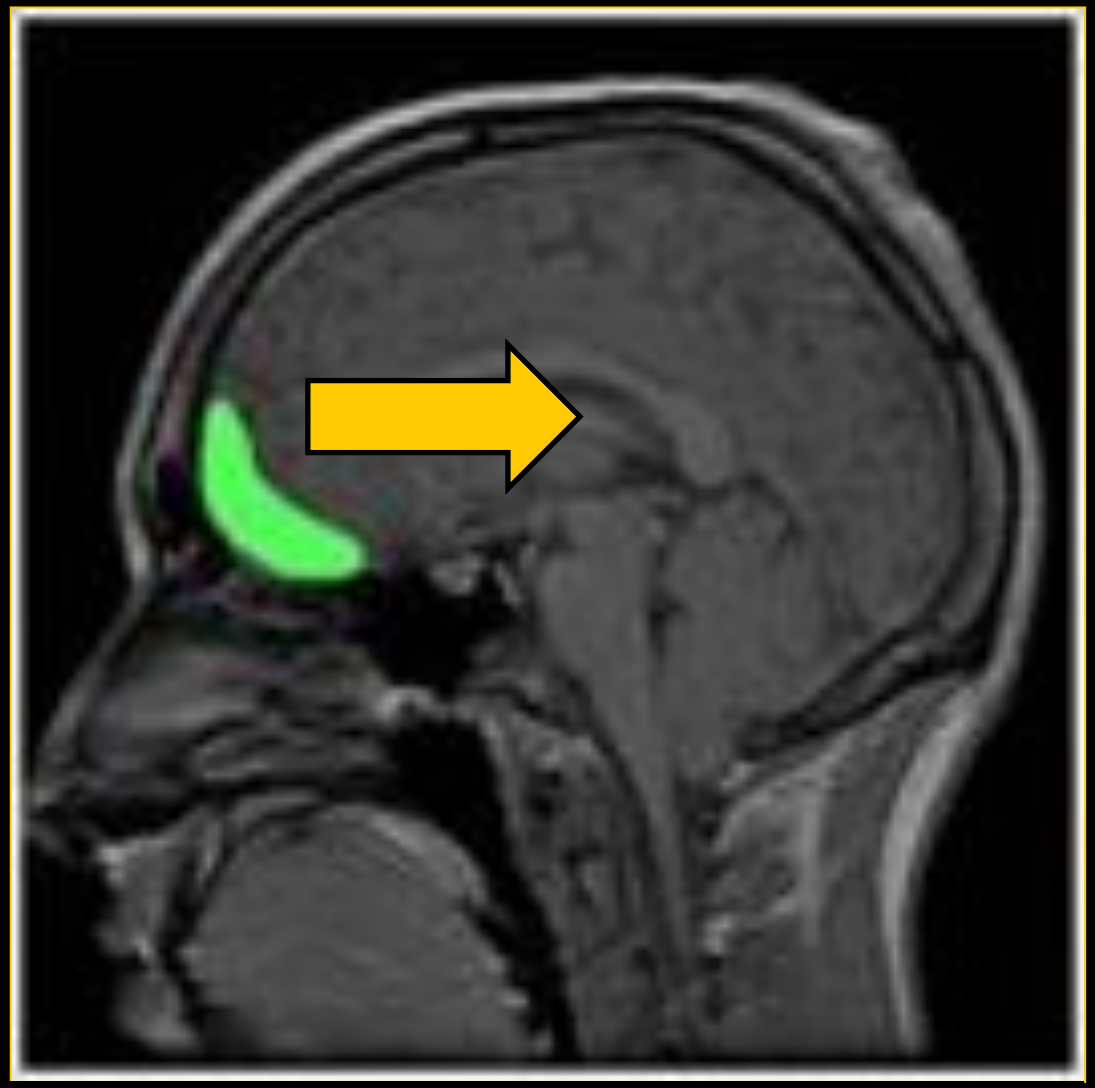
PRE-MOVEMENT

MOVEMENT

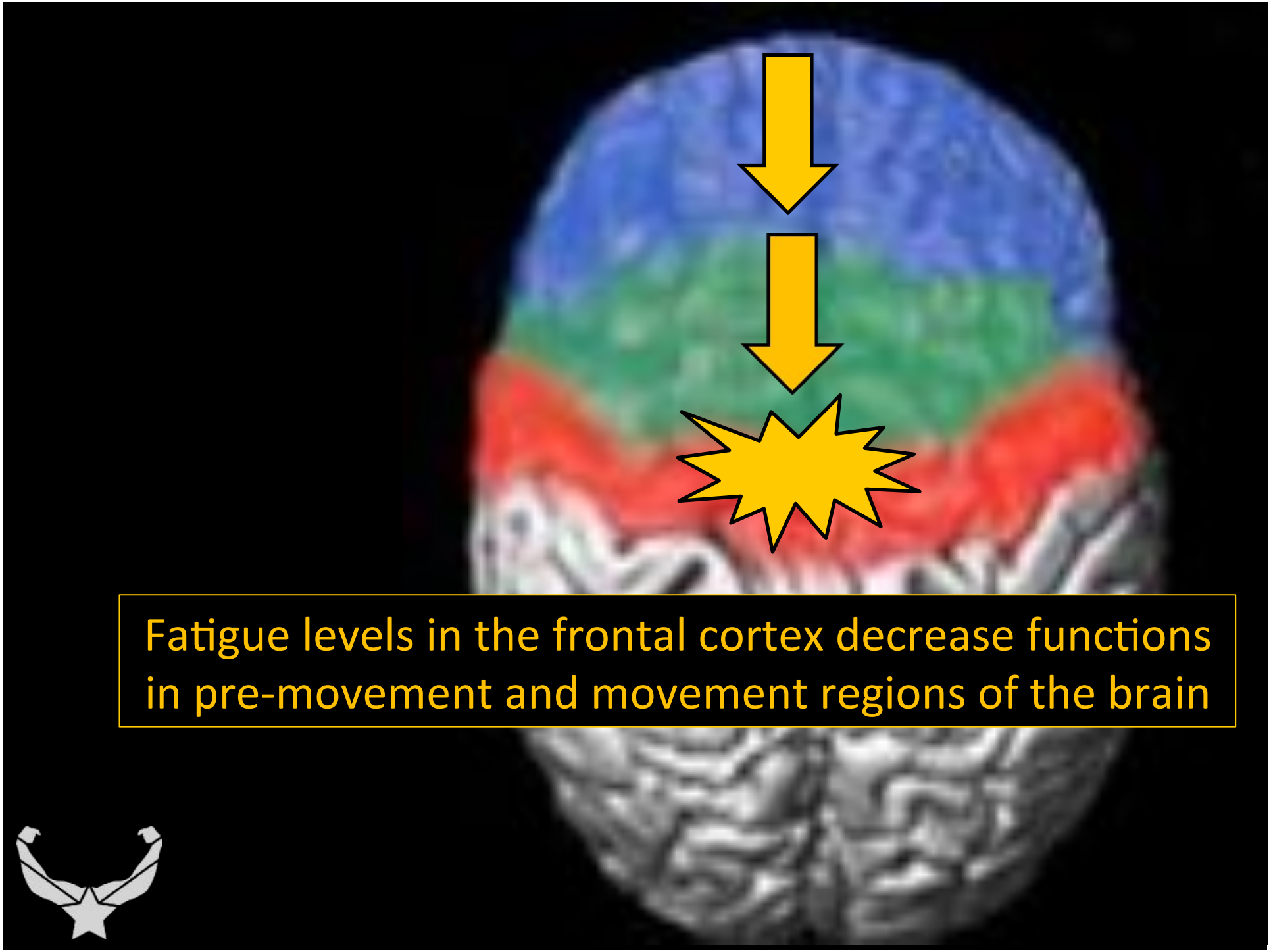


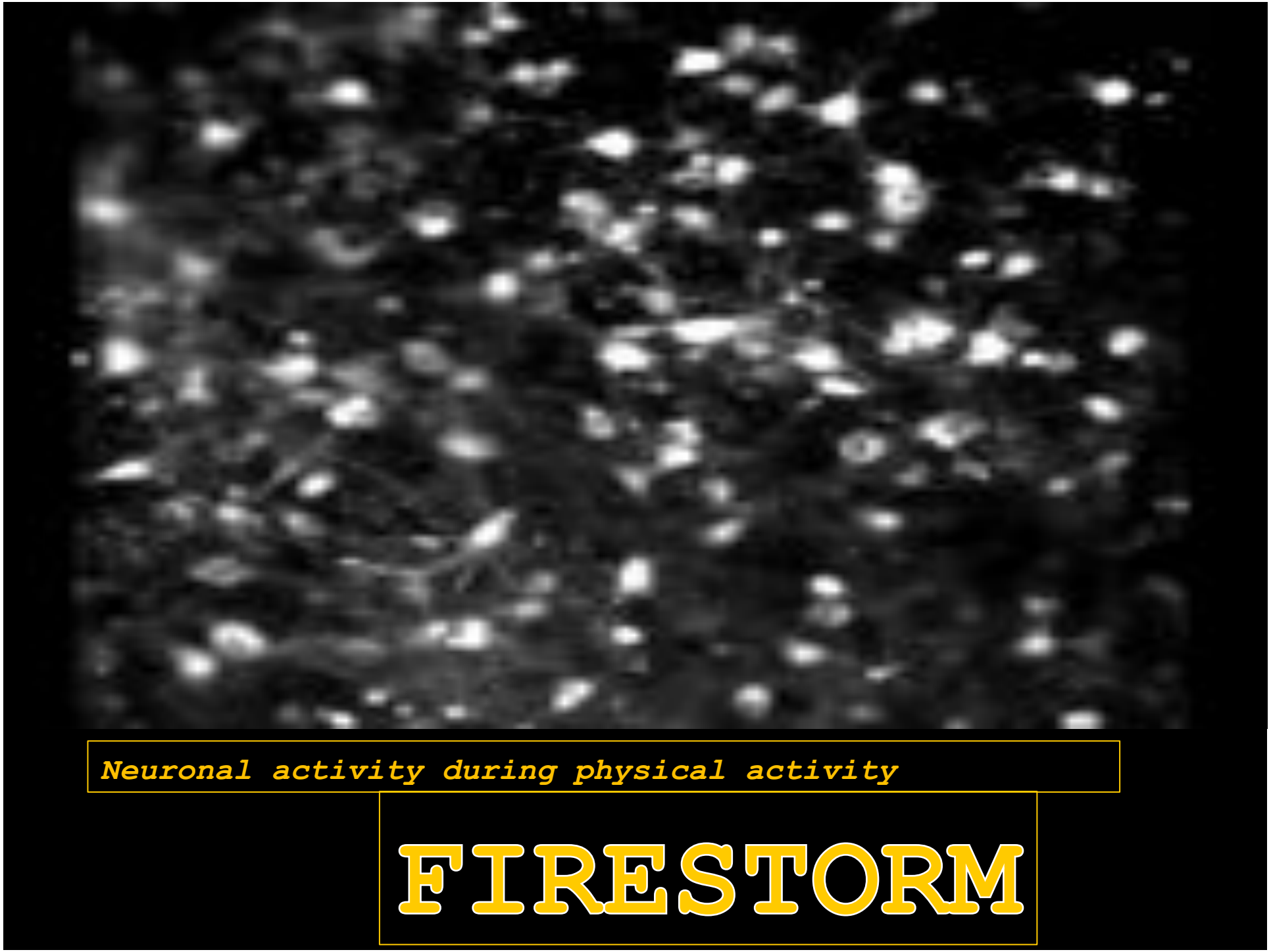
Brain and Movement

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!

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

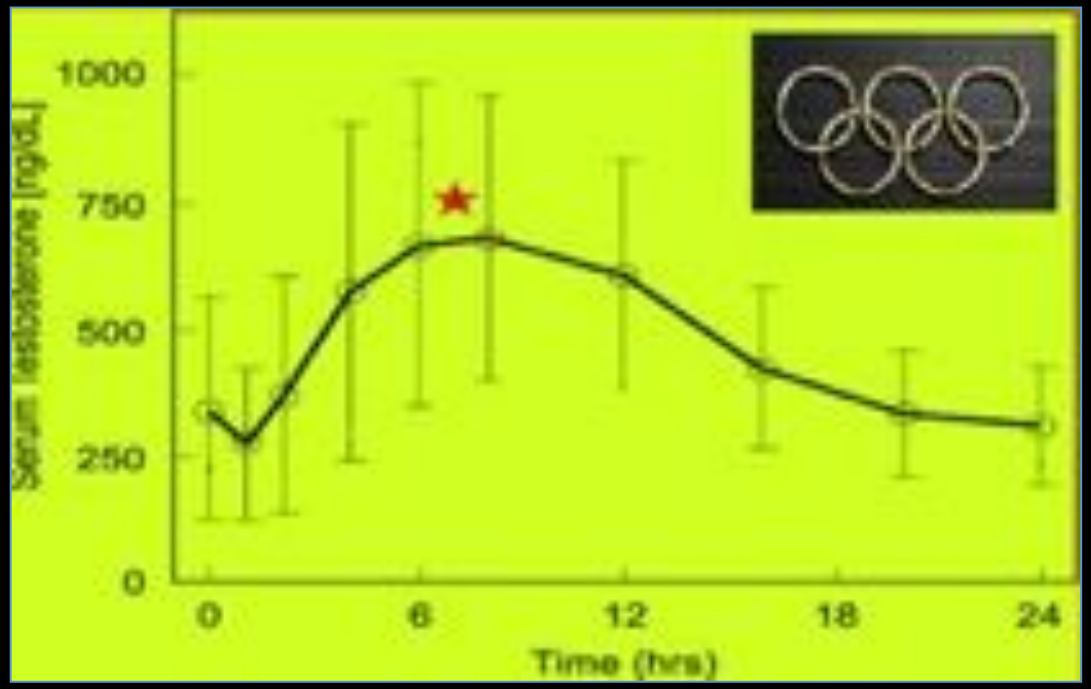
Everyone gets 24 hours . . .
its how you use them that matters

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…

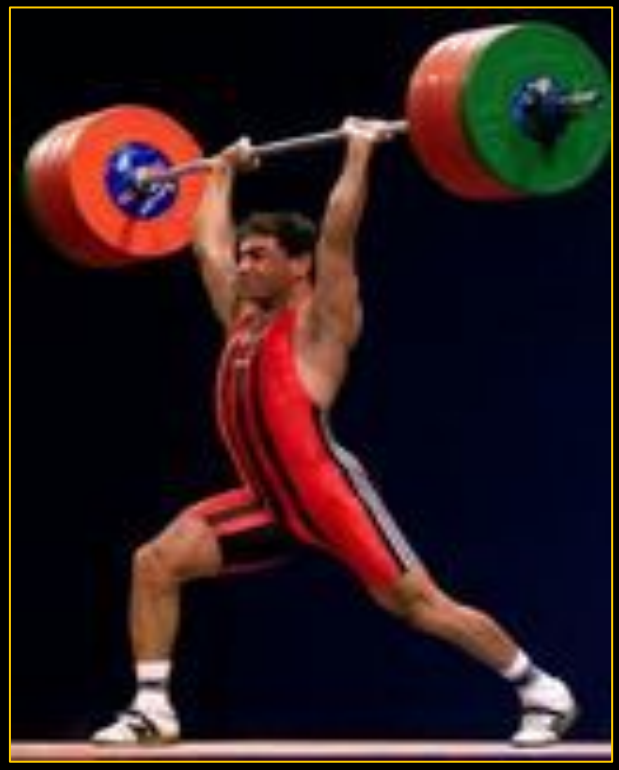
Fatigued
Forget it

OPTIMAL?

Morning training is only effective when athletes are rested…

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

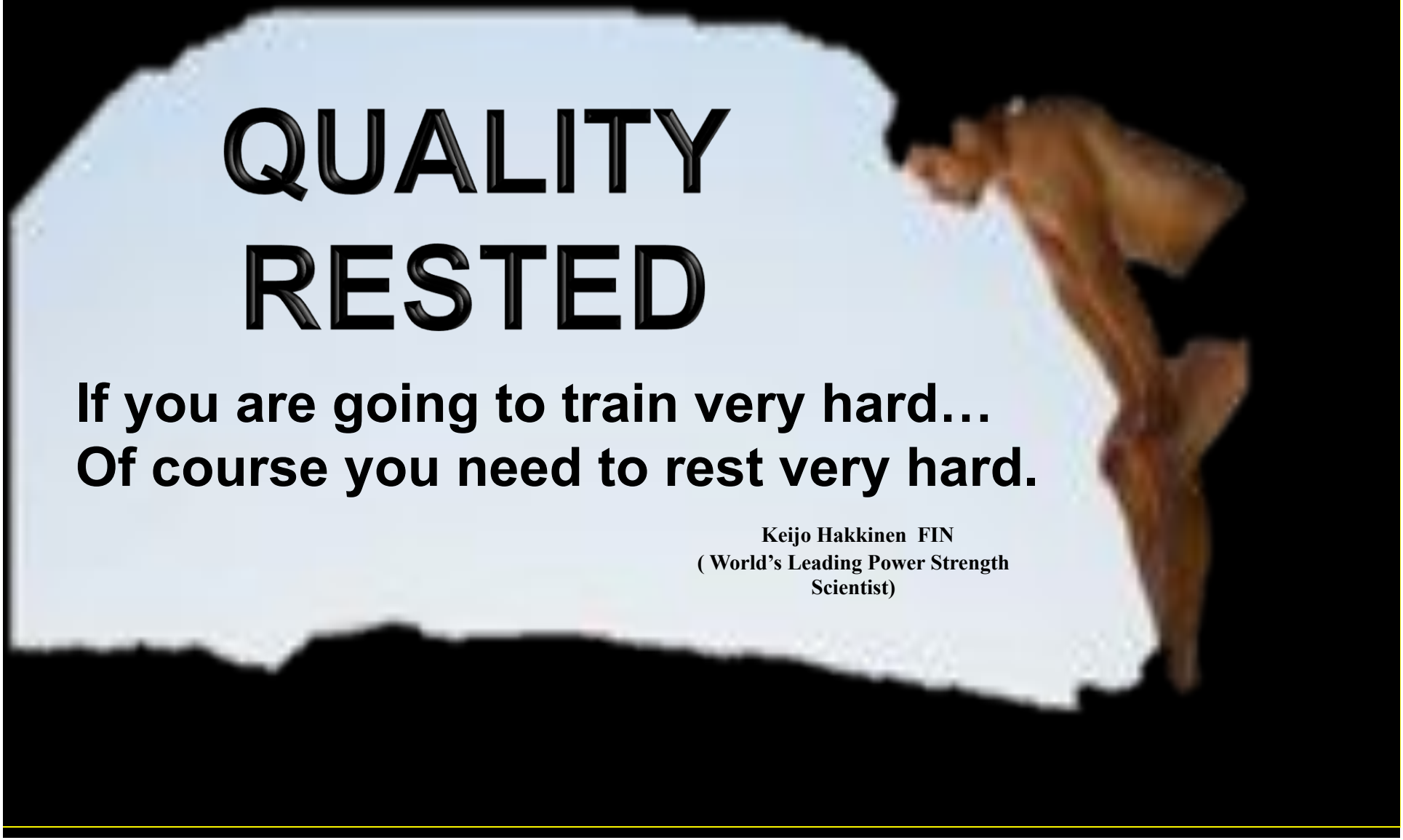

HORMONE RELEASE
HEARTRATE
EFFICIENCY
MUSCLE FUNCTION
Neural Fatigue (NF) is defined as an involuntary reduction in voluntary activation.



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.



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


KENYA
KENYA


AP

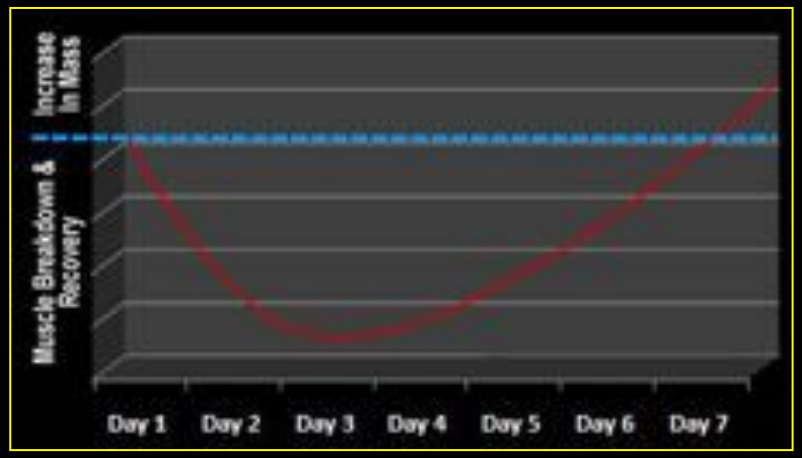

1572
1565
566
5

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.

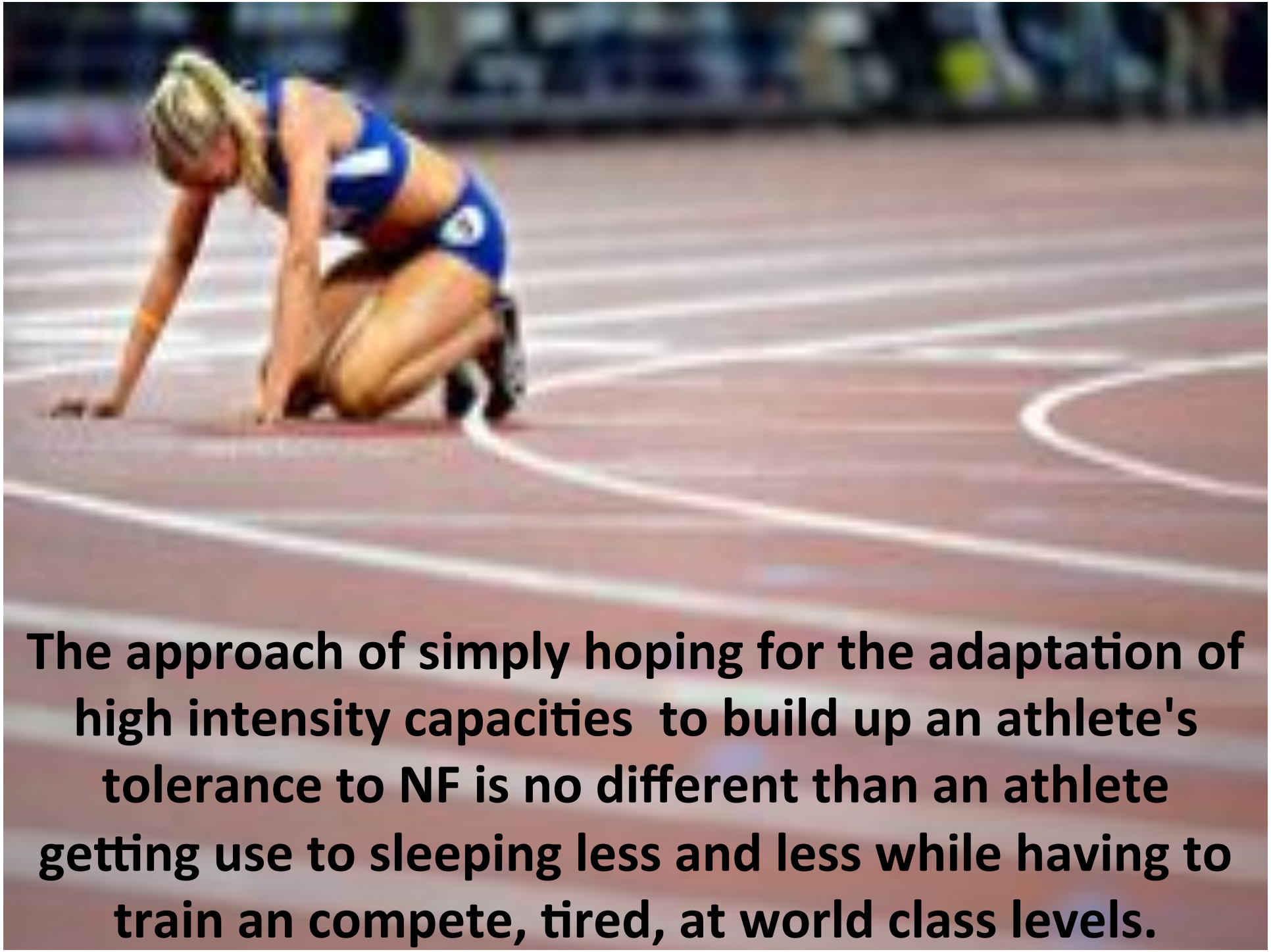
Scientific recommendations have centered in recent years on recovery methods (reactive) and minimizing training damage (reactive)

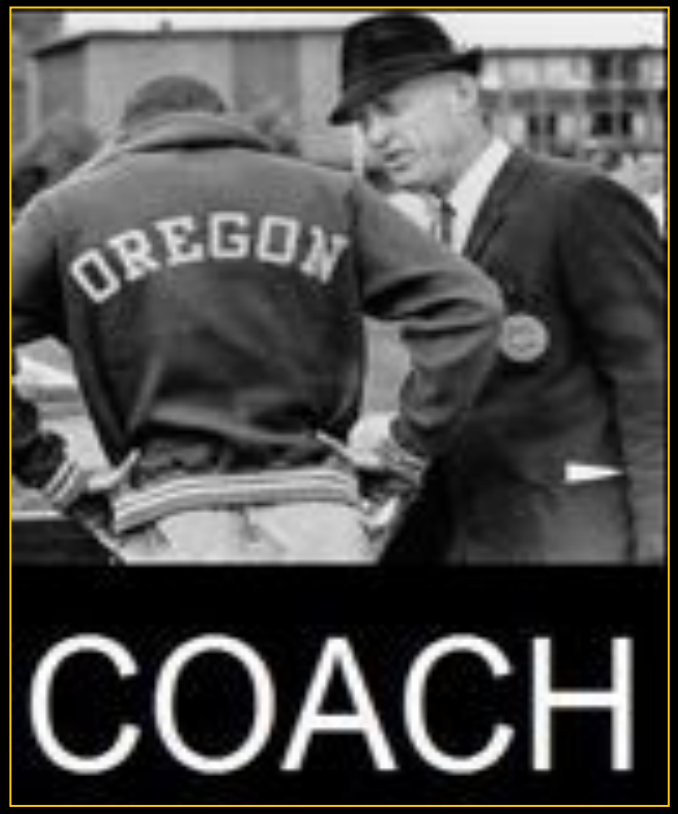
RECOVERY
MINIMIZE DAMAGE



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

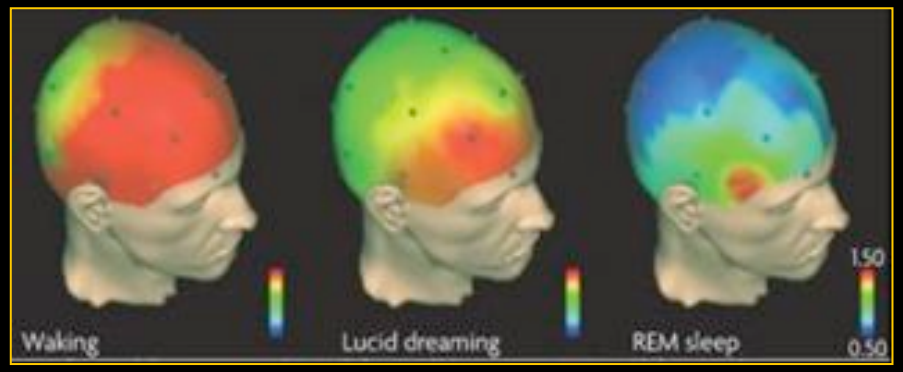
PROACTIVE CONSIDERATIONS


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 an compete, tired, at world class levels.



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?

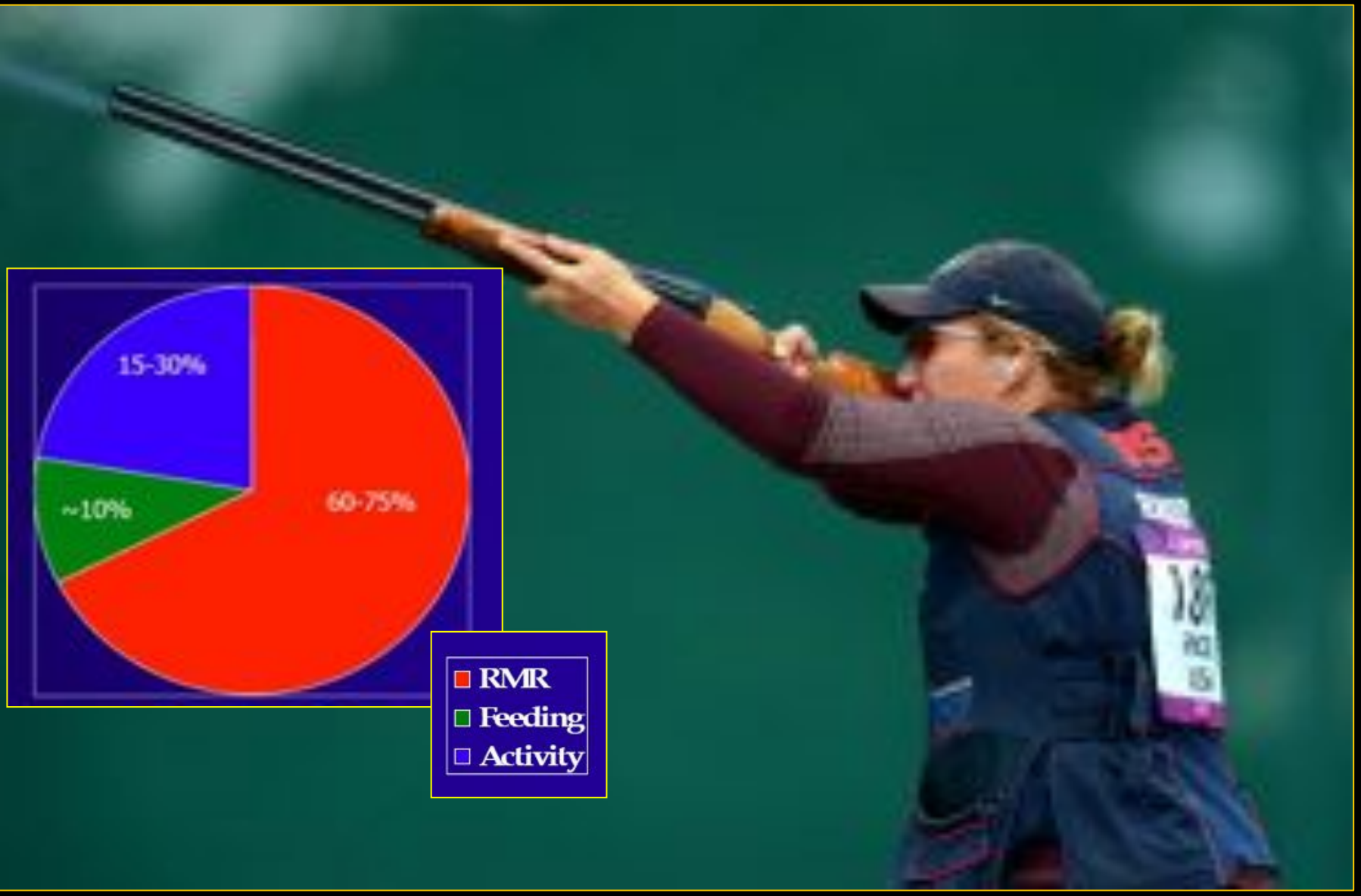
PHYSICAL
PSYCHO-SOCIAL
EMOTIONAL
CNS

ATHLETE STRESS

Many athletes create stress!

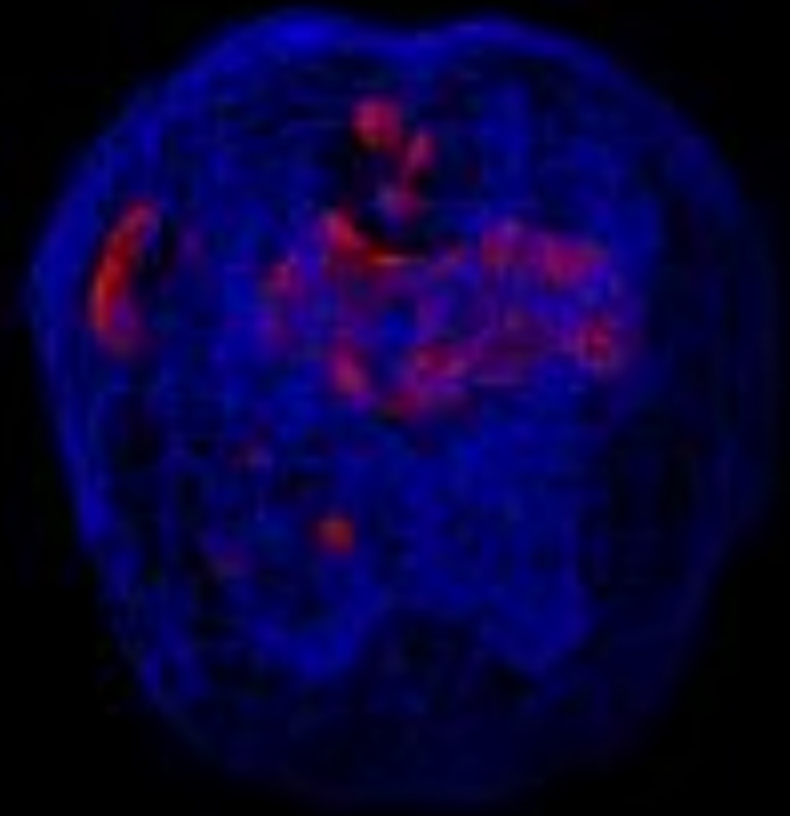
Just from a hormonal standpoint testosterone and cortisol indicate that stress destroys much of the training stimulus and recovery that results in adaptation…

Daily activity yields stress!

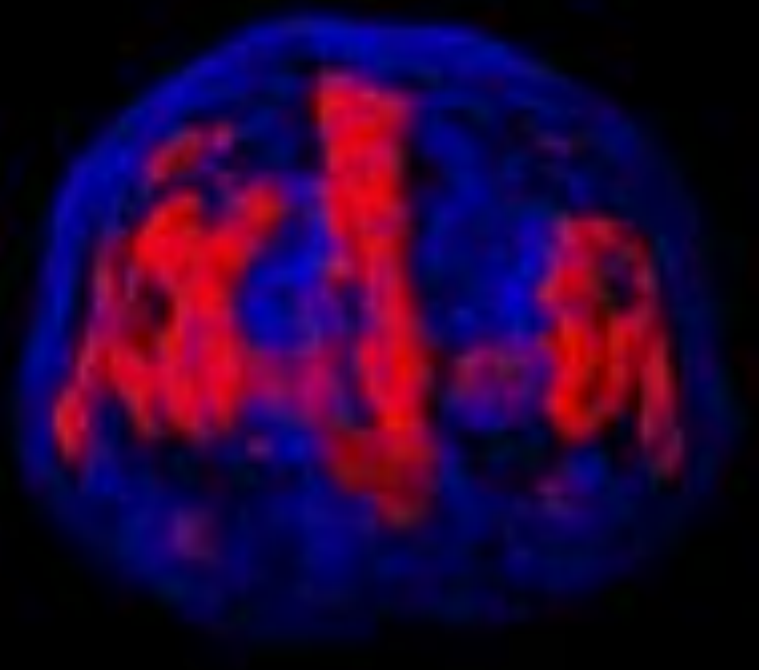


% TOTAL ENERGY EXPENDITURE

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!

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
AFFILOIATIONS
ACADEMICS

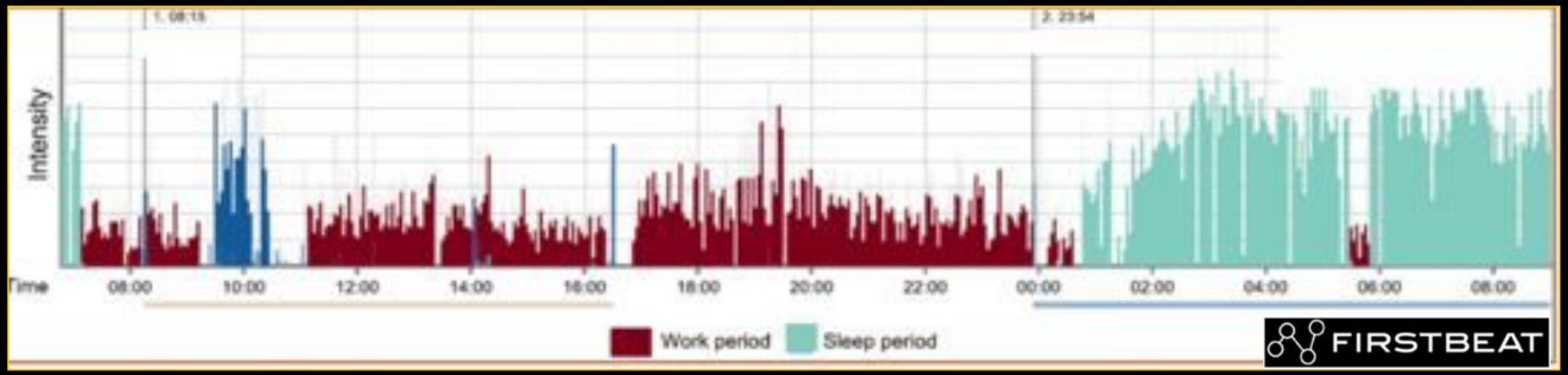
READINESS TO TRAIN/COMPETE

Poor recovery	**Moderate recovery**	**Good recovery**
Increased risk of overtraining	Easy training recommended	No risk of overtraining

2:1

AWAKE
STRESS

ASLEEP
RECOVER



16 HOURS 8 HOURS

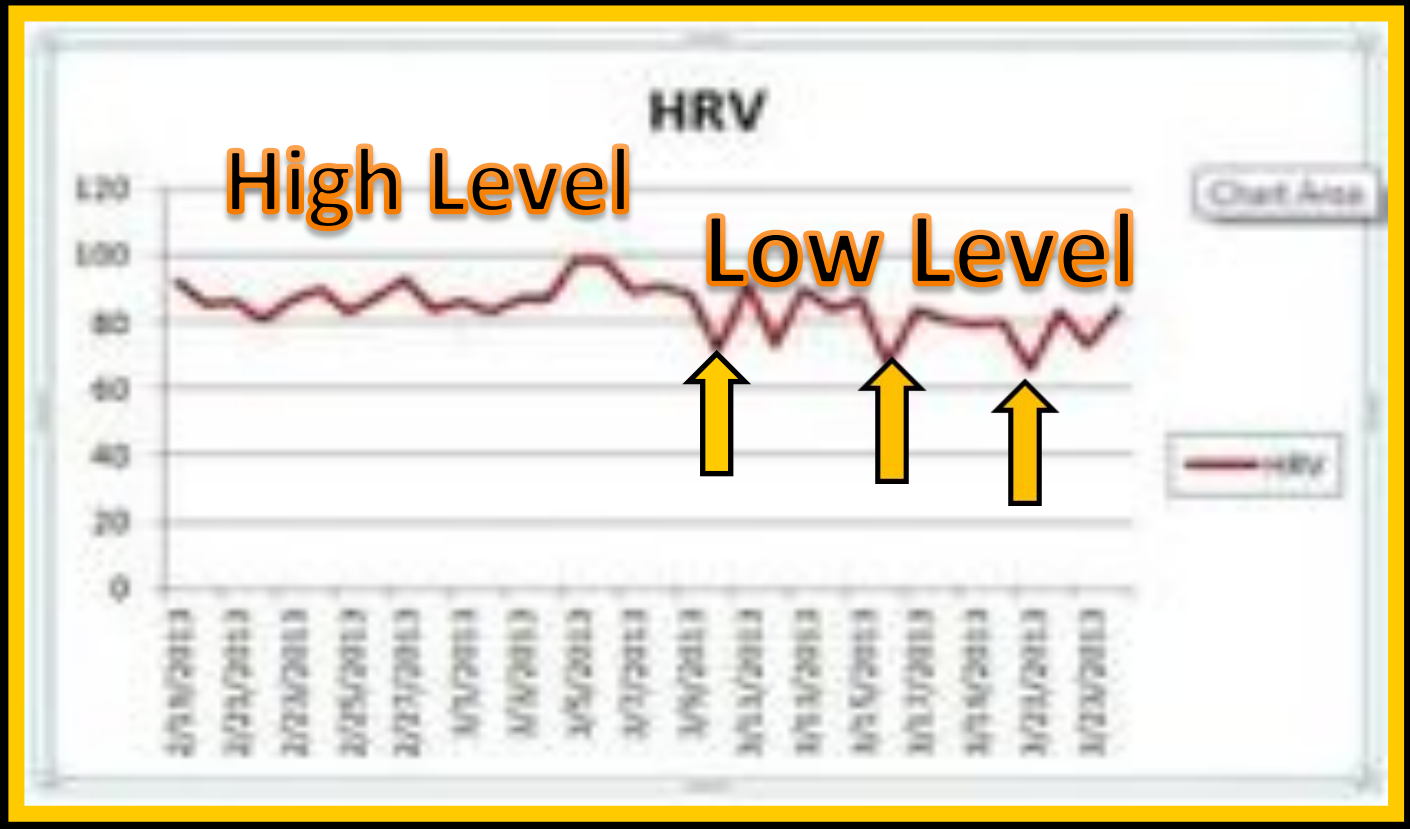
DAILY STRESS


omegawave™

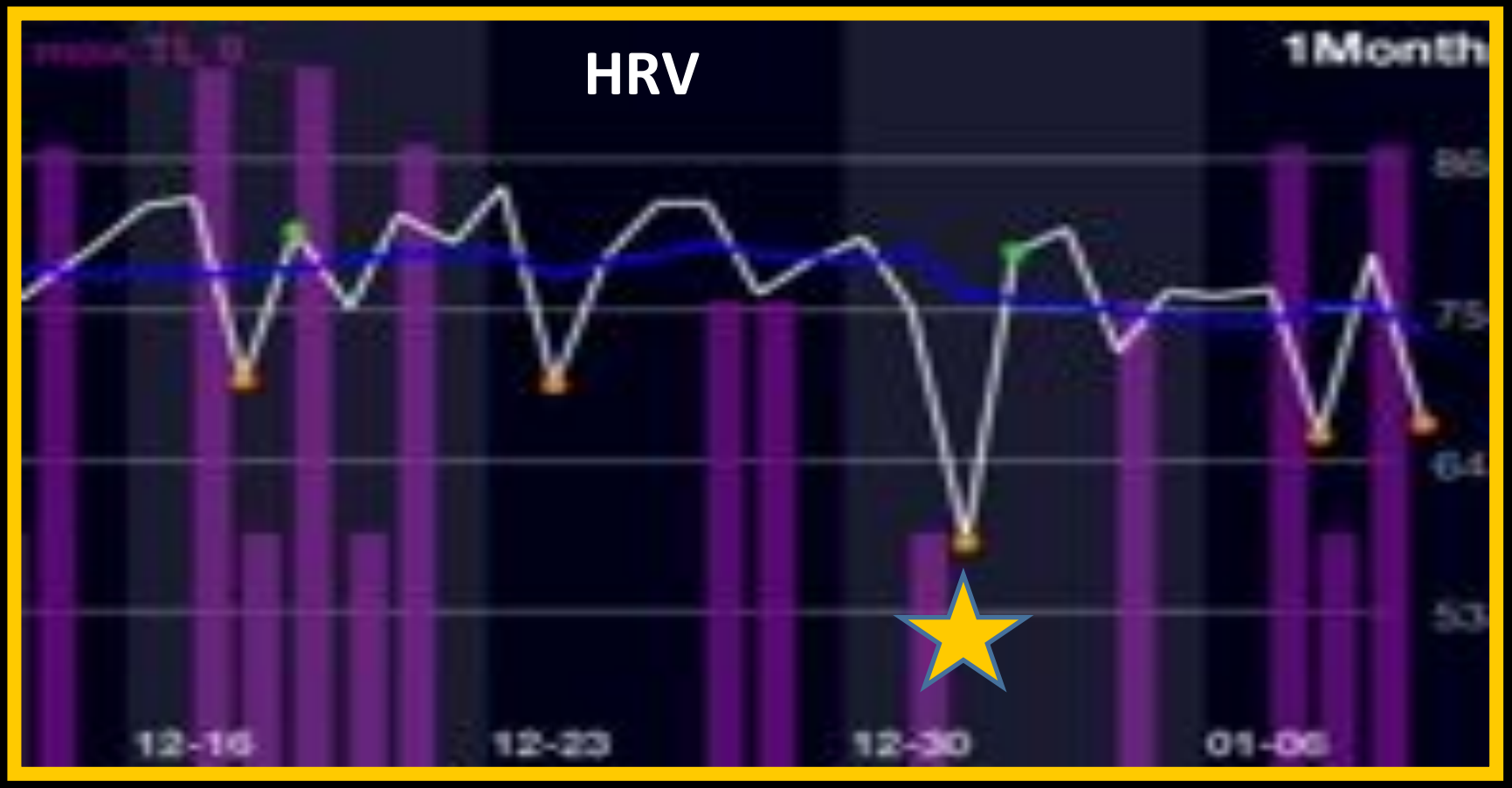
HEARTRATE VARIABILITY

Normal profile

Disturbances



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

SENSORY MOTOR


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

Reaction Timing Test

SLEEP

The Importance of SLEEP
in Mental and Physical Performance


Life of an Athlete
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 of an Athlete

Average sleep for most athletes

27% < 6 HOURS 17% 8 HOURS>

Life of an Athlete

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.

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
Muscle Restorative
Organ Restorative
CNS Restorative

Stanford Sleep Studies

Cheri Mah

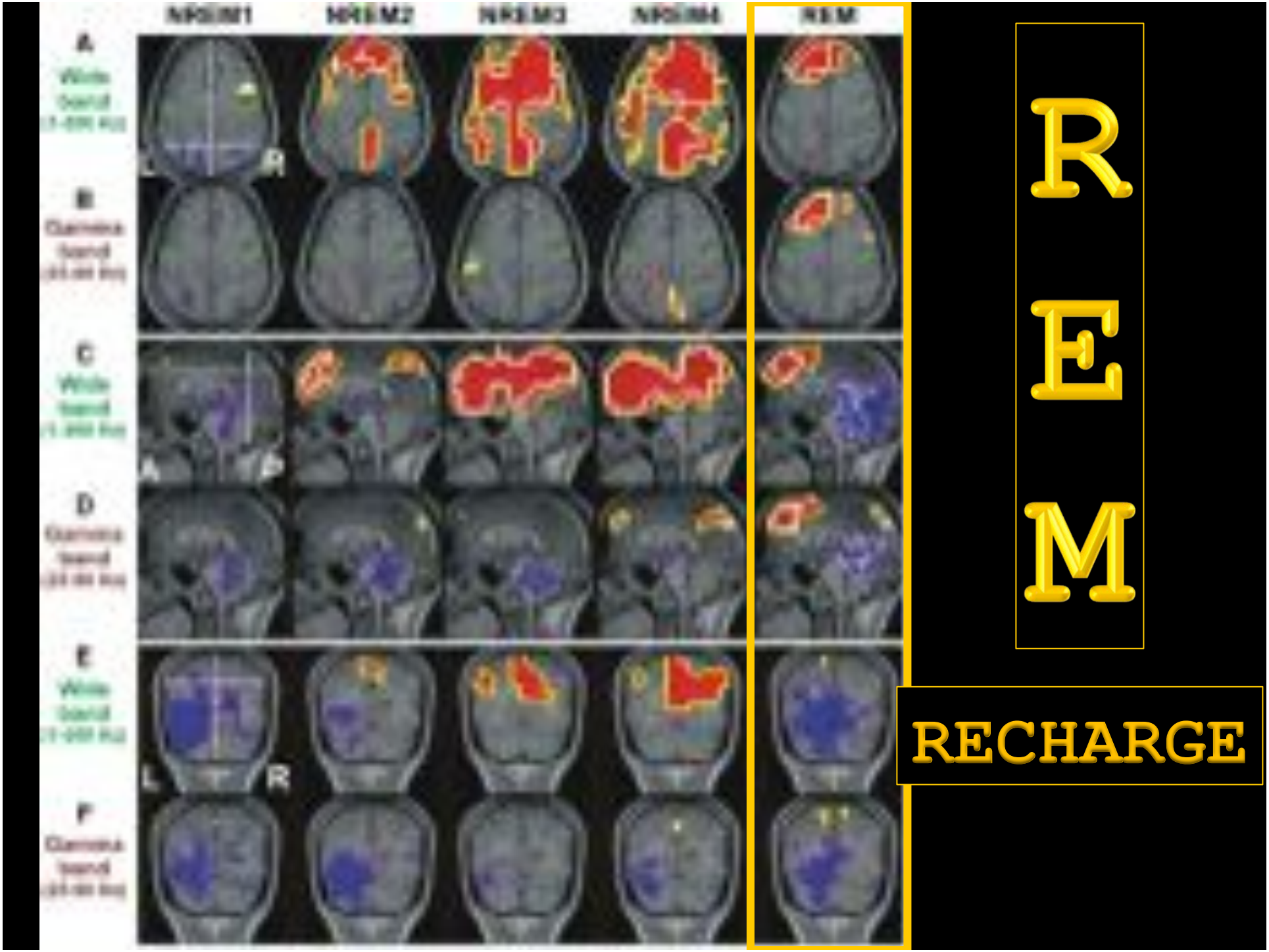
The more you sleep the better you perform
Universal + effect on performance
All stats improve in competition level performance
All improve in measured core battery of tests
Most personal bests/records set

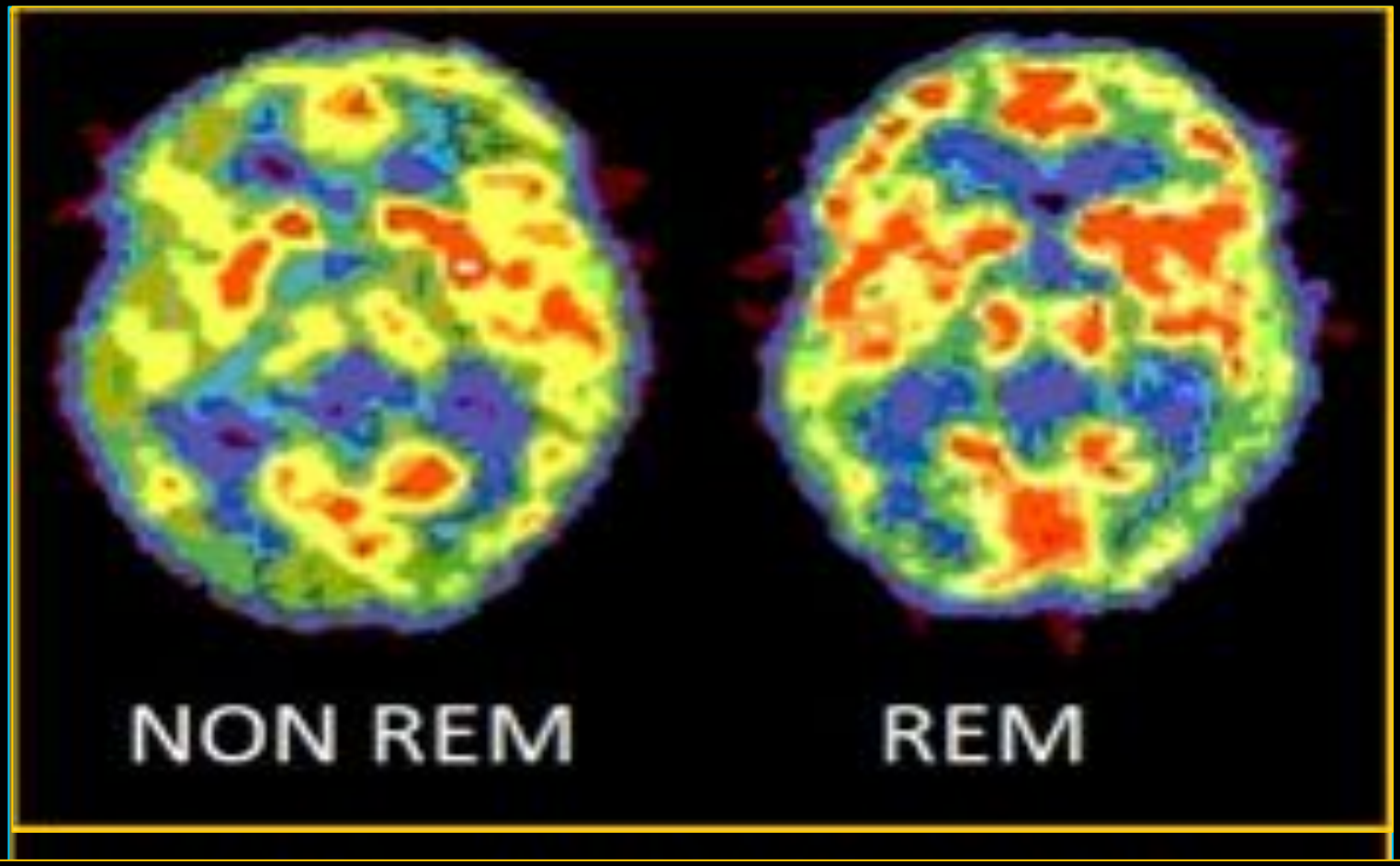
Sleep is an absolute predictor of performance in any sport!


Lifestyle Strikes Back
Sleep
Now Clearly a Predictor of Performance


HERE'S TO THE AFTER HOURS ATHLETE
Life of an Athlete
Go waste your effort, throw away your work!

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

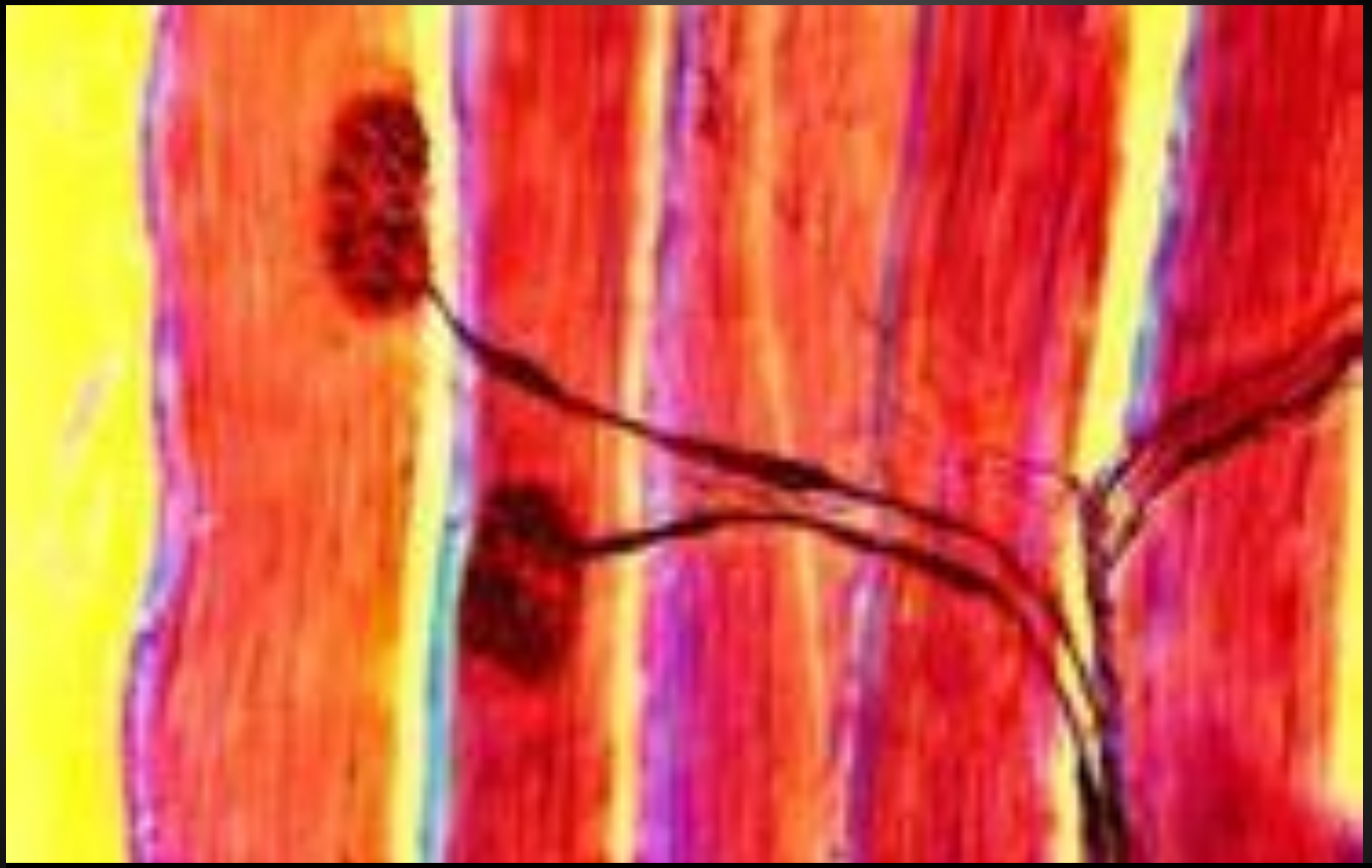

NREM1
NREM2
NREM3
NREM4
REM
A
Wide band
B
Gamma band
C
Wide band
D
Gamma band
E
Wide band
F
Gamma band
L
R
A
P
R E M
RECHARGE



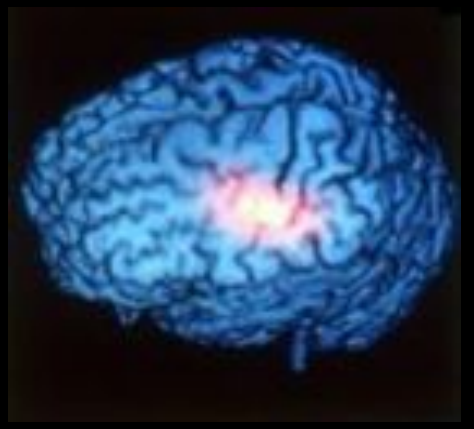
You need 1 ½ -2 1/2 hours of REM

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.

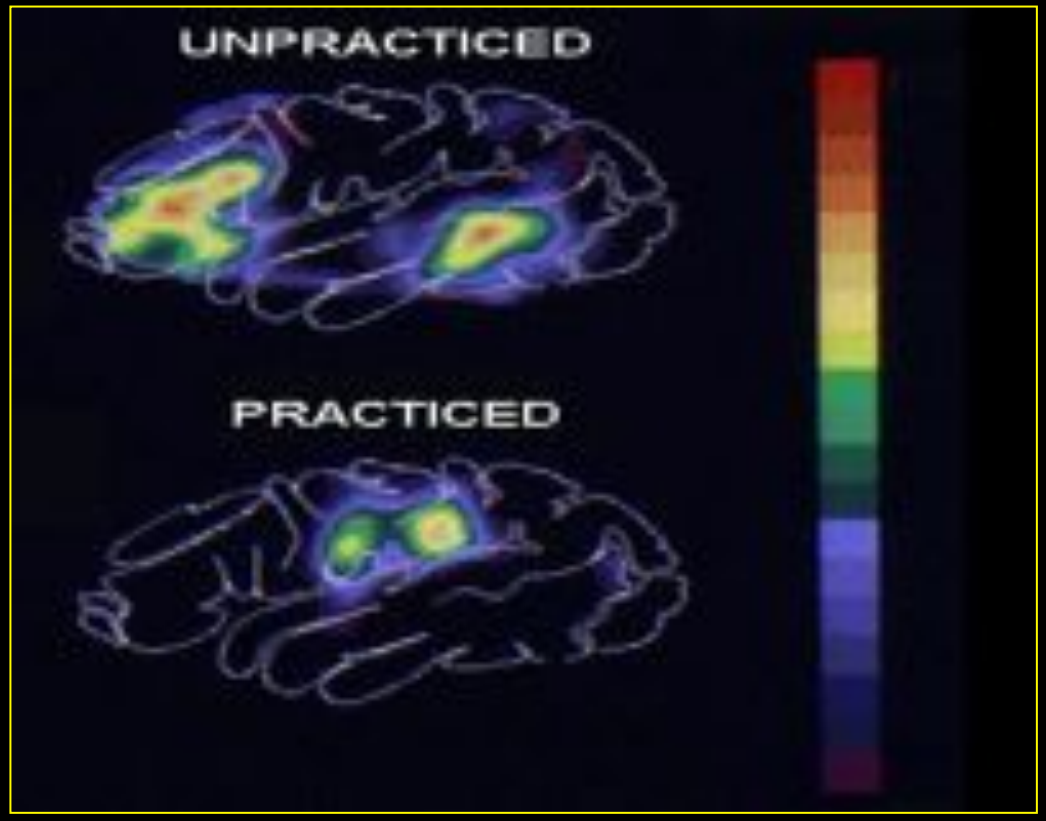


Neuro-Muscular Junction



Movement Memory
Firing Patterns
Biomechanics
Efficiency

Skill Development



Perfection
Innovation
Efficiency

Life of an 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

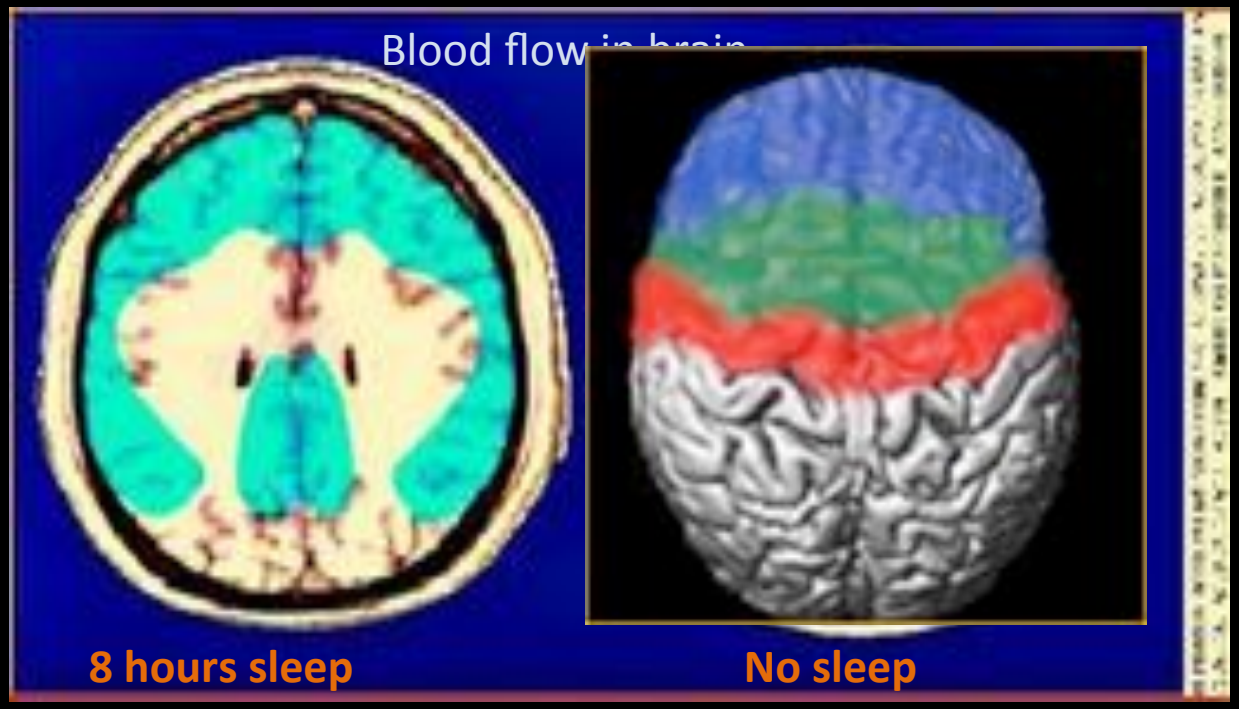
TOTAL SLEEP

ACCUMULATED REM

8 HOURS

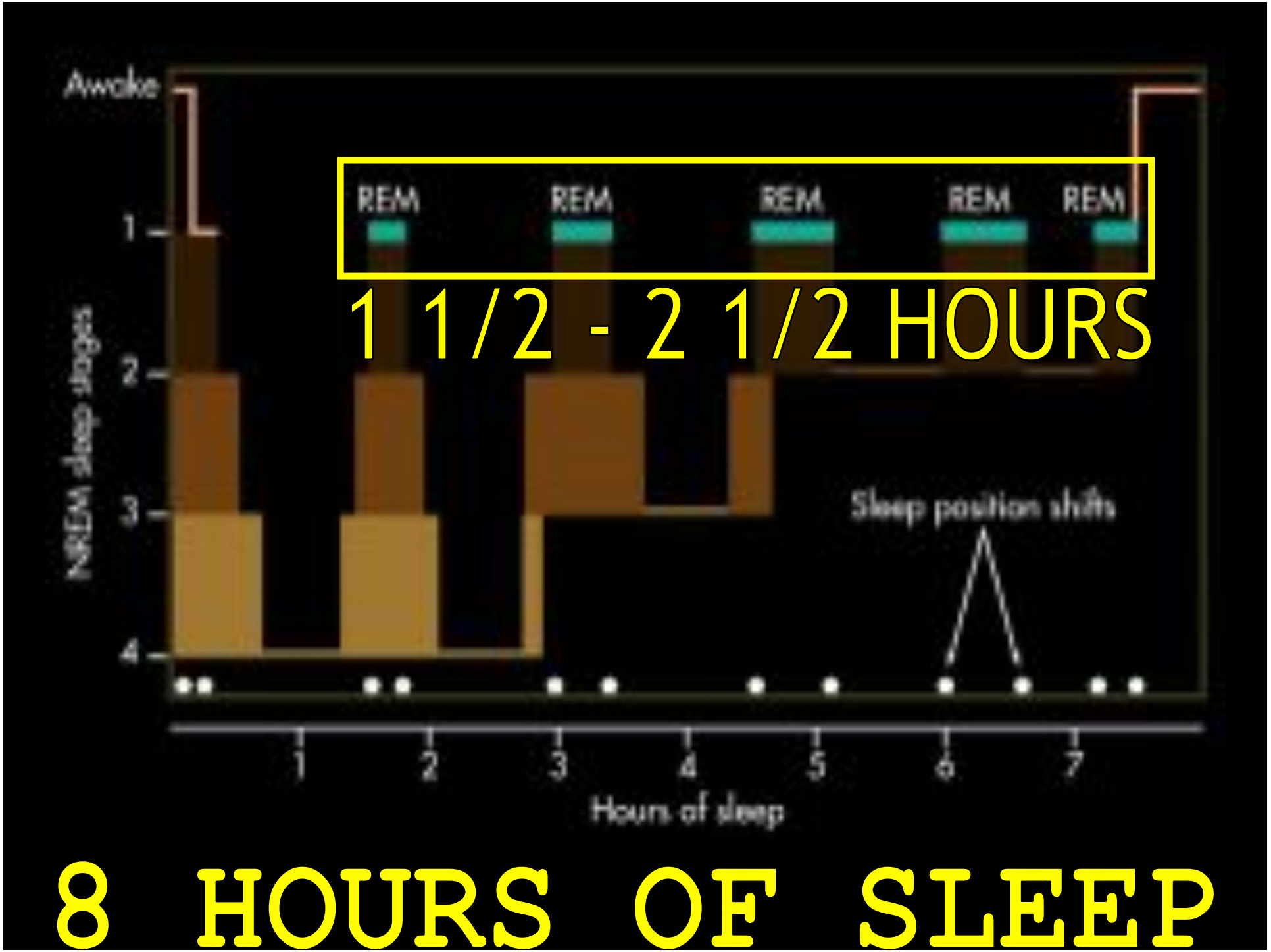
1 ½ -2½ HOURS

Sleep No Sleep



Blood Flow in Brain

Nasa


Awake
REM
REM
REM
REM
REM
1 1/2 - 2 1/2 HOURS
1
2
3
4
NREM sleep stages
Sleep position shifts
1
2
3
4
5
6
7
Hours of sleep
8 HOURS OF SLEEP