THE MUSCULAR SYSTEM

By, Dr. Tim R. Rogers
For Transformation Enzymes

Background

- Just a little bit about me…
  - Presently own/operate function based chiropractic practice inside Urban Active
  - Teach chiropractic seminars focused on clinical procedures, neurology and nutrition
  - An actual Transformation Client…almost 3 years!
  - Interested in correcting movement based dysfunctions…writing a book about it
  - Have been fascinated by the human body my whole life…

Disclaimer

- This presentation although not wanting to assume that everyone understands anatomy and physiology of the musculo-skeletal system, will focus only briefly on A&P.
- I am an expert only in the application of the physical aspects of nutrition and therapies are utilized every day **in my practice**

Disclaimer, cont'd

- The use of enzymes is completely up to the individual and the practitioners…the opinions stated within are not necessarily those of Transformation Enzymes.
- Questions and comments may be forwarded to my direct e-mail: chirofitdoc@gmail.com
- Patients must use drrogers@proactiveyou.com

Muscles

- Basic Stuff:
  - More than 600 in the human body
  - Made primarily of protein
  - Function in a bath of calcium, sugars and proteins…
  - Responsible for fat burning when the conditions are optimal
  - Thought to generate as much as 85% of ALL body heat-Tortora Principles of Anatomy and Physiology 8th ed.

Muscles

- Layering from the outside includes:
  - Superficial Fascia
  - Deep Fascia
  - Epimysium
  - Perimysium-surrounds the fascicles
  - Endomysium-insulates individual fibers
  - Sarcolemma

Muscle Energy

- Excitation of muscle fibers come as a consequence of the release of acetylcholine (neurotransmitter made from amino acids)
- The influx of Na+ into the cell propagates the change across the membrane
- Sarcolemma=plasma membrane of the muscle cell

Metabolic Machinery

- The nuclei of the muscle lie on the periphery…out of the way
- The mitochondria are organized in a line along the proteins that require ATP…aka "Myofibrils": the contractile portion
- Myofibrils are made of filaments both thin and thick
- Filaments are arranged as sarcomeres

Metabolic Machinery cont'd

- Myosin and Actin make up the contractile proteins that connect and release on each other
- A third elastic filament adds stability to the muscle called "Titan" by connecting anchor points called Z discs to thick filaments
  - ALSO plays a role in recovery of the resting sarcomere length when a muscle is stretched or during relaxation

Calcium and Energy

- Stored in cisterns (sarcoplasmic reticulum) surrounding myofibrils is Ca2+
- The release of calcium into the space around the filaments triggers the contraction
- A subsequent DECREASE in Ca2+ will turn off the contraction process
- Active Transport pumps will automatically balance levels within the cell

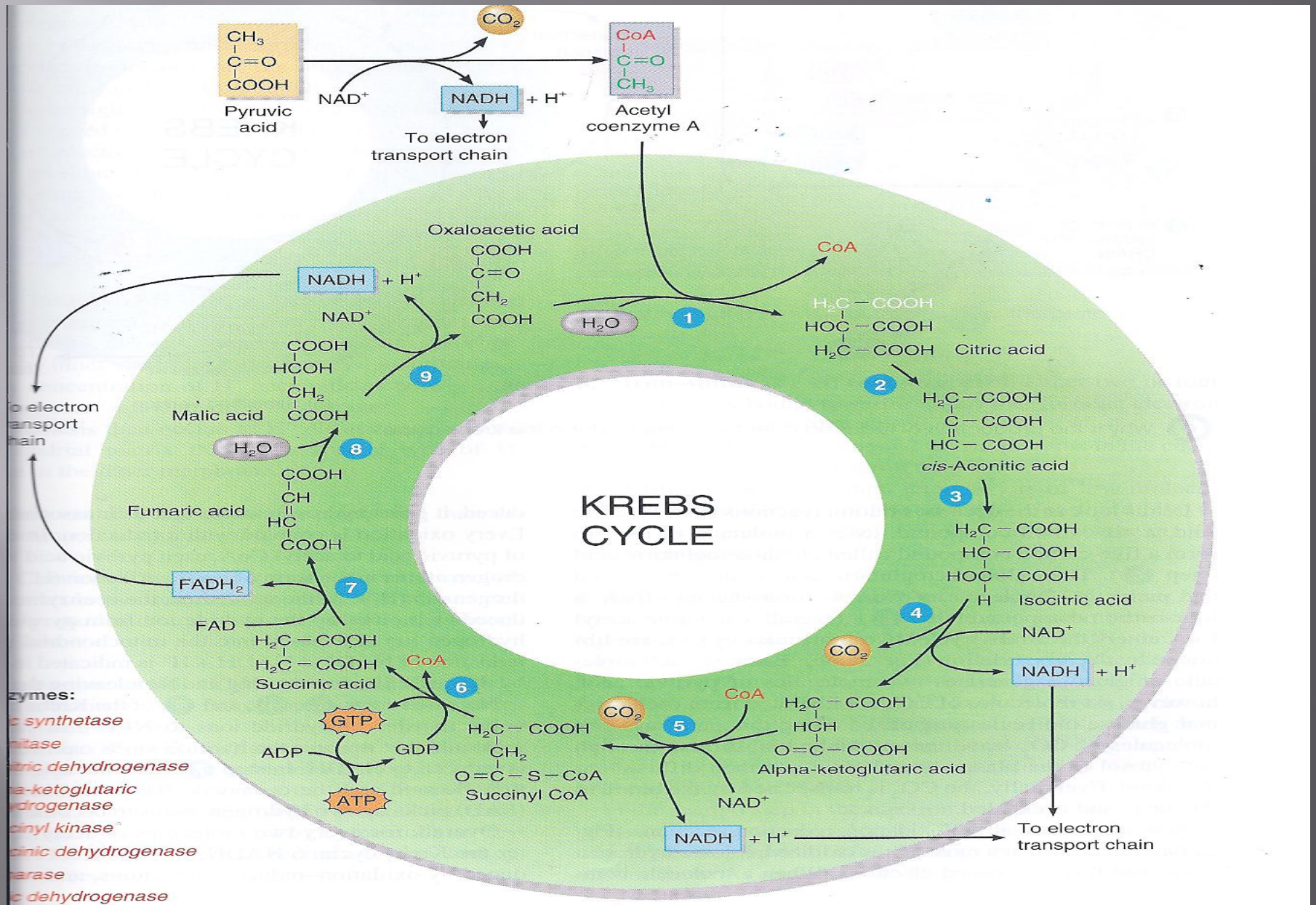
ATP and the Power Stroke

- Before the contraction begins, enzymes within the fibril create a hydrolysis reaction, splitting ATP to ADP + p
- This effectively gives the energy to myosin for future events
- Ca+2 unblocks the actin (via tropomyosin release)
- Mysoin and Actin connect: Power Stroke

ATP and the Power Stroke

- ADP is released as the filaments reach their full ROM
- ATP once again moves in to begin the process

- How do we get ATP????



(a) Detailed version

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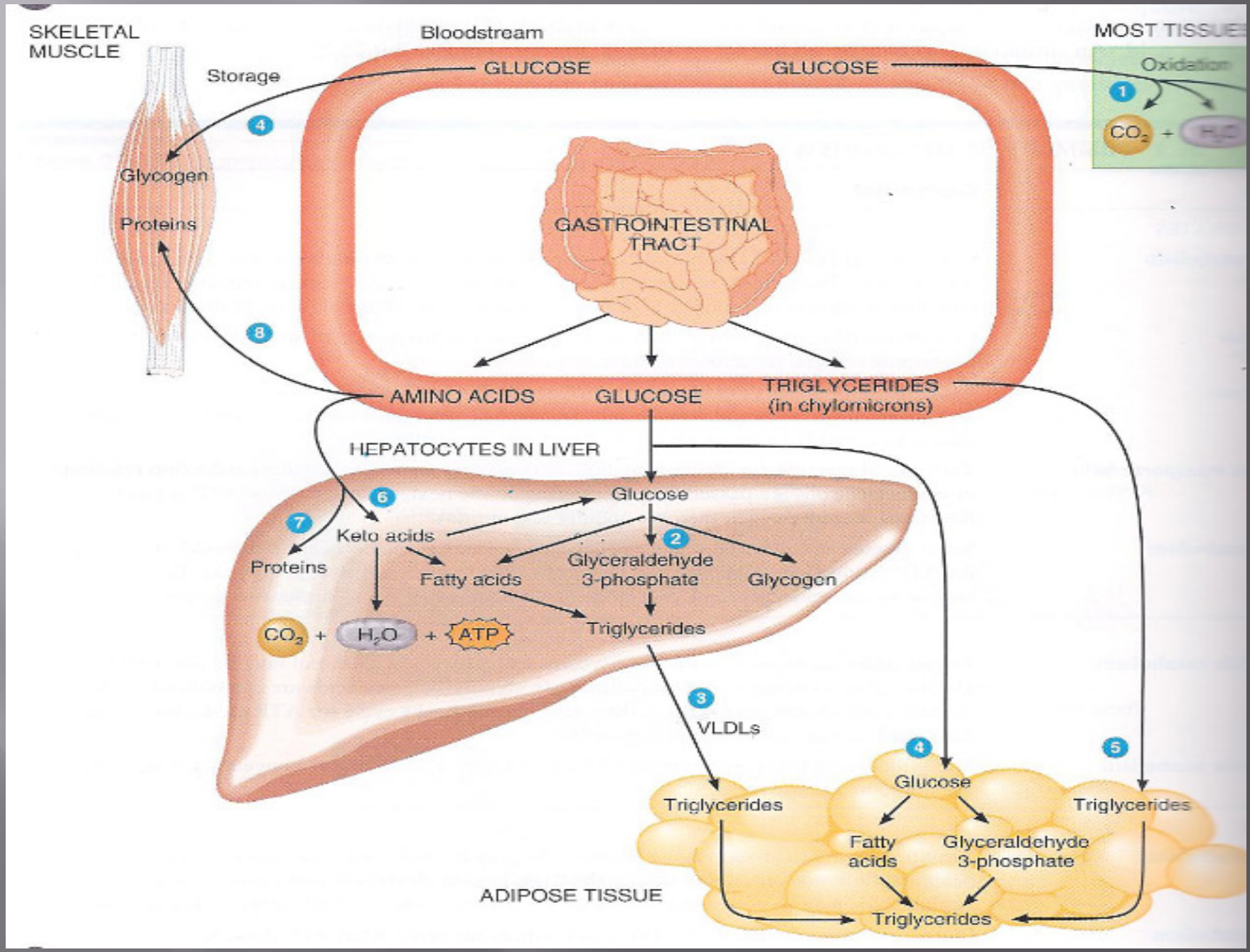
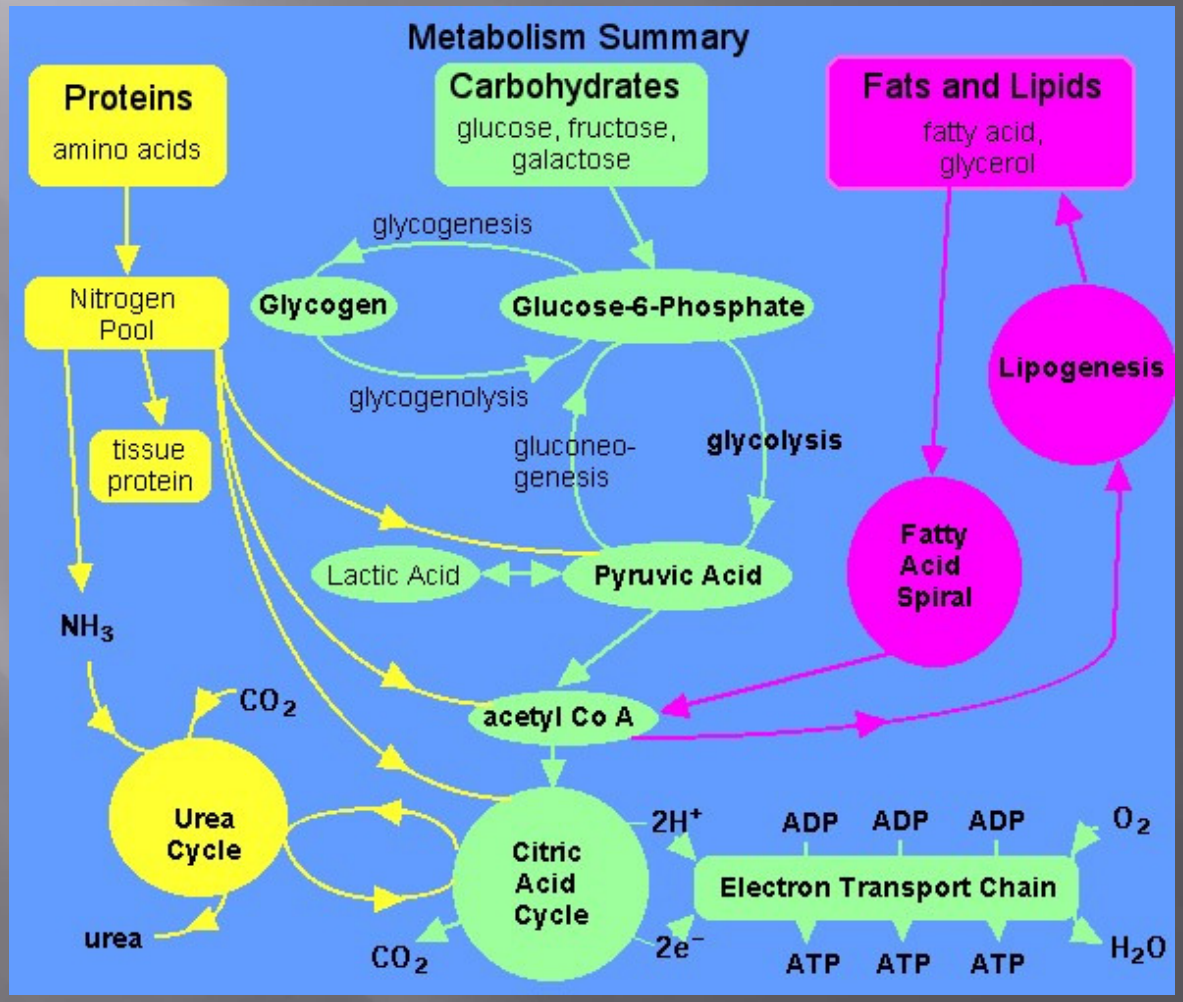
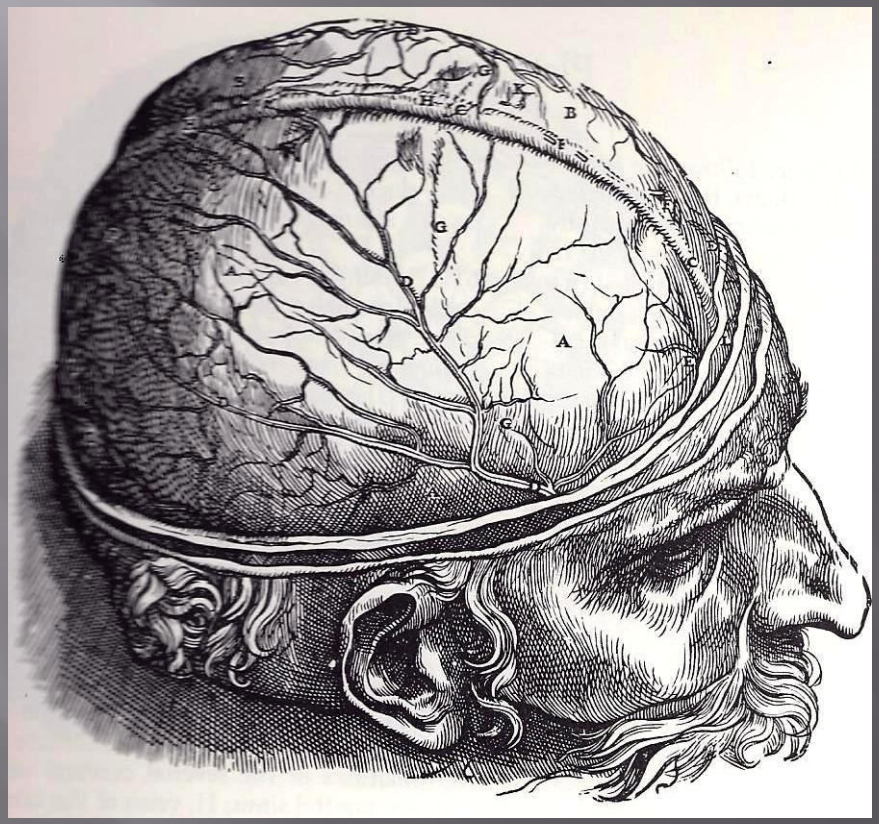

SKELETAL MUSCLE
Bloodstream
MOST TISSUES
Storage
GLUCOSE
GLUCOSE
Oxidation
1
CO_2 + H_2O
4
Glycogen
Proteins
GASTROINTESTINAL TRACT
8
AMINO ACIDS
GLUCOSE
TRIGLYCERIDES (in chylomicrons)
HEPATOCYTES IN LIVER
Glucose
6
7
Keto acids
2
Proteins
Fatty acids
Glyceraldehyde 3-phosphate
Glycogen
CO_2 + H_2O + ATP
Triglycerides
3
VLDLs
4
5
Glucose
Triglycerides
Triglycerides
Fatty acids
Glyceraldehyde 3-phosphate
ADIPOSE TISSUE
Triglycerides

Summary of Energy Creation



The Brain Rules!



Hierarchy

- The control of muscle in the body is delegated toward the survival of the organism first then is coordinated to promote normal functioning:
  - Survival/Threat (Fight or Flight)
    - Move or Be Eaten!!!!
  - Stability
    - Once you're safe, don't let the brain hit the turf!!!
  - Movement
    - Now that we're sure we're in good shape, we can move about the country…all needs being met

Fight or Flight…Boo!

Fight or Flight

- Governed by the process of surviving to live, the muscular system is hardwired to engage to avoid death or threat of death
- Paleocortical connections in the basal ganglia project to the motor neurons that fire at the expense of everything else…

  TO AVOID BEING EATEN!!!

People coming into the gym following a stressful day, commonly make the mistake of working our too hard

Stability

Stability

- Once the threats are neutralized, the function of the muscular system shifts to stabilization
  - Phasic and Tonic Muscles have different roles
  - True Core relates to the muscles closest to the spine and the ligamentous structures (imagine a bullseye):
    - Spinal column first, ligaments, then small muscles spanning a joint or two
    - Moving outward the muscles get larger, spanning more segments.

Stability Pathogenesis

- Instability at the joint level can come from several pathogeneses:
  - Falls and blunt injury: MACROTRAUMA
  - Sitting for 8 hours per day: MICROTRAUMA
  - Standing on concrete floors
  - Walking on flat surfaces in shoes
  - Toxic overload…loss of sulfur in phase II of liver detox leaving less for discs and ligaments

Stability and Energy

- Normal muscle balance creates a lower state of energy necessary to maintain a body
- Tight or hypertonic muscles are a result of something else acting on it…robbing energy from the body to stabilize itself via larger muscles to act as a brace
- Forward head carriage can deplete 30% of someone's shoulder power
- Flexibility of the lower body is often lost due to poor adaptive controls of head posture secondary to work related ergonomics

Stability as a Threat

- Lack of normal "shunt" stabilization of the joint will create imbalance in primary movers activating without support
- Joints rip apart as a result of the disagreement in TIMING between stabilizers and primary movers
- Patients complaining of tennis elbow most like use a computer all day…

Instability and Cortisol

- Misfiring of muscles trigger deep brain centers out of fear of falling or joint separation/danger
  - Adrenaline
  - Cortisol
  - Over time, the body will steal pregnelone from cholesterol to make more cortisol when joints fail, leaving you with less progesterone and testosterone
    - Ultimately leads to tissue degradation and impaired repair mechanisms

Motion=Life

Movement

- All things being satisfied in the previous areas of threat and stability, the brain prefers the lowest state of energy possible.
- When activity supersedes normal resting state, increased **Oxygen, Fuel and Rest** are needed to keep up with the increased metabolic needs of the muscular system
- Brain prefers the lowest state of energy possible until you ask it to do something
- The better balance the above constituents are, the better supported the activity

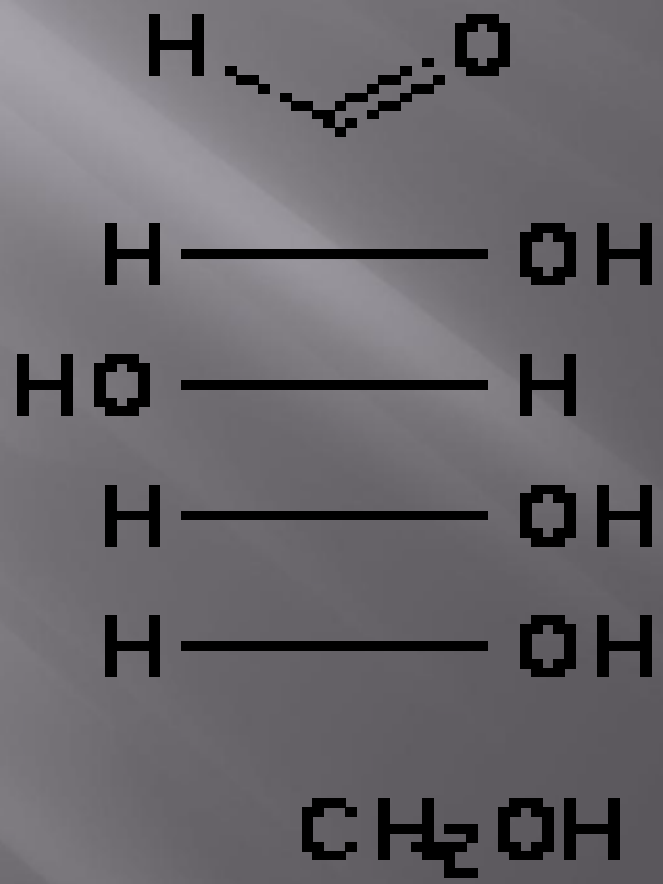
Movement and Oxygen

- Muscles use O2 to create energy needed for contraction
- Lack of O2 changes the texture and elastic properties of all tissues.-Ida Rolf
  - Phasic Muscles blow off oxygen quickly and refill slowly due to size and power generated
  - Tonic muscles have faster refill due to size

Muscles and Fuels

- Aerobic Metabolism of substrates yields greater ATP yields
  - Carbohydrate= 36 ATP per molecule
  - Fats= 100ATP + and are completely dependent on the presence of oxygen and the number of glucose molecules made during gluconeogenesis
  - Proteins= 4Kcals/gram as a last resort in starvation in today's carb rich diets or catabolism due to cortisol.
    - Potentially ENERGY NEGATIVE process
    - Becomes easier to initiate each successive turn

Glucose



C6 H12 O6

- Sugar: The brain's main source of fuel.

- Recent research shows that the brain uses between **150-200 g of glucose per day**
- Gluconeogenesis bridges the gap when blood sugar drops low enough for pyruvate to be made from AAs
- With carbohydrate loads today, fat burning for energy is greatly diminished -Life Without Bread

Gluconeogenesis

- With plenty of Protein & Fat in the Diet, the anabolic process of building glucose from AAs is fueled by fats and the ATP generated in the mitochondria
- This glucose is used by the brain and tissues on an as needed basis which eliminates the build up of insulin (often created by excessive carbohydrate consumption)
- The end result is that people burn Fat or Gain Muscle

Starvation/Survival

- When depleted to emergency levels, glucose is made from muscle via cortisol but just enough to endure the event or sustain activity
  - **DOES NOT HAPPEN IN THE PRESENCE OF PLENTY OF PROTEIN**
- Primary source of today's carbohydrates comes from processed and fast foods these days.

- Greatest reason people are fatter today due to:

Insulin Resistance

- Prolonged insulin levels due to sustained presence of carbohydrate leads to decreased receptors on cells
- This creates mass sugar storage as FAT

- The average person will consume 100+ lbs of sugar this year (your grandparents likely consumed 1/10 of that!)

Sad Fact

- We've been told to decrease fats in our diets (dangerous) for decades and even with reduced fat preparations, the increase in heart disease, cholesterol and hormone imbalances and diabetes is INCREASING!
- Since the introduction of agriculture and grain domestication, life expectancy, physical height and dental health has DECREASED*
  - Life Without Bread : How A Low Carbohydrate Diet Can Save Your Life, Allan and Lutz, McGraw Hill 2000

Misunderstanding

- The presence of **Ketone bodies** in the Urine has been looked upon as a negative effect related to starvation
- Present in the cells as an energy source
- *Brain can even use Ketone bodies for energy*
- From Breakdown of FAs + 2acetyl CoAs for generating ATP
- **TRUE** that they are present during Starvation
- ***ALSO TRUE*** that they are present when Fats are being used for energy (Fat & Protein ++)
  - Ketones don't form when carbs are present : preventing fat burning

Human Evolution

- Carbohydrates are an energy rich food source. Amylase is thought to have played a key role in human evolution in allowing humans an alternative to fruit and protein. A duplication of the pancreatic amylase gene developed independently in humans and rodents, further suggesting its importance. The salivary amylase levels found in the human lineage are six to eight times higher in humans than in chimpanzees, which are mostly fruit eaters and ingest little starch relative to humans. **Wikipedia**

De-evolution

- It has also been noted that since grains became domesticated, the human species got shorter by an average of 6 inches in males and females
- Weston Price studied the effect of the introduction of the Western Diet to West African tribal societies and found it created dental caries and increased systemic diseases along with increased infant mortality.
- -The Weston Price Foundation
- Diseases have only increased NOT decreased in the presence of supposed LOW fat diets

Amylase

Amylase

- Mucosal amylase begins the process of digestion in the mouth
- As the taste buds detect the sweetness, the pancreas begins the release of pancreatic amylase and insulin
- Mastication begins the mechanical breakdown of solid carbohydrate (our flat teeth are designed for that)

Summary of Amylase

- Amylase is present in human saliva, where it begins the chemical process of digestion. Foods that contain much starch but little sugar, such as rice and potato, taste slightly sweet as they are chewed because amylase turns some of their starch into sugar in the mouth. The pancreas also makes amylase (alpha amylase) to hydrolyze dietary starch into disaccharides and trisaccharides which are converted by other enzymes to glucose to supply the body with energy

Amylase and Energy

- Assuming the appropriate concentration of enzymes, C6 H12 O6 becomes 36 ATP per molecule of glucose in the presence of O2

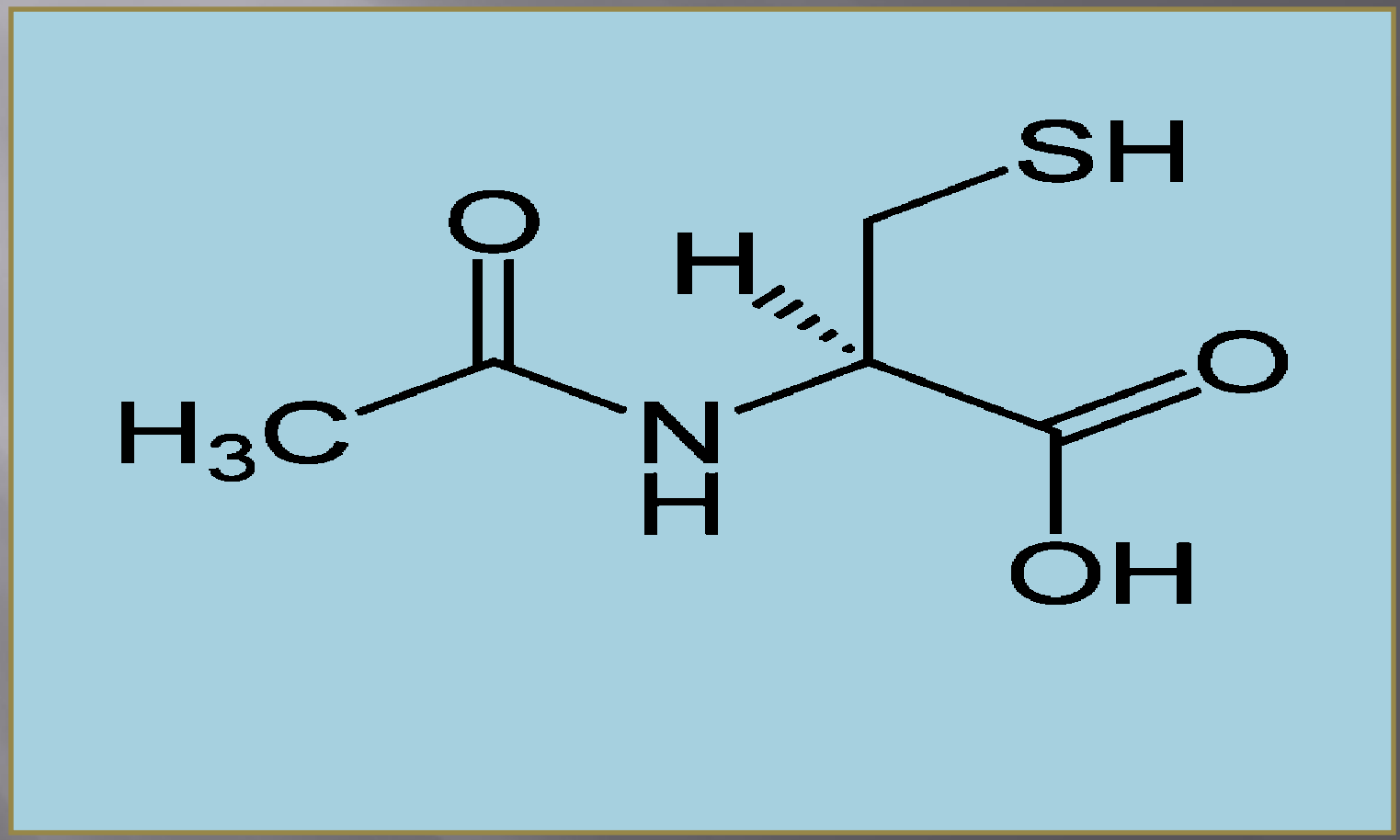
- Anaerobic production creates only 2 ATP

Lipase

Lipase and Fats

- Pancreatic lipase is an enzyme (more specifically, a lipase) secreted from the pancreas that uses hydrolysis to break apart fat molecules. Bile salts secreted from the liver and stored in gallbladder are released into the duodenum where they coat and emulsify large fat droplets into smaller droplets, thus increasing the overall surface area of the fat, which allows the lipase to break apart the fat more effectively. The resulting monomers (2 free fatty acids and one 2-monoacylglycerol) are then moved by way of peristalsis along the small intestine to be absorbed into the lymphatic system by a specialized vessel called a lacteal.

Proteins to Amino Acids



Proteases and Protein

- A **protease** (also termed **peptidase** or **proteinase**) breaks down proteins. A *protease* is any enzyme that conducts proteolysis, that is, begins protein catabolism by hydrolysis of the peptide bonds that link amino acids together in the polypeptide chain forming the protein. Proteases work best in acidic conditions except alkaline proteases

Muscle Composition

- Muscle Constitutes 40-50% of the total body weight
- 3 major groups: skeletal, smooth and cardiac
- Transformation Enzymes' focus is on optimal growth, repair and performance of the muscular system. From Transformation Enzymes System 11

Basic Physiology

- **Skeletal Muscle** is called so because it is primarily attached to bones and moves parts of the skeleton
- Striated: Alternating bands of light and dark bands (visible under the microscope)
- Voluntary

Physiology Cont'd

- **Smooth Muscle** is located in the walls of hollow internal structures
- Nonstriated and involuntary
- Hormone and NT regulated
- Located in the following:
  - Blood Vessels
  - Stomach
  - Intestines
  - Most Abdominal Organs

Smooth Muscle

- **2 types:** visceral single unit and multi unit
- Visceral single units contract in a way that the whole organ contracts at the same time
- Multi Units as in some of the arteries, pupillary and ciliary body muscles, erector pili and bronchioles contract in segments due to stimulation of individual fibers due to few gap junctions
- Usually thicker in the middle and tapered at the ends

Smooth Muscle, cont'd

- Contains thin and thick filaments like Skeletal Muscle…just not in an orderly fashion
- Little Sarcoplasmic Reticulum (SR) therefore relies on extracellular fluid for Ca+2
- Contraction starts more slowly and last longer
- ALSO can shorten and stretch to a greater extent than Cardiac and Sk Muscle
- Also receptive to changes in pH

More Physiology

- **Cardiac Muscle**
  - Forms most of the Heart
  - Also Striated Muscle but is INVOLUNTARY
  - Uses a built in Pacemaker system
  - Also influenced by NTs and Hormones
  - More numerous and larger Mitochondria (make up 50% of the cell)
  - Ca+2 is provided in the extracellular fluid vs. from SR like in Skeletal Muscle
  - Units of muscle contract simultaneously as a result of Gap junctions and intercalated discs

Muscle Physiology, cont'd

- Cardiac Muscle uses FATs almost exclusively for energy **FROM SATURATED FAT!!!**
- **Funny how it has been said for so long that fat is bad for the heart when it uses the very evil proposed by "experts"…**
- **FAs can be synthesized by acetyl-CoA from glycolysis as needed**
  - **FA synthesis does not significantly contribute to the energy needs of the heart muscle**

True or False?

Low Fat High/Carb Diets are GOOD for the Heart?

(I hope you answered it correctly)

Treatment/Supplementation

- To handle the muscular system, we are rally talking about several components of the System 11 approach:
  - Muscles
  - Lymphatic System
  - Respiratory
  - Digestive
  - Nervous
  - Cardiovascular
  - Endocrine
  - Skeletal

Lymphatic System

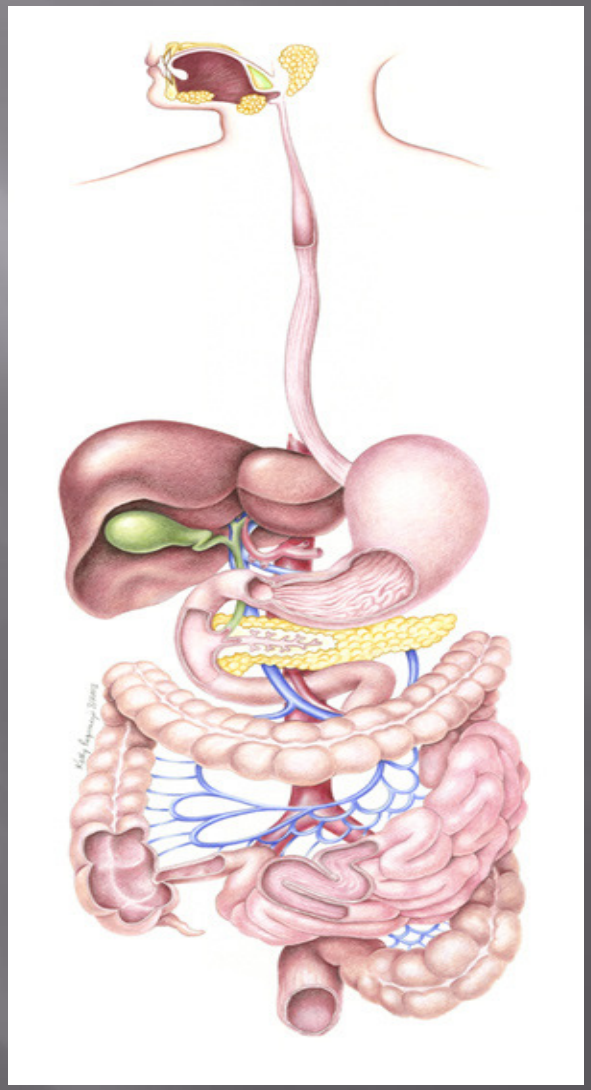
Lymphatic System

- Lymphatics embedded in muscle and connective tissue responsible for the supply of local nutrients and removal of waste products
- Reduction of granular tissue that accompanies injury leading to less scar tissue
- Supply of necessary WBCs to keep infection down and modulate the presence of unwanted viruses, bacteria, metabolites

Lymphatic Support

- Essential Fatty Acids
- Mineral Complex
- Protease IM
- L Drain
- K Drain

Digestive System



Digestive System

- Breakdown of nutrients and removal of waste products essential for relief of toxic load in the blood stream while supplying cells with optimal units of carbohydrate, fats and proteins
- Carbohydrate eaten does not necessarily equate to sugars necessary for brain..with enough proteins and fats, there is enough carbs for sugars present

Digestive System

- Complete breakdown of proteins obvious for cellular repair and fuel
- Complete breakdown of proteins lead to less fermentation in the intestines and potential for leaky gut/permeability and fodder for yeast
- Lipase assists in the emulsification of fats
- Amylase decreases the energy necessary for breakdown and assimilation of carbohydrates

Digestive Enzymes

- Digest
- ReleaseZyme
- Vitamin C Complex
- Liver Support
- RepairZyme
- Protease IFC
- Yeast/Fungal Detox

Endocrine System

Endocrine

- Modulating the response of the endocrine system by supporting the organs and glands with raw materials allows for appropriate response to energy demands
- For instance, calmer adrenals due to the presence of P-5-P and pantethine decrease the theft of pregnalone from cholesterol to make cortisol.
- The loss of pregnalone, decreases testosterone and progesterone, necessary for reconstruction and recovery

Endocrine

- Adrenal Complex
- Thyroid Complex
- Liver Support
- CalmZyme
- Protease
- MasterZyme

Respiratory System

Respiratory

- pH balance is crucial for the determination of the metabolism of fats, which do not burn in the absence of oxygen
- Acidity leads to the metabolism of sugars, increase in Lactic Acid (good for the heart, not skeletal muscle)
- Respiration has the greatest effect on pH.

Respiratory

- Probiotic
- Protease
- Protease IM-quercitin
- K Drain
- L Drain
- Liver Support

Nervous System

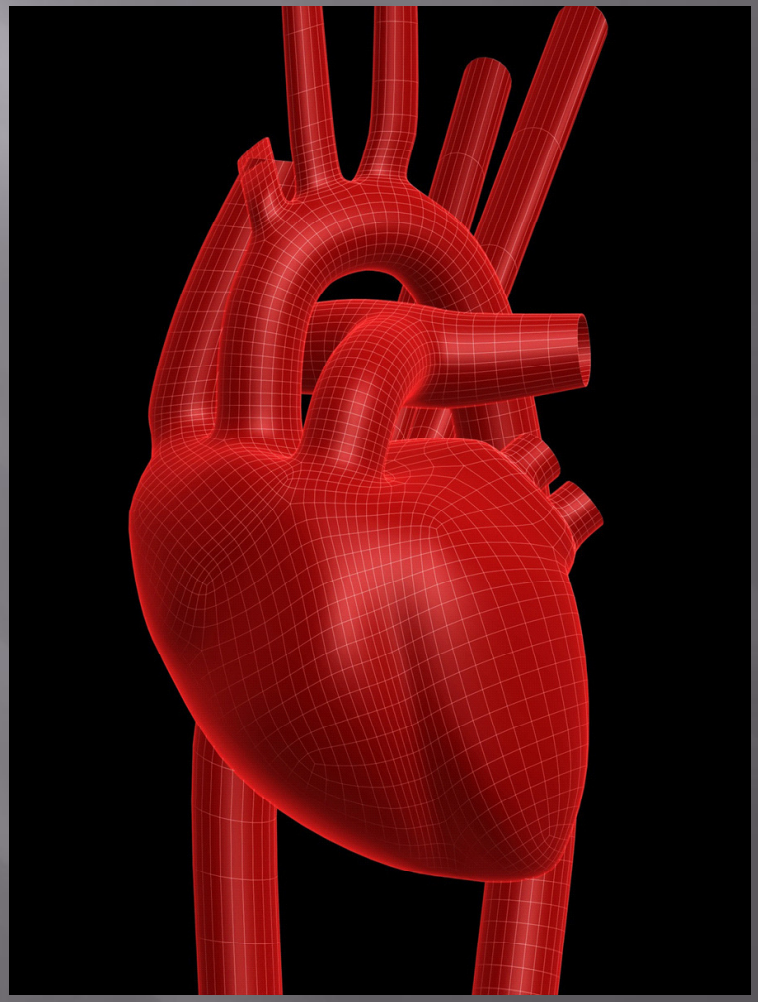
Nervous System

- Assembly of NTs from Amino Acids require complete breakdown of protein
- Clearance of debris from the system leads to a decrease immune system presence and the gobbling up of AAs that are required for assembling Acetylcholine

Nervous System

- HM Support
- EFA
- Antioxidant
- Digest
- Adrenal Complex
- Protease

Cardiovascular System



Cardiovascular

- Efficiency of cardiovascular function is essential for the supply of nutrients, O2 and electrolytes as well as the removal of metabolic debris
- Cardiac Muscle relies ironically on FATs and the lactic acid produced from ANAEROBIC metabolism

BONUS Section!!!

- The system not talked about in the series that has a great deal of importance in relation to the muscular system is FASCIA
- The stuff that creates and maintains the SHAPE of our bodies most obviously the shape and length of our muscle
- Classified as connective tissue

Fascia

From Gray's Anatomy

- "Connective Tissues play essential roles in the body, both structural, since many of the extracellular elements posses special mechanical properties and defensive, a role which has a cellular basis. They also often possess important trophic and morphogenic roles in organizing ***and influencing the growth and differentiation of the surrounding tissues***."
- -adapted from Anatomy Trains, Thomas W. Myers, Elsevier Ltd., 2009

The Glue That Binds…and Forms

- Less effective at contraction than muscle tissue but nonetheless as important due to the template that it sets for muscles power and influence
- Secrete a variety of products into the intracellular space that combine to form our bones, cartilage, ligaments, tendons and fascial sheets…guide wires for the development of muscle

ECM

- Extracellular matrix consists of insoluble protein fibrils and soluble complexes composed of carbohydrate polymers linked to protein molecules (proteoglycans) which bind water.
- **Designed to distribute the stresses of movement and gravity while at the same time maintaining the shape of the body**.
- Provides the porous environment for cells embedded in it to receive nutrition and release wastes through diffusion.

The Facts About Fascia

- Stores and communicates information across the entire body
- 3 types of fibers
  - Collagen, Reticulin and Elastin
- Ground Substance extruded into the extracellular space which changes its shape constantly to meet local needs
  - Dehydrates in “held” or still areas becoming viscous while it hold metabolites and toxins

In a word…

- Fascia makes up the pockets in which all structures develop and communicates across it the tension, stresses and movements throughout the organism
- Changes instantly and distributes loads as a buffer to the outside world
- Relies on a constant supply of substrate made from macronutrients
- **Functions best in Alkyl pH**

Personal Protocol

- To support the development and maintenance of fascia and the ECM:
  - Digest and Betaine HCL
  - Protease IFC
  - RepairZyme
  - HM support
  - Liver Support
  - L Drain, K Drain

Thank You

It has been a pleasure speaking with you today.

Thanks to Transformation Enzymes for the opportunity to share this information!

Check out “Strolling Under the Skin”

and “The Fuzz "on YOUTUBE.