Kundalini and the Nadis: Ida, Pingala and Shushunma

Lessons from Kanchen and BNS Iyengar Mysore, India RYT 200 Hour-2014, 2015, 2016

Science explains Nadis in terms of nerve pulses, but the ancient texts perceived it as energy and consciousness flowing through interconnected channels in the body. At first this may seem incomprehensible. However, these channels of flowing energy can be felt when the concentration and meditation becomes much deeper.

Nadis are pathways of pranic, mental and spiritual currents, which form a matrix throughout the physical body. They provide energy to the whole body. Nadis are in the soles of the feet up to the crown chakra of the head. Nadis carry source energy, Prana.

Scientific research has proven the existence of nadis. Dr. Hiroshi Motoyama has found stable voltages of electromagnetic currents flowing within close proximity to the nervous system which he cited as evidence for the existence of nadis.

Please note, that these nadis are much different than acupuncture meridians where the location as previous research has suggested as collagenous bands on the fascia plane between the muscles or between a muscle and bone or tendon.

According to Hindi texts there are 72,000 nadis. Nadi comes from the Sanskrit root “nadi” which means flow current stream. Nadi is a subtle vibration and make up the subtle flow of energetic vibration within the body.

The most important Nadis are Pingala, Ida and Shushumna. These three nadis are responsible for conducting three energetic forces within the physical body.

From the left side of the Mooladhara chakra (root chakra), Ida Nadi begins to flow. Whereas, from the right side of the spinal column Pingala begins.

Sushumna rises straight up through the center of the spine, meeting Ida, Pingala at the points where they cross chakras uniting these 3 Nadi Channels at the Anya (third eye).

Both Ida and Pingala cross at 4 major points of the central subtle energetic body. They cross at Swadhisthana, Manipura, Anahata, Vishuddhi chakras.

When Ida, Pingala are balanced then Shushumna Nadi (the spiritual channel) awakens and allows Kundalini to flow. Shushumna is the pathway through which the Kundalini rises and thus forms the basis for the progressive awakening of higher knowledge.

The Shushumna is dormant in most people today on Earth unless a higher state of evolution is reached. When Kundalini (or Shakti) passes through this channel transcendental experience takes place.

Kundalini awakening is only possible through pranayama practice according to BNS Iyengar and Krishnamacharya. However, some other yogi masters also believe we can also raise Kundalini through Osho Kundalini meditations and practicing kriyas and practicing Kundalini yoga. The purpose of all of these practices is to raise Kundalini via opening the main Nadi, Shushumna.

The snake-like coiled up Shatki –Kundalini potential is inside the square called the Linga at the Mooladhara chakra. This energy is similar to electricity or rather, cosmic electricity. Serpentine Power is also another name of Kundalini or Kunda or Shakti Power.

When one unites with cosmic universal prana one has awakened Kundalini.

Mooladhara or the root chakra is the seat of primal energy-Kundalini Shakti. The awakening of prana starts from Mooladhara. Infinite energy and spiritual experience emanates from Mooladhara root chakra.

When Kundalini reaches the Sahasrara (crown) self-realization or Samadhi is experienced. At this point, individual consciousness dies and universal consciousness is born.

Sahasrara is infinite in dimension. It is visualized, as a violet or fuchsia thousand petal lotus unfolding from the crown of the head in all direction into eternity.

During Kumbhaka (breath retention) the temperature in Mooladhara rises. As brain waves are lowered a surge takes place in Mooladhara and this is the awakening of Kundalini.

Pranayama and the Respiratory System

"As long as there is breach in the body, there is lite. When breath departs, so too does life. Therefore, regulate the breath.

(Hatha Yoga Pradipika Ch.2: S3.)·

1. During normal inhalation, an average person takes in about 500 cubic centimeters of air; during deep inhalation the intake of air is about six times as great, amounting to almost 3000 cubic centimeters. The capacities of individual very according to their constitution. The practice of pranayama increases the sadhaka's lung capacity and allows the lungs to achieve optimum ventilation.
2. The second chapter of Hatha Yoga Pradipika deals with pranayama. The first three verses state："Being firmly established in the practice of asanas, with his senses under control, the yogi should practice pranayama as taught by his Guru, observing moderate and nutritious diet. When the breath is irregular, the mind wavers; when the breath is steady, so is the mind. To attain steadiness, the yogi should restrain his breath. As long as there is breath within the body, there is life. When breath departs, life also departs. Therefore, regular the breath."
3. The practice of pranayama helps to cleanse the nadis, which are tubular organs of the subtle body through which energy flows. There are several thousand nadis in the body and most of them start from the areas of the heart and the navel. Pranayama keeps the nadis in a healthy condition and prevents their decay. This in turn brings about changes in the mental attitude of the sadhaka. The reason for this is that in pranayama breathing starts from the base of the diaphragm on either side of the body near the pelvic girdle. As such, the thoracic diaphragm and the accessory respiratory muscles of the neck are relaxed. This in turn helps to relax the facial muscles. When the facial muscles relax, they loosen their grip over the organs of perception, namely, the eyes, ears, nose, tongue and skin, thereby lessening the tension in the brain. When tension there is lessened, the Sadhaka attains concentration, equanimity and serenity.

Why so many pranayamas?

4. Numerous asanas have been evolved to exercise various parts of the anatomy-muscles, nerves, organs and glands- so that the entire organism woks in a healthy and harmonious manner. Human environments, constitutions, temperaments and states of health and mind vary, and different asanas help in different situations to alleviate human ills and develop harmony. Many types of Pranayamas have been devised and evolved to meet the physical, mental, intellectual and spiritual requirements of the sadhakas (student in Sanscrit) under fluctuating conditions.

Four stages of Pranayama

5. The Siva Samhita discusses the four stages (avastha)of pranayama. There are: (a) commencement (arambha), (b)intent endeavor (ghata), (c)intimate knowledge (parichaya) and (d) consummation (nispatti).

6. In the arambha stage, the sadhaka's interest in pranayama is awakened. In the beginning he is hasty and by reason of his exertion and the speed with which he wants results, his body trembles and he perspires. When by perseverance he continues his practice, the tremors and perspiration cease and the sadhaka reaches the second stage of ghatavastha. Ghata means a water pot. The body is compared to a pot. Like and unbaked earthen pot. The physical body wears away. Bake it hard in the fire of pranayama to gain stability. In this stage the five kosas and the three sariras are integrated. After this integration, the sadhaka reaches the parichayavastha, where he obtains intimate knowledge of pranayama practices and of himself. By this knowledge he controls his qualities (gunas) and realizes the causes of his actions (karma). From the third stage, the sadhaka goes forth toward nispatti avastha, the final stage of consummation. His efforts have ripened, the seeds of his karma are burnt out. He has crossed the barriers of the gunas and becomes a gunatita. He becomes a jivanmukta- a person who is emancipated (mukta) during his lifetime (jivana) by the knowledge of the Supreme Spirit. He has experienced the state of ecstasy (ananda)

Respiratory system

7. To enable the reader to have a clear picture of how pranayama benefits the body, it is essential to have some idea of the respiratory system. This is discussed below.
8. It is known that the basic energy needs of the human body are met predominantly by oxygen plus glucose. The former aids in the process of elimination by oxidizing the waste matter, while glucose supplied with oxygen nourishes the body cells in the flow of respiration.
9. The purpose of pranayama is to make the respiratory system function at its best. This automatically improves the circulatory system, without which the processes of digestion and elimination would suffer. Toxins would accumulate, diseases spread through the body and ill-health becomes habitual.
10. The respiratory system is the gateway to purifying the body, mind and intellect. The key to this is pranayama.
11. Respiration is essential for sustaining all forms of animal life from the single-celled amoeba to man. Tis is possible to live without food or water for a few day, but when respiration ceases so does life. In the Chandogyopanisad it is said: "Even as the spokes are fastened to the hub, so on this lift breath, all is fastened. Life moves with the life breath, which gives lift to a living creature. Life breath is one's father, … one's mother, ….one's brother, …one's sister, and one's teacher, …the Brahman… Verily, he who sees this knows and understands this becomes the excellent speaker." (S. Radhakrishnan: The Principal Upanisads, VII, 15, I-4.)
12. The Kausitake Upanisad says "One can live deprived of speech, for we see the dumb; one deprived of sight, for we see the blind; of hearing, for we see the deaf; and of mind, for we see the childish; one can live without arms and legs, for thus we see. But now it is the breathing spirit alone, the intelligence-self that seizes hold of this body and makes it rise up. This is the all obtaining in the breathing spirit. What is the breathing spirit, that is the intelligence-self. What is intelligence-self, that is the breathing spirit, for together they live in this body and together they go out of it". (S. Radhakrishnan: The Principal Upanisads, III, 3.)

13. Breathing starts with independent life outside the mother and end when life ceases. When the child is still in the womb its oxygen is suppler through its mother's blood, and its lungs are not required to function. When it is born, the first breath of life is started by command from the brain.
14. During most of one's life, the depth and rate of breathing are self-regulated through the nervous system to meet the purposes of breathing , supply in a regulated and controlled way the fresh oxygen which constantly needed by the cells and to discharge the carbon dioxide accumulated in them.
15. Most of us assume that because breathing is usually automatic, it beyond our active control. This is not true. In pranayama by arduous training of the lungs and nervous system, breathing can be made more efficient by changing its rate, depth and quality. The lung capacity of great athletes, mountain climbers, and yogis is far greater than that of average humans, allowing them to defy extraordinary fears. Better breathing mean a better and healthier life.
16. The act of breathing is so organized that the lungs inflate sixteen to eighteen times a minute. Fresh air containing life-giving oxygen is sucked into them, and gases containing carbon dioxide from the body tissues are sent out in exchange through the breathing passages. The rhythmic inflation of the soft, honey-combed bellows of the lungs is maintained by the movements of the rib-cage and diaphragm. The latter in turn are driven or powered by impulses sent down by the respiratory centre in the brain to the relevant muscles through the nerves. Thus the brain is the instigator through which the respiration and the three mental functions of thought, will and consciousness are regulated.
17. The breathing cycle consists of three part: inhalation, exhalation and retention. Inhalation is an active expansion of the chest by which the lungs are filled with fresh air. Exhalation is normal and passive recoil of the elastic chest wall by means of which the stale air is exhaled and the lungs are emptied. Retention is a pause at the end of each inhalation and exhalation. These three form one cycle of breathing. The breathing affects the heart rate. During the prolonged holding of breath, a slowing of the heart rate is observed, which ensures increased rest to the heart muscle.
18. Respiration may be classified into four types:
    (a) High or clavicular breathing, where the relevant muscles in the neck mainly activate the top parts of the lungs.
    (b) Intercostal or midbreathing, where only the central parts of the lungs are activated.
    (c) Low or diaphragmatic breathing, where the lower portions of the lungs are activated chiefly, while the top and central portions remain less active.
    (d) In total or pranayamic breathing, the entire lungs are used to their fullest capacity.
19. This series of movements of the abdomen, chestwall and neck, in which each step of the sequence prepares the ground for the next, results in a maximum filling of the lungs, to create space for the incoming air to reach every corner of each lung.
20. One must first direct body-conscious awareness specifically and intelligently at the lower anterior abdominal wall just above the pelvis. To accomplish this, he has to move the lower abdominal wall towards the spine and against the diaphragm as if massaging from the skin to the muscles and muscles to the inner organs. This sense of active conscious contraction is associated with visible movements of the abdominal wall from the surface skin to its deepest layers, and can be directed at will. After that, direct your attention to expand the lateral and posterior regions of the chest. Elevate the lower chest wall simultaneously expanding the top chest wall with its skin and muscles. The diaphragm gradually and smoothly resumes its domed shape as it starts to relax towards the end of inspiration. During exhalation the dome moves up again. Tis is active at the start of expiration to encourage a

smooth slow start to the elastic recoil of the lung.

21. The fresh oxygen which us sucked in percolates the minute sacs (the alveolar sacs) which form the basic unit of the lungs. The membranes round these alveoli convey this oxygen into the blood stream and then the carbon dioxide from the blood into the air of the lungs for ns disposal through exhalation. The blood with fresh oxygen is carried by arteries from the left side of the heart to cells in every nook and corner of the body, thus replenishing their store of life giving oxygen. The waste products (mainly the carbon dioxide) thrown out by each sac are then taken by the venous bloods stream from the right side of the heart to the lungs for disposal. The heart pumps this blood through the body at an average rate of seventy times per minute. Hence to breathe properly we need the smooth co-ordination of all the relevant parts of the body, the power or controlhouse (the nervous system), the bellows (the lungs), the pump (the heart) and the plumbing system(the arteries and veins), besides the driving motor of the rib cage and the diaphragm.

The Chest

22. the chest is the cages formed by the ribs in which the lungs and heart arc located. It is shaped like a truncated cone, narrow at the top and widening below. The top is closed off by the muscles of the neck attached to the clavicles. The wind-pipe (trachea) passes through it on its way from the throat to the lungs. This truncated cone is slightly flat from front to back. Its bony surfaces include the thoracic part of the vertebral column in the midline at the back and the breast plate in the front. It has twelve pairs of flattened ribs which curve across the gap between the spine at the breastbone in front to form semicircular bridges on each side. The spaces between the ribs are filled by internal and external intercostal muscles. There are, in addition, muscles joining the twelfth rib to the pelvis and the first one to the cervical spine. There are eleven pairs muscles in all. The expansion and contraction of the chest are controlled by these muscles and the diaphragm. The thoracic dorsal area is like the broad midsection of a banana leaf, the spine being the stem, the evenly spaced ribs being the veins and the tail bone the thin end of the leaf (pls 1&2)

The lungs and the Bronchial Tree

23. The right and left lungs differ in shape and capacity. In most of us the bulk of the heart, which is about the size of a fist, is on the left side. Consequently, that lungs is smaller. It is divided into two lobes, one above the other, whereas the right lung has three lobes. (Fig.5)
24. The lungs are covered with a membrane called tbc pleura and due to their shape expand rather like the bladder of a football.
25. The dome of the right diaphragm is higher than the left. Beneath it is the liver, the largest solid abdominal organ, less compressible and depressible than the stomach and spleen lying below the left diaphragm. In full inhalation, when attempting to fill the lungs, most people can feel a sense of increased resistance below the right side of the diaphragm, where the liver is, when their attention is drawn to the area. In order to equalise the filling of bot lungs from base and side, special effort and attention must be directed to diaphragmatic and chest wall movements on the right side.
26. The bronchial system, connecting the windpipe and the alveoli, is in the thoracic cage. It resembles and inverted tree with its roots in the gullet, while the branches spread out downwards towards the diaphragm and the side walls of the chest cavity.

27. The windpipe in the throat is a tube about four inches long and less than inch wide, which branches out into two primary bronchi, one leading into each lung. Both then branch out into numerous tiny air-passages called the bronchioles. At the end of each of these bronchioles are the alveoli, the tiny air sacs clustered like bunches of grapes, some 300 million lining each lung, their surface covers about eighty to one hundred square yards- forty to fifty times that of the human skin.
28. These alveoli are small, multiple sac like chambers with an incomplete lining of cells. The gap between the cells (the interstitial space) is filled with fluid. Around the outer wall of the alveoli lie minute blood vessels (the capillaries). Exchange of gases takes place between the alveoli and the red blood cells and plasma of the blood via the fluid in the alveoli or interstitial space.
29. The air in the alveoli contains more oxygen and less carbon dioxide than the blood passing through the capillaries in the lungs. During the exchange of oxygen and carbon dioxide, the molecules of oxygen diffuse into, and carbon dioxide out of, the blood.

The Spine

30. The spine should be kept firm the trunk of a tree. The spinal cord is protected by thirty three vertebrae. The seven vertebrae in the neck are called cervical. Below them arc the twelve dorsal or thoracic vertebrae which are connected to the ribs, forming a cage to protect the lungs and the heart. The ten top ribs on either side are joined in front to the inner side of the breastbone but not the two floating ribs below. The floating ribs are so called, as they are not anchored to the breastbone. Below the dorsal are the lumbar vertebrae and lower still the sacrum and coccyx, both formed of fused vertebrae. The lowest coccygeal vertebra curls forward.

The Breastbone

31. The breastbone has three ports. In breathing, the top and bottom should be kept perpendicular to act a support for lifting the side ribs like the handle of a bucket, and so create more space through the expansion of the lungs sideways and upwards.
32. The lungs open sideways and space for expansion is created with the help of the intercostal muscles. Keep the interior intercostal muscles at the back firm. lf the skin at the back does not co-ordinate with the intercostal muscles, berating becomes shallow, reducing the intake of oxygen, causing physical weakness and lack of bodily resistance.

The Skin

33. As a drummer tightens the skin of his drum to get resonance and a violinist tightens his strings to get resonance and a violinist tightens his strings to get clarity of sound, the yogi adjusts and stretches the skin of his torso to create maximum response from the intercostal muscles to aid the respiratory process when practising pranayama.
34. The floating ribs, not being fixed in front to the sternum expand like a pair of calipers to create more space in the chest. Laterally, the thick middle ribs can also expand laterally, thus widening and lifting the rib-cage. This does not affect the top ribs. To fill the uppermost reaches of the lungs requires training and attention. Learn to use the upper inner intercostal muscles and the top part of the sternum. Expand the rib-cage from the inner frame outwards, as this will stretch the intercostal muscles.

The Diaphragm

35. The diaphragm is a large dome-shaped muscle-like partition which separates the thoracic cavity from the abdominal one. Anchored all around the circumference of

the lower thoracic cage, it is attached at the back to the lumbar vertebrae, at the sides to the lower six ribs and in the front to the dagger shaped cartilage of the breastbone. Above it are the heart and lungs and below it the liver on the right and the stomach and spleen on the left.

Accessory Muscles

36. The respiratory muscles of the throat, torso, spine and abdomen are the accessories used in breathing, which is ordinarily dominated by the diaphragm. Besides the muscles already described, those of the neck, especially the sternomastoids and the scalenus, play their parts. They contribute very little to quiet breathing, but become active when the rate or depth is increase and rigid when the breath is held. The use of accessory respiratory muscles varies from one individual to another. It also varies from time to time in the same person, depending on how powerfully he exerts in his breathing and how efficiently and how tensely.
37. We all breathe, but how many of us do so correctly, with attention? Bad posture, an ill-shaped or caved-in chest, obesity, emotional disorders, various lung troubles, smoking and uneven use of the respiratory muscles, lead to improper breathing, below one's capacity. We are aware of the discomfort and disability which then arise. Many subtle changes take place in our body as a result of poor breathing and bad posture, leading to heavy breathing, inadequate pulmonary function and aggravation of heart disease. Pranayama can help to prevent these disorders and help to check or cure them so that one can live fully and well.
38. As light radiates from the disc of the sun, so air is spread through the lungs Move the chest up and out. If the skin over the centre of the breastbone can move vertically up and down and it can expand from side to side circumferentially, it shows that the lungs are being filled to their maximum capacity.

Anatomy

CELLS & TISSUES

Biological Organization

1. The human body is made up of **Systems**
2. Systems are made up of the **organs**
3. Organs are made up of **Tissues**
4. Tissues are made up of **Cells**
5. Cells

DEFINITIONS

1. **Cells:** The smallest biological structure, which is able to exist independently.
2. **Tissues**: The group of cells which share a common structure & function
3. **Organ**: Made of different types of tissues and has a unique function
4. **System**: A group of organs which work together to form specific functions.

CELLS STRUCTURE:

1. **Cell Membrane**: Outer, protective layer of a cell consisting of proteins and lipids.
2. **Cytoplasm**: Liquid substance surrounding nucleus within the cell membrane.

3. **Mitochondria**: Rod shaped structures containing enzymes which provide energy.

4. **Golgi Body**: Smooth, irregular structure containing enzymes, proteins and lipid

5. **Nuclear Membrane**: Double layered membrane around nucleus.

6. **Nucleus:** Largest cell structure containing chromosomes, DNA and protein.

CELL FUNCTION:

1. **Cell Membrane:** A semi-permeable outer shell which allows selective permeability by other substances.
2. **Mitochondria**: Contain enzymes which concert raw materials into energy.
3. **Golgi Body**: Produces collagen and mucus
4. **Nucleus** "The control centre" of all cellular activity.
5. **Respiration**: Cell take in oxygen and glucose to produce energy in form of heat. Waste products are carbon dioxide and water.
6. **Excretion**: Waste products of respiration must be excreted.
7. **Reproduction**: Cell nuclei divide into two and a new cell is formed, this is mitosis.
8. **Irritability**: Cells respond to stimuli in the form of electrical, thermal or chemical.

HUMAN TISSUE

There are four types of human tissue. Each has a particular structure and function:

1. Epithelial Tissue
2. Connective Tissue
3. Muscular tissue
4. Nervous tissue

Epithelial Tissue:

1. Provides lining for internal and external surfaces
2. Protects from wear and tear
3. There are different types of epithelial tissue found in different areas of the body.

   a. **Simple pavement epithelial tissue**: Line the blood vessels

   b. **Simple Cubical epithelial tissue**: Covers the ovary

   c. **Simple Columnar epithelial tissue**: lines the stomach and intestine.

   d. **Ciliated epithelial tissue**: lines the respiratory tract.

   e. **Stratified epithelial tissue:** lines the mouth and forms skin.

   f. **Transitional epithelial tissue**: lines the bladder.

CONNECTIVE TISSUE

Connects and supports other types of tissue. Consists of

1. **Living cells**: e.g. Blood vessels
2. **Non-living fibres**: Collagenous fibres and elastic fibres

   a. Collagenous fibres provide strength

   b. Elastic fibres provide elasticity

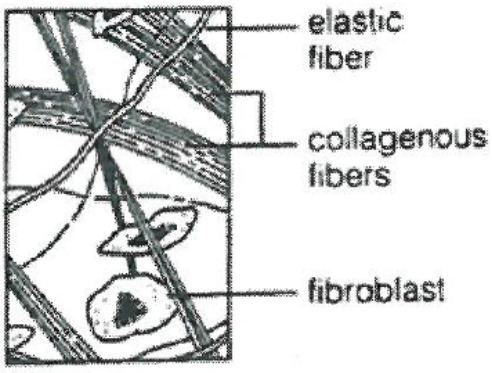
Three common types of cells:

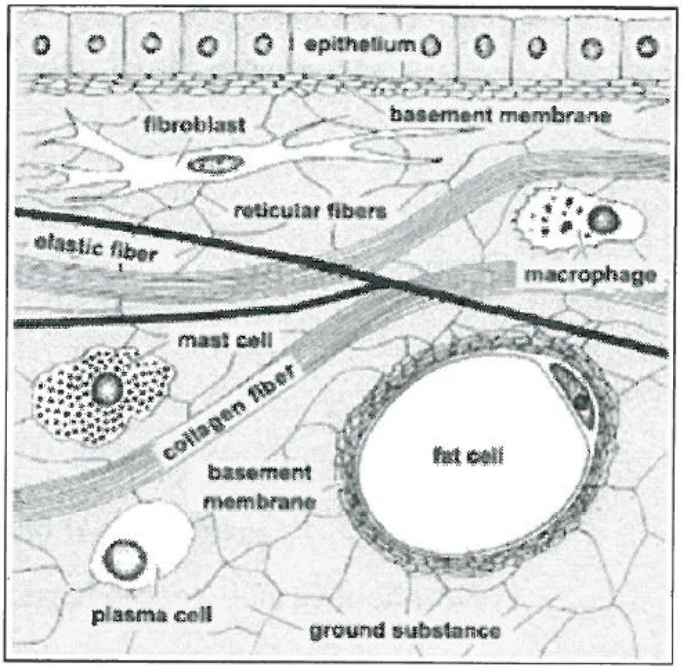
1. mast cells (prevents blood clots)
2. macrophages (phagocytise) and
3. fibroblasts (most abundant, produce fibres)

Main types of fibres:

Collagenous fibres: thick, made of protein collagen, major structural protein in the body, appear in long parallel bundles. Strong, flexible, but not very elastic, also known as white fibres. (bones, ligaments, tendons)

Elastic fibres: micro fibrils in protein elastin, yellow fibres. Not as strong, but very elastic (respiratory and vocal cords)





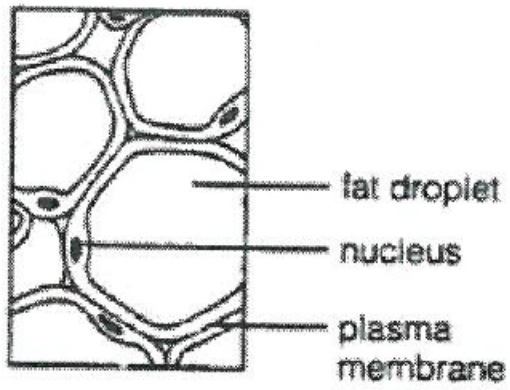
Five Types Of Connective Tissue:

1. LOOSE CONNECTIVE TISSUE or AREOLAR TISSUE

binds skin to underlying organs and organs to organs, space between muscles, throughout body

2. ADIPOSE TISSUE

FAT, beneath skin, around kidneys and eyeballs, abdominal membranes. Function: Protective cushion, insulation to preserve body heat, stores energy, cells are called adipocytes



3. FIBROUS CONNECTIVE TISSUE

Dense tissue, closely packed, thick collagenous fibres and fine network of elastic fibres. Few cells, poor blood supply, thus slow healing.

Tendons- connect muscles to bones

Ligaments- connect bones to bones

Cartilage (all cartilage cells are called chondrocytes)

a. **Hyaline Cartilage** - very fine white (collagenous) fibres. Most common cartilage. Covers ends of bones and joints, noise, respiratory passages.
b. **Elastic Cartilage** - more flexible and elastic, external ear and larynx
c. **Fibro cartilage** - very tough, large numerous collagenous fibres. Intervertebral disks,

4. **BONE TISSUE** - Osseous tissue. Rigid due to mineral salts.
Layers - lamellae, haversian canals, osteocytes

5. **BLOOD TISSUE** - circulates throughout the body

Main Five Types of Connective Tissue;

1. Loose connective tissue: lines between and within organs.
2. Adipose tissue: Protects and insulates internal organs, acts as food reserve.
3. Dense connective tissue: is fascia surrounding muscle and in tendons

4. Cartilage: Forms tough, elastic discs between vertebrae of the spine.

5. Bone tissue: is a specialized type of cartilage which forms strong, rigid bone.

MUSCLE TISSUE

1. Skeletal - skeletal muscles - voluntary (striated)

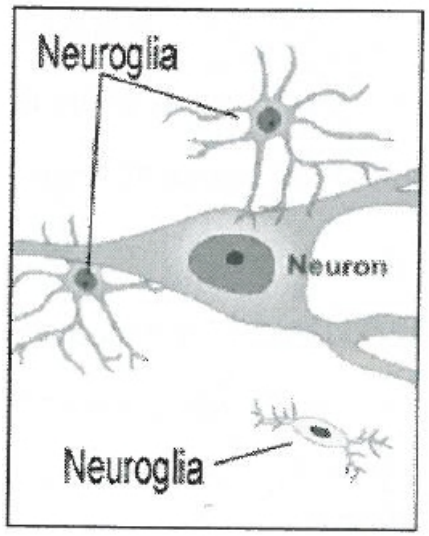
2. Smooth - in hollow organs, stomach - involuntary

3. Cardiac - wall of the heart

NERVE TISSUE

Found in brain, spinal cord, nerves

1. Neurons - transmit signals.
2. Neuroglia - protection, support



Anatomy

CELLS & TISSUES Continued

When the body is stressed the body creates acids, more gases and disease

A Cells are the fundamental building blocks of life 100 trillion cells. Nutrients go into the cells and are metabolized and turned into energy that fuels the cell.

B Any problems to the cells ability to allow nutrients in and the excrement of waste out will lead to the death of a cell.

C In terms of yoga the cells are part of
Prana- nourished a living entity and apana- refers to waste that is eliminated

D Nucleus: Largest cell structure containing chromosomes, DNA and protein.

E On the tips of the DNA are “telomeres” which serve as an eternal clock that determine the longevity of the cells. Science says that people with more “telomeres” are more youthful. What kills off the telomeres? Stress!

F B Yoga+ Pranayama ! reduces stress and Yoga+ Pranayama ! slows down the aging process of the “telomeres” on the DNA.

GB B Stress is a killer on the body; wreaks havoc with the cellular machinery

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The tissues which are a group of cells share a common structure+ function.

In terms of yoga we have connective tissues and connective tissues get torn + injured at times if in incorrect alignment or over usage of muscles in postures.

Tears in the shoulder joint for example, are painful and if untreated at the onset – sometimes surgery is needed. As yogis, we know that we do not need surgery for this because our bodies are like Pharmacies we can treat many things+ heal many injuries ourselves through yoga+ Pranayana.

In the book, “Science of Yoga” it states that a cure of a tear in the rotator cuff one can focus on inversions such as Dolfin + 1/2 headstand+ Full headstand.

A HUMAN TISSUE: Group of cells which share common structure+ function

B Which connective tissues of the body is commonly injured?

It Is in the shoulder joint

C The most flexible in the body. Due to the shallow ball + socket joint range of motion. Up, down, side, rotates. That is, movements in all planes and rotations are the basic movements available at the shoulder joint. Such as; flexion/extension, abduction/adduction and rotation.

D The tendons merge to form the connection

E Tears in the tendon are painful+ limit motion

F Amazingly, According the "Science of Yoga" doing the head stand, cures this problem. The two other important muscles had joined forces. That is training yourself to use different muscles by a modified head stand has benefits: No pain in the torn tendon

There are four types of human tissue. Each has a particular structure and function:

1. Epithelial Tissue
2. Connective Tissue
3. Muscular tissue
4. Nervous tissue

Epithelial Tissue:

1. Provides lining for internal and external surfaces
2. Protects from wear and tear
3. There are different types of epithelial tissue found in different areas of the body.
   a. Simple pavement epithelial tissue: Line the blood vessels
   b. Simple Cubical epithelial tissue: Covers the ovary
   c. Simple Columnar epithelial tissue: Lines the stomach and intestine.
   d. Ciliated epithelial tissue: lines the respiratory tract.
   e. Stratified epithelial tissue: lines the mouth and forms skin.
   f. Transitional epithelial tissue: lines the bladder.

CONNECTIVE TISSUE

Connects and support other types of tissue. Consists of

1. **Living cells**: e.g. Blood vessels
2. **Non-living fibres**: Collagenous fibres and elastic fibres
   a. Collagenous fibres provide strength
   b. Elastic fibres provide elasticity

Three common types of cells:

1. Mast cells (prevents blood clots)
2. Macrophages (phagocytise) and
3. Fibroblasts (most abundant, produce fibers)

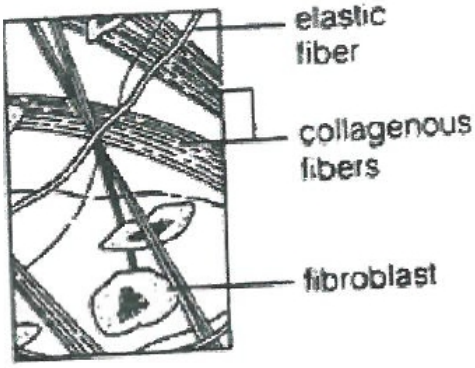
Matter is very dense

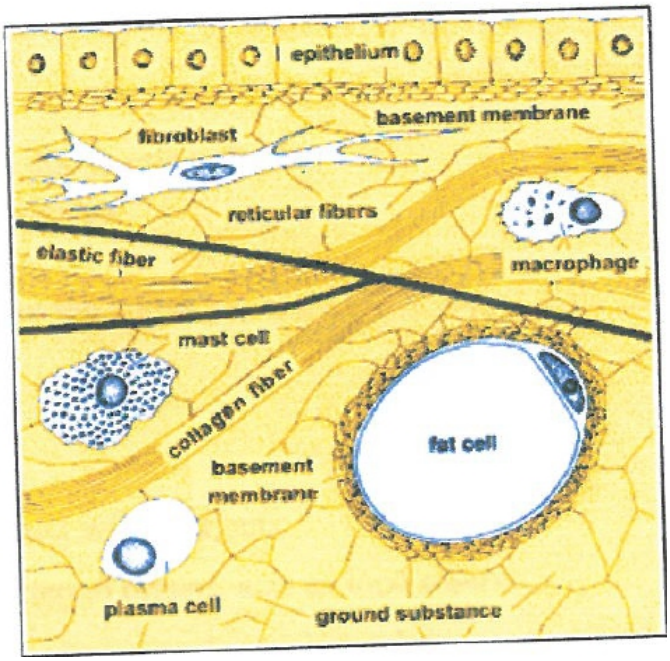
Fasting, Pranayama and detoxing drinks such as lemon water +salt can help remove toxins
Fasting +YOGA is a detox it eliminates the acids amino acids.

Main types of fibres:

Collagenous fibres: thick, made of protein collagen, major structural protein in the body, appear in long parallel bundles. Strong, flexible, but not very elastic, also known as white fibres. (bones, ligaments, tendons)

Elastic fibres: micro fibrils in protein elastin, yellow fibres. Not as strong, but very elastic (respiratory and vocal cords)





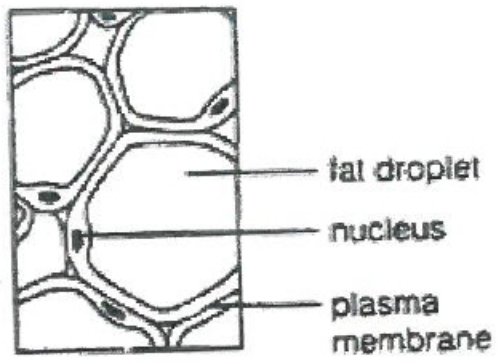
Five Types Of Connective Tissue :

1. LOOSE CONNECTIVE TISSUE or AREOLAR TISSUE

binds skin to underlying organs and organs to organs, space between muscles, throughout body

2. ADIPOSE TISSUE

FAT, beneath skin, around kidneys and eyeballs, abdominal membranes. Function Protective cushion, insulation to preserve body heat, stores energy, cells are called adipocytes



3. FIBROUS CONNECTIVE TISSUE

! Dense tissue, closely packed, thick collagenous fibres and fine network of elastic fibres. Few cells, poor blood supply, thus slow healing.

Tendons - connect muscles to bones

Ligaments - connect bones to bones

Cartilage (all cartilage cells are called chondrocytes)

a. **Hyaline Cartilage** - very fine white (collagenous) fibres. Most common cartilage. Covers ends of bones and joints, noise, respiratory passages.
b. **Elastic Cartilage** - more flexible and elastic, external ear and larynx
c. **Fibro cartilage** - very tough, large numerous collagenous fibres. Intervertebral disks, menisci

4. BONE TISSUE - Osseous tissue. Rigid due to mineral salts.

Layers - lamellae, haversian canals, osteocytes

5. BLOOD TISSUE - circulates throughout the body

Main Five Types of Connective Tissue;

1. Loose connective tissue: lines between and within organs.
2. Adipose tissue: Protects and insulates internal organs, acts as food reserve.
3. Dense connective tissue: is fascia surrounding muscle and in tendons
4. Cartilage: Forms tough, elastic discs between vertebrae of the spine.
5. Bone tissue: is a specialized type of cartilage which forms strong, rigid bone.

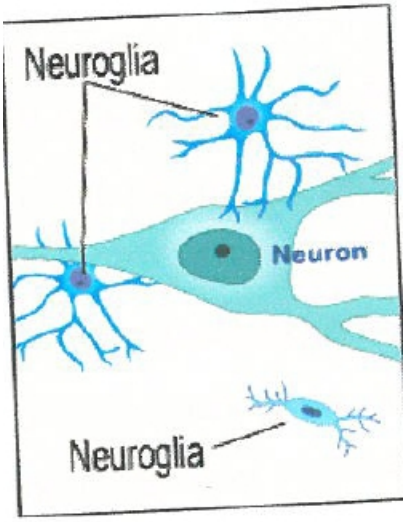
MUSCLE TISSUE

1. Skeletal - skeletal muscles - voluntary (striated)
2. Smooth - in hollow organs, stomach - involuntary
3. Cardiac - wall of the heart

NERVE TISSUE

Found in brain, spinal cord, nerves

1. Neurons- transmit signals.
2. Neuroglia - protection, support



- Learn about injury prevention
- PNF stretching
- The effect yoga has on the nervous system

PRANAYAMA

The idea that pranayama + fast breathing (Basktrika) bring in more oxygen to the body is a myth. Essentially, the yogi is blowing off tons of carbon dioxide. Pranayama does not increase the level of oxygen in the body. Carbon dioxide drops during fast breathing. Carbon dioxide increase in the body during slow breathing eg: Uiijayi.

THE RESPIRATORY SYSTEM

The Respiratory system deals with the exchange of gases between the external environment and internal environment of the body. Oxygen is taken into the body and carbon dioxide is eliminated from the body.

Please stress to your students to take it easy and to not over do the rapid breathing (Bastrika/ Kapalabhati Pranayama) because if overdone this can lead to respiratory alkalosis which heightens the excitability of the nerves and muscles- so much that many circuits short out , producing tingling in the hands + spasms in the muscles. Also, be careful and warn your students not to push themselves as it can lead to hyperventilation because of the drop on carbon dioxide. **B** But; Benefits of "Rapid breath of Fire": done in a safe, moderate way Bastrika+ Kapalabhati increases the vibrational energy of the body, clears the "granthis" (obstructions) in the body, heightens prana, raises kundalini in moderation excites the nerves creating a sense of calm, peace invigorates the liver, spleen, pancreas and abdominal- muscles. Digestion is improved. Sinuses drained and a sense of exhilaration.

Structure of the Respiratory System:

1. **Nose & Nasal Passages:** Allow for the passage of air from external to internal environment.
2. **Pharynx:** Tube leading from the cavity of the nose to the larynx.
3. **Larynx:** Tube leading from pharynx to trachea contains the voice box.
4. **Trachea**: muscular tube with rings of cartilage leading from larynx to a bronchus. Also know as a windpipe.
5. **Bronchi:** 2 muscular tubes leading to trachea, 1 to left lung and 1 to the right lung.
6. **Bronchioles:** Bronchi divide into many small branches called bronchioles.
7. **Alveoli**: many small sac like structures from the lungs. (Simple epithelium allowing quick diffusion of gases).
8. **Lungs:** 2cone-shaped sponge like structure on either side of the heart in the thoracic cavity. The pleural membrane, which are membranes surrounding each lung. It is composed of 2 layers, between the two layers is the pleural cavity which contains fluid, this prevents friction between the surfaces during breathing.
9. **Capillary Network:** network of blood vessels around the alveoli allowing for quick gaseous exchange between the lungs and the blood.

The Diaphragm:

This is a dome shaped muscle situated beneath the lungs separating the thoracic cavity from the abdominal cavity. It assists with the breathing process.

Mechanism of Respiration:

The movement of air in and out of the lungs is composed of 2 phases.

Inspiration: Taking air into the lungs

Expiration: Expelling air out of the lungs

Chief Muscles of respiration:

Diaphragm, intercostals

Other muscles that assist in respiration:

Stenocleidomastoid, pectorals major, abdominals

Inspiration/ Breathing in:

1. Stimulated by the phrenic nerve
2. Intercostals lift the ribs up and out, sternum swings forward
3. Diaphragm flattens and lowers
4. Lungs expand to fill the thoracic cavity as they fill with air.

Expiration/ Breathing out:

1. Vague nerve stimulates the relaxation of muscles and exhalation
2. Intercostals relax
3. Diaphragm relaxes into its usual dome shape
4. Lungs relax and expel air

Forced expiration:

1. Intercostals contract to lower the ribs
2. Air is forced out.

Cycle of Respiration:

1. Air is inhaled through the nose
2. Air passes via pharynx, larynx, trachea, bronchi, bronchioles into the alveoli of the lungs.
3. Oxygen passes from the alveoli to the capillaries to be taken to body cells.
4. Carbon dioxide passes from the capillaries to the alveoli to be exhaled.

Control of respiration:

1. The control is part nervous and part chemical.
2. Excess carbon dioxide in the blood stimulates centres in the brain.
3. Respiratory nerves control the diaphragm and intercostal muscles.
4. The muscles contract resulting in inspiration

The rate of respiration will change according to the body's demand for oxygen. Exercise or stress will increase the rate, relaxation, stillness will decrease the rate.

Gaseous Exchange:

1. All gases diffuse from areas of high pressure to areas of low pressure across a semi permeable membrane.
2. Oxygen at high pressure in the alveoli diffuses into the capillaries where there is lower pressure
3. Carbon dioxide at high pressure in the capillaries diffuses into the alveoli where, there is lower pressure.
4. Expired air therefore contains less oxygen and more carbon dioxide.

Inspired Air:

1. Nitrogen- 79%
2. Oxygen-21%
3. Carbon dioxide- 0.04%
4. Water Vapour/ other gases- trace

Expired Air:

I. Nitrogen-79%

2. Oxygen-16%
3. Carbon dioxide-4.5%
4. Water/other gases- trace

Chemical & Nervous Control of Respiration:

Chemical Control: Involves the release of hormones from the adrenal glands. Adrenalin passes into the bloodstrearm and helps the rate of breathing during stressful periods.

Nervous Control: Nervous system registers when the body requires oxygen by activating the diaphragm to contract so that breathing takes place.

Diseases and Disorders of the Respiration system:

Bronchitis- Inflammation of the bronchi .

Asthma- Spasm of the bronchi, which causes difficulty in breathing.

Pulmonary Tuberculosis- Contagious inflammation of the lungs.

Emphysema- Inflammation of the alveoli which reduces elasticity of the tissue and reduces blood flow.

Rapid breath of Fire

Bastriki- Light on Yoga BKS IYENGAR: Bhastrika means a bellow used in a furnace

The air is forcibly drawn in +out as in a blacksmiths bellows.

1. Therefore, first we prepare, close the eyes and look inwards
2. Exhale completely
3. Take a slow, deep steady breath through both nostrils

Fill the lungs up to the brim with air

* the entire abdominals from pubis to breast- bone should be pulled back towards the spine.

Hold breath for a second “Kumbaka”(breath retention) Observe Mula Banda (1st energy lock at perinium).

4. Exhale slowly, until lungs are completely empty

! take fast vigorous breath + exhale fast+ forcefully for 10 cycles. Last inhale on 10 “Kumbaka” hold breath for a second.

Chin down to chest. Relax. Take Rest Shavasana

60 minute Pranayama practice

Practice 10Rounds of Ujjayi= Victorious Breath

Practice 10 Rounds of Bastrika

Practice 10 Rounds of Kapalabahti

Teach Ujjayi in every yoga class

! Adverse side effects can occur when one pushes the body to physic logic extremes.

*Kids should not learn the forceful pranayama such as Bastrika; Rapid breath of Fire

* Ujjayi ok for kids.

(Ujjayi) ! Go through steps: Teach

Benefits of Ujjayi

Strengthens the lungs, removes phlegm, gives endurance when feeling tired, soothes the nerves and tones the entire body. Those who suffer coronary problems and high blood pressure can practice ujjayi for relief.