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Examensuppsats (thesis paper)

Oxygen, O　氧 yǎngqi

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* oxygen is Yang since it protects
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* oxygen is Yang but contains its opposite, the seed of Yin
* oxygen cannot be Yang without the matter Yin since the interdependence of Yang and Yin, energy and matter constitute two states of a continuum
* oxygen as Yin-Yang of two opposing states of density of matter and of two phases of a cyclical movement
* oxygen dependents on blood as Yang depends on Yin and blood depends on oxygen as Yin on Yang
* the mutual consuming of Yin and Yang, is reflected by the oxygen consumption in the organism

4. Oxygen and the theory of the Five Elements

* oxygen belongs to a *Metal* since it is governed by the *Lungs*
* as Metal *generates* the *Water* likewise oxygen nourishes the brain
* as *Metal controls* the *Wood* and the *Lungs* control the *Liver*, oxygen influences the muscles as well as stress (or anger)
* *Fire* element, the *Heart controls* and *balances* the *Metal* element, the *Lungs* thus promoting oxygen supply into the body tissues
* in the *insulting cycle* the *Metal* can counteract the *Fire*, consequently *Lungs* deprive the *Heart* of oxygen
* *Metal* is *generated* by the *Earth* thus likewise oxygenation can be nourished by our intellect (or focus)

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* central parallels (similarities) between:
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  * Eastern theory of *Yin –Yang* and Western knowledge of *oxygen*
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1.2 Method

* comparative analysis:
  * *oxygen* as a phenomenon in biomedicine
  * *oxygen* as a phenomenon in TCM

1.3 Terminology

In biomedicine *oxygen* as a chemical compound is studied mainly in three main forms:

* O_2
  * elemental oxygen, *O* in nature forms a compound, O_2 this form of *oxygen* is naturally used by all complex living organisms during *respiration* cycle
  * this form of *oxygen* for the most part is explored in this paper
* O_3
  * is called *ozone* and is formed when in the upper layer of the atmosphere UV energy causes *oxygen* atoms to temporarily recombine in groups of three
  * this form of *oxygen* comprises *earth's shield* and is used for *therapeutic* purposes in medicine
* H_2O_2
  * is called *hydrogen peroxide* and is formed in *cellular respiration* during *oxidation* process of O_2
  * this form of *oxygen* is produced by cells *peroxisomes*, constitutes an integral part of body's *defense* system, and is also used for *therapeutic* purposes
* O_3 and H_2O_2
  * are $_{only}$ partially explored in this paper

The Chinese character for *oxygen* 氧 *yang* comprises two parts [1]:

* 气 radical for *qì*, *air*, *gases* and 羊, short for 養 radical for *to nourish/foster* that can be interpreted as "a continuous supply of oxygenated air nourishes almost all animals" http://en.wikipedia.org/wiki/Chemical_elements_in_East_Asian_languages.

Since the *oxygen* as a particular form of *gas* was not mentioned in TCM sources, the *oxygen* as a phenomenon in TCM tradition is approached in this paper through the function of *breathing* as well as other processes that are involved to describe *oxygen functions* in *nature* and in a *human physiology*, namely *Qi Gong, Tai Ji, Dao Yin.*

As the only natural way of *oxygen* supply is through the lungs' function of *breathing* (also refered to as *oxygenation*), the *Lungs*, the *respiration* as well as the pathology of respiration *(hyperventilation, poor oxygenation/hypoxia)* are the other additional aspects that are explored to a certain extent in this paper.

In order to view the *oxygen* from the Western perspective the disciplines of *medicine* and *biology* are combined (and are called *biomedicine*) since the terminology as well as mechanisms of both sciences are employed in this paper.

The TCM *terminology* that is attributed to the *oxygen* as a substance is only relative and is not defying this substance per se. For example, if *oxygen* is defined as *Qi* it is only certain properties of *Qi* (ex *life energy, aggregation, dispersal*) that can describe *oxygen* by TCM tradition, not that *oxygen* in itself is *Qi*.

The *key words* as well as *TCM* and *biomedical terminology* employed in this paper appear in *italics* for easier and more efficient reading.
In order to more clearly distinguish between *biomedical* or *TCM* terms, the TCM terminology appears in *italics* as well as capitals *(ex Qi, Lungs, Metal, Body Fluids,*etc.)

1.4 Objective

The brilliance of Chinese philosophical and medical thinking lays in that all processes in *nature* as well as human *physiology* and even causes of *disease* could be understood through three simple yet profound *theories of Qi*, *Yin-Yang,* and the *Five Elements.* Thus *oxygen* as a natural phenomenon could be explained or associated with:

* qualities and functions of *Qi*
* *Yin-Yang* and four aspects of their relationship: *opposition, interdependence, mutual consuming* and *intertransformation*
* the dynamics of the *Five Elements*, namely their correspondences as in:
  * harmonious cycles: *promoting (nourishing)* and *controlling (acting upon, balancing)*

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[1] In the Traditional Chinese there are only four radicals used for chemical elements:

* 金 / 钅 (*jīn* "gold") for solid metals, 石 (*shí* "stone") for solid non-metals
* 水/ (*shuǐ* "water") for liquids, and 气 (*qì* "air") for gases

The names for *chemical elements* in East Asian languages, along with those for some chemical compounds (mostly *organic*), are among the newest words to enter the local vocabularies. Except for those metals well-known since antiquity, most elements had their names created after modern chemistry was introduced to East Asia in the 18th and 19th century, with more translations being coined for those elements discovered later.

* conflicting cycles: *overacting (attacking)* and *counteracting (insulting), affecting* (opposite of promoting ex. mother affects the son or vice versa) [2]

The *Five Element correspondences* are illustrated (in this paper) by *human physiology* as well as *pathological conditions* as defined by biomedicine.

According to an ancient *Taoist* observation human life depends on the unobstructed movement and transformation of *three main forces*, which manifest as three different substances or *energies*, the *Three Treasures*: *Jing,* sexual essence*; Qi*, vitality or life force; *Shen*, spirit. We receive these energies from our *parents*, from the *food* we eat, and from the *air* we breathe.

Taoist believe, that the process of *breathing* provides an entrance way and support for the various *other energies* that animate human being and have a*" powerful influence on the quantity and quality of these energies and thus on the quality and direction of our lives*" D. Lewis *The Tao of Natural Breathing*

The main component in *breathing* is *oxygen.* In the West *oxygen* derives from the Greek roots □ξύς *oxys* "*acid*", literally "*sharp*", referring to the sour taste of acids and -γόνος (-gonos) ("*producer*", literally "*begetter*"), because at the time of naming, it was mistakenly thought that all acids required *oxygen* in their composition. Among the chemical properties of *oxygen,* Western science mentions *life support*.

Oxygen was independently discovered by Carl Wilhelm Scheele, in Uppsala, in 1773 and Joseph Priestley in Wiltshire, in 1774, but Priestley is often given priority because his work was published first. For the past century this *element* has fallen under scrutiny of biological as well as medical science, expressly after German physiologist and medical doctor, two-time Nobel Prize winner (for *respiratory enzymes*) Otto Warburg was awarded in 1931 *Nobel Prize for Physiology or Medicine* concerning *intracellular combustion*: "*the fundamental vital process by which substances directly supplied to cells or stored in them are broken down into simpler components while using up oxygen"*. Warburg found that the presence of increased amounts of *oxygen* inhibits the spread of *cancer cells* and will eventually cause them to die. He stated that *cancer* is not compatible in a healthy *ph* environment full of *oxygen*.

Both TCM and biomedical science views on *oxygen* coincide since the former visions it as a '*support for the various other energies* as it "*animates human being"* and the latter assesses it as *"life support"*. The *goal* of this paper is to explore *oxygen* as phenomenon in a TCM tradition by relating it to a Western biomedical approach, explore the functions and properties of *oxygen* as disclosed by both sciences as well as try to "reconcile" these sciences in their view on *oxygen***.**

[2] Other aspects that define *Five Element interaction* but not included in this paper are the *Five Elements basic qualities, movements, seasonal cycle* as well as *affecting* cycle.

Chapter2. Oxygen through a biomedical approach

The phenomenon can only be understood through studying its attributes and functions. In order to comprehend the TCM view on *oxygen* as a *natural substance* it would be useful to explore this vital element from biological point of view, where seven main aspects (properties) of O_2 could be distinguished:

1 Oxygen transport (or gas exchange)

Oxygen enters our body as two atoms of gas, O_2. It exits either as two atoms of *gas* attached to a *carbon* atom as *carbon dioxide*, CO_2 or as one *oxygen* atom bonded to two *hydrogen* atoms as *water,* H_2O. The *gas exchange* process starts in the lungs when *oxygen* enters at its 21% concentration (the rest comprises *nitrogen* and *carbon dioxide* 0,03%). The *windpipe* carries the air from the nose and mouth into the lungs, where it branches through *bronchial tree* into the left and right lung. Each *bronchus* keeps dividing into smaller twigs, the *bronchioles*, which grow finer into *bronchioles* that are able to absorb the air. They lead into small ducts each ending in a cluster of small sacs which are tiny air cells known as *alveoli*.

The lungs contain some 600 million *alveolae,* providing an oxygen-absorbing surface of at least 55, 8 m^2 which is 25 times the total skin surface of the body. It is in the *alveolae* that *oxygen* passes from the *air* into the bloodstream and the *carbon dioxide* from the preceding breath passes from the bloodstream back into the *air*. The *exhaled* air consists of 16 % O_2 and 4 % CO_2. The *O_2 transportation* in the blood stream occurs solely with the help and presence of a *hemoglobin* molecule that is present in bloods' *erythrocytes*. This round trip biopathway of O_2 to the tissues and then bringing waste materials as CO_2 to the lungs for elimination, takes the only 30 to 45 seconds and can be summarized as follows: Table 1

In lungs capillaries:

* Inspired O_2 → alveoli: O_2 → capillary wall → plasma: O_2 dissolves →erythrocyte: O_2 dissolves via hemoglobin attachment → HbO_2 is formed →

In tissue capillaries:

* circulation carried HbO_2 → erythrocyte: O_2 dissolves → plasma: O_2 dissolves → capillary wall → interstitial fluid: O_2 dissolves → cell: O_2 is used in mitochondria →

In tissue capillaries:

* cell: CO_2 is produced → interstitial fluid: CO_2 dissolves →capillary wall → plasma: CO_2 dissolves → erythrocyte: CO_2 dissolves via hemoglobin attachment → Hb CO_2 is formed

In lungs capillaries:

* erythrocyte: $HbCO_2$ splits → CO_2 dissolves → plasma: O_2 dissolves → capillary wall → alveoli: CO_2→ expired CO_2

2 Oxygen as energy converter

This *oxygen* function implies the process of *oxidation* that involves *oxygen* combining with another substance, where electrons are transferred and result in changes in the chemical composition of both substances. *Oxidation* produces large amounts of energy in the form of *light, heat,* or *electricity.*

Initially *oxygen* is produced by *cyanobacteria*, *algae* and *plants*, and is then used in *cellular respiration* by all complex organisms. *Cellular respiration* is the opposite of *photosynthesis*. What plants do in *photosynthesis* to convert *sun energy* into *sugar* (stored in plant fiber), *cell respiration* does in reverse to change *sugar* into *kinetic energy* and *heat*. *Cellular respiration* within the body occurs through *oxidation,* or more precise, *combustion* process when *oxygen* converts energy from one chemical form (*glucose*) – by breaking down macromolecules of food – into another form (*ATP, adenosine triphosphate,*). For example, about 98% of our foods is made of *carbon*, *nitrogen*, *hydrogen* (and even *oxygen*). They give us energy by burning with *oxygen*.

3 Oxygen as fuel for life sustainment, energy production and propagation

Cellular respiration is driven by a circular sequence called the *citric acid cycle* or the *Kreb's cycle*. This process takes place in cells *mitochondria* where through the process of *glycolysis* and *electron transport chain* the energy stored as *ATP (*when it is synthesized from *adenosine diphosphate* (ADP)). When ATP is converted back to ADP, *energy* is released and the ADP is recycled along with the extra *phosphate* back into the system to be remade into ATP. In this process *O_2* functions as an excellent *electron sink,* capable of releasing large quantities of *energy* through the *oxidation* of *glucose*. *ATP* is the only type of molecule that can be recognized and used by all cells of an organism as an *energy source* anytime that energy is required.

In *aerobic cell respiration* the *oxygen* is used and the output of this process is: *carbon dioxide* $_2$*, water, heat*, execution of the *metabolic functions*, *electric impulse transmission* in *CNS, endocrine signaling* and *muscle contraction.* This happens essentially the same way in nerves, muscles, the heart, and all body tissues. When deprived of *oxygen*, *cellular respiration* comes to a halt within 2 minutes, and the cell dies.

The main function of *mitochondria* is not only to produce energy and metabolize macromolecules but also *synthesize* other substances in the organism. On Earth, with only a few exceptions, all *eukaryotic* organisms (those that have a nucleus) are obligate *aerobes*. They can rarely survive and can never reproduce in the absence of *oxygen*. For example, *mitotic cell division* depends on the contractile properties of the protein *actomyosin*, which only forms when *oxygen* is present. *Also H_2O_2* leads to an increased rate of *DNA replication* and *cell proliferation.*

4 Oxygen as a building block

If by biomedical tradition to split a human organism into atoms, one could obtain that *oxygen* is the most abundant chemical element by mass, constituting 65 % of a bodyweight, (after *carbon* 18,5% , *hydrogen* 9,5% and *nitrogen* 3,3% (the rest is shared between minerals 3,7 % and trace elements< 0,01%)) and a second most abundant chemical element by atoms after *hydrogen*. Because it comprises most of the mass in water, *oxygen* comprises most of the mass of living organisms. All major classes of structural molecules in living organisms, such as *proteins, carbohydrates*, and *fats*, contain *oxygen*, as do the major *inorganic compounds* that comprise animal shells, teeth, and bone.

5 Oxygen as a buffer and defense

It is known that one of the main reasons why complex living organism ceases to exist is the result of aging, where *acidation* of tissues prevails.

According to Dr. Sang Wang who stated in his book *Reverse Aging* (2002) that "*The two major categories of diseases are contagious diseases and acid-induced adult degenerative diseases … The accumulation of acids in our body, poor blood circulation and poor cell activity are cited as reasons to be the underlying reasons for the development of adult diseases* "

Our body uses *oxidation* as its first line of *defense* against harmful *bacteria, viruses, fungi*, and *parasites*. Many such toxins as well as cancerous cells are *anaerobic*. *Oxidation* breaks down the toxic cells into CO_2 and H_2O, and they are removed from the body through its normal processes of *elimination*, thus 70 % of body's waste products are eliminated through the lungs (while the rest are eliminated through the urine, feces, and skin). This protective function of *oxygen* could be observed through two main aspects.

The first is *peroxisomes*. Like *mitochondria*, these cell organelles consume *oxygen*, (although in much smaller amounts). *Peroxisome* undergoes reactions that remove *hydrogen* from various organic molecules including *lipids, alcoho*l, and various potentially toxic ingested substances. *Peroxisomes* are common in liver and kidney cells that break down potentially harmful substances. One of the reaction products is *hydrogen peroxide*, H_2O_2, that can be toxic to cells in high concentrations, but *peroxisomes* can also destroy H_2O_2, by turning it into water and thus prevent its toxic effects.

The second aspect is maintenance of *homeostasis,* where *respiration* regulates *gas exchange* and *blood pH (acid/base balance)*. *Gas exchange* is performed by the lungs by eliminating CO_2 and supplying *oxygen* needed for *ATP* (as mentioned above). The blood's *acid/base balance* is executed by the lungs as well as *buffers*. It is known that *pH* is the concentration of *hydrogen ions (H+)*. *Buffers* are molecules which take in or release *ions* in order to maintain the *H+ ion concentration* at a certain level. The most important *buffer* we have in our bodies is *carbonic acid* H_2CO_3, a mixture of *carbon dioxide* (CO_2) and *bicarbonate* ion (HCO_3):

* CO_2 forms carbonic acid (H_2CO_3) when it dissolves in water and acts as an *acid* giving up hydrogen ions (H+) when needed.
* HCO_3 is a *base* and soaks up hydrogen ions ($H+$) when there are too many of them

In short, *blood pH* is determined by a balance between *bicarbonate* and *carbon dioxide*:

* too much HCO_3 or too little CO_2 in the blood will cause *alkalosis*, so the body will try to breathe less (hypoventilate) to release HCO_3.
* too much CO_2 or too little HCO_3 in the blood causes *acidosis*.

For example, the CO_2 level is increased when *hypoventilation* or *slow breathing* occurs, such as in case of lung *emphysema* or *pneumonia*. The HCO_3 level is lowered by *ketoacidosis*, a condition caused by excess *fat metabolism* (ex *diabetes mellitus*). To counteract this the lungs breath more (*hyperventilate*), and release H+.

6 Oxygen as a cure

According to Frank Shallenberger, M.D., H.M.D., one of America's most respected oxidative practitioners, *ozone* O_3 and *hydrogen peroxide*, H_2O_2 therapies have been found to have the following effects on the human body:

"* they stimulate the production of white blood cells, which are necessary to fight infection.
* Ozone and hydrogen peroxide are veridical
* they increase oxygen and hemoglobin disassociation, thus increasing the delivery of oxygen from the blood to the cells
* ozone and hydrogen peroxide are anti-neoplastic, which means that they inhibit the growth of new tissues like tumors
* they oxidize petrochemicals
* they increase red blood cell membrane distensibility, thus enhancing their flexibility and effectiveness
* they increase the production of interferon and tumor necrosis factor, which the body uses to fight infections and cancers
* they increase the efficiency of the antioxidant enzyme system, which scavenges excess free radicals in the body
* they accelerate the citric acid cycle, which is the main cycle for the liberation of energy from sugars. It also breaks down proteins, carbohydrates, and fats to be used as energy
* oxidative therapies increase tissue oxygenation, thus bringing about patient improvement" N. Altman, *The Oxygen Prescription*,p.21

7 Oxygen deleterious effects

This dark side of *oxygen* manifests during *oxidation* process the *by-product* of which is the formation of *free radicals. Free radicals* are *atoms, molecules*, or *ions* with *unpaired electrons* in an *outer shell*, called *open shell* configuration (*atomic orbital* which is not completely filled with electrons), where *unpaired electron* is spinning in lonely orbit and searching for another *electron* to counterbalance it.

Stable molecules have *electrons* in pairs. To become stable, a *free radical* will steal an *electron* from a *stable molecule*, which then becomes a *free radical* itself. *Oxygen* has two *unpaired electrons* in separate *orbitals* in its *outer shell*. This *electron structure* makes *oxygen* especially susceptible to *radical* formation. This kind of molecular change results in cell damage, including *mutations*. To be more precise, *free radicals* can:

" * break off the membrane *proteins*, destroying a cell's identity
* fuse together membrane *lipids* and membrane *proteins*, hardening the cell membrane and making it brittle
* puncture the *cell membrane*, allowing bacteria and viruses easy entry
* disrupt the *nuclear membrane*, opening up the nucleus and exposing genetic material
* mutate and destroy *genetic material*, rewriting and destroying genetic information
* burden the *immune system* with the above havoc and threaten the *immune system* itself by undermining immune cells with similar damage" Nathaniel Altman, *The Oxygen Prescription*, p.13

To summarize, the vital functions of *oxygen* could be illustrated by listing damaging effects of *shallow breathing* (when not enough *oxygen* supply reaches the body tissues), [it]**:**

" * reduces the efficiency of lungs and thus the amount of oxygen available to our cells
* necessitates that we take from two to four times as many breaths as we would with natural, abdominal breathing, and thus increases energy expenditure through higher breath and *heart rates*
* retards *venous blood flow*, which carries *metabolic wastes* from the cells to the kidneys and lungs where they can be excreted before they do harm to the organism
* retards the functioning of the *lymphatic system,* whose job it is to trap and destroy viral and bacterial invaders, and thus gives these invaders more time to cause disease.
* reduces the amount of *digestive juices*, including the enzyme *pepsin*, available for the digestive process
* slows down he process of *peristalsis* in the small and large intestines. This causes toxins to pile up and fester throughout the digestive tract " Dennis Lewis *The Tao of Natural Breathing,* p. 42

In short, insufficient *oxygenation* weakens and disharmonizes the functioning of almost every major system in the body and makes us more susceptible to chronic and acute illnesses among those: infections, constipation, respiratory illnesses, digestive problems, ulcers, depression, sexual disorders, sleep disorders, fatigue, headaches, poor blood circulation, premature aging, and so on. Many researchers even believe that *bad breathing habits* also contribute to life-threatening diseases such as *cancer* and *heart diseases*.

Chapter 3. Oxygen and the theory of Qi

Oxygen is Qi

In Chinese philosophy there are following interpretations of *Qi*:

* its character indicates that it is something both *material* and immaterial: *'vapor, steam, gas' and 'uncooked rice'*
* has various translations: *'energy', 'material force', 'matter', 'ether', 'matter-energy', 'vital force', 'life force', 'vital power' 'moving power'*
* can assume different *manifestations* and be different *things* in different *situations*
* it is the fundamental *substance* constituting the *universe*, and its *changes* and *movement* produced of all the *phenomena*

In TCM *Qi* used in two major ways: (Maccioccia)

1 as *refined energy*:
* produced by the *Internal Organs*
* nourishes body + mind
* takes several *forms* depending on its location and function Ex.: Zong Qi: is in the chest, nourishes Heart + Lungs Ex.: Yuan Qi: is in Lower Burner, nourishes Kidneys

2 as *functional activity* of the *Internal Organs*

Applying this fundamental knowledge of *Qi* to that of *oxygen* one could draw following similarities:

Oxygen is Yang Qi since it marks the appearance and existence of life

In TCM *Yang Qi* refers to the body's *vitality* or its *functional activity* (ex.: warming function). When we are born our first action on this earth is to *inhale*, when we die our last action on this earth is is to *exhale*. From beginning to end our life is all immense *breath*.

Likewise in Western tradition, all life begins with *breath*. The *Book of Genesis* says: *"And the Lord God formed man of the dust of the ground and breathed into his nostrils the breath of life; and the man became a living being." Breathing* is technically known as *respiration*. In Western culture this word comes from Latin verb *spirare,* which means "to breathe." The same root yields the word *spirit*. The relationship between *breathing* and the *spirit* has been a subject of intense study to Eastern philosophers for thousands of years. The Indians recognized that states of *mind* and *spirit* can be profoundly influenced by how one breathes. In Sanskrit, *breath* is *prana,* or "*life energy" or "life force"* **Ex.:** ancient Greeks called the Soul *anemos* = 'wind or vital breath', and the Spirit *pneuma* = 'breath' **Ex.:** breathing exercises, *praaayama,* are basic yogic healing techniques

In TCM *breathing* is under reign of *Lungs* that house the *spirit*, *Po*. *Po* is a *Corporeal Soul,* the Yin (physical) part of a *human soul* and is a direct manifestation of the '*breath of life*' (Maccioccia) It is responsible for *physical sensations, feelings, all somatic expressions, hearing* and *sight*. It is formed at the *conception* and described as *entering and exiting of Essence*, *Jing*.

Just as in Western medicine we identify *breathing* with *life* where the first independent breath marks the life of a *newborn*, in Chinese medicine *breathing* is a manifestation of *Corporeal Soul*, which affects all *physiological functions* of the body and dies with body when the last *breath* is made.

Oxygen is Qi since akin manifestations of Qi it acquires *varying degrees of materiality*

In modern physics *Qi* corresponds to *energy* and *matter*: the material substance of the universe that has *mass*, occupies *space*, and is convertible to *energy*.

In its most *immaterial* form *oxygen* is obtained by us when inhaled as *gas* from air and is used by our cells to produce *energy (kinetic, thermal,* and *biological* i.e.in the form of *ATP)*. In its most *material* state *oxygen* can be found as a part of a compound of *macromolecules* of proteins, lipids and carbohydrates in the human body**.** Since these *molecules* comprise most of the tissue in the body, *oxygen* is a vital component to materials that comprise the body itself.

Oxygen is Qi since it like *Qi*:

* that is formed after birth ex unlike Jing, Essence, that primarily is derived parents before birth is inhaled after birth
* that is replenished easily on a day-to-day basis ex Jing is replenished with difficulty is replenished 12-13 times a minute ex 6-5 times a minute in breathing- exercise practitioners as we inhale
* that follows brief cycles: some yearly, circadian, some even shorter ex Jing follows very long cycles of 7 or 8 years *oxygenates* the body in cycles see below *ultradian* (nasal) *cycle*
* that moves /changes quickly from moment to moment ex Jing changes slowly/gradually over long periods of time *diffuses* rapidly into the cells as O_2 in *inhalation* and disperses as CO_2 in *exhalation*

Oxygen is Qi since it is a type of *biological energy*

The Chinese character, for *oxygen* 氧 yang qi, *to nourish the energy* reflects this relationship. In TCM Yang Qi is a life energy that sustains our being. Likewise in biology, *oxygen* is responsible for *birth*, *growth* and *development* of a biological cell or an *organelle* of a biological organism. In a high living organism this *biological energy* is stored by cells in the structures of molecules of substances such as *carbohydrates* , *lipids*, and *proteins*, which release *energy (ATP)* when reacted with *oxygen* in *cellular respiration*.

Oxygen is an integral part of *Heavenly Qi*

In TCM the *Lungs* govern *Qi* in general as well as *Zong Qi* in chest region by inhaling *Heavenly Qi, Le*. *Heavenly Qi* then combines with *Gu Qi,* thus *Zong Qi* and *Ying Qi* (related to Blood) are formed resulting in all *physiological activities* of the body Maccioccia, *The Foundations of Chinese Medicine*.

Heavenly Qi in *bioscience* could be related to a compound comprising two life essential properties, namely *oxygen* and *negative ions* (or *anions*), which have been extensively studied since the middle of the 20th century.

Taoists and *Qi Gong* masters believe that the process of *breathing* not only draws in the *oxygen* needed by the body to transform food into *chemical energy* through the flame of internal *combustion*, but that it also provides an entrance-way and support for the various other *energies* that animate our being. After the discovery by modern science that the earth's atmosphere is filled with life essential electrical charges called *ions*, rushed some Taoists identify *negative ions* with those "other *energies",* which is *Qi.*

Ions are either *positively* or *negatively* charged atoms or parts of molecules. *Negative ions*, which are tiny packets of almost pure electrical energy, are formed naturally by interactions of the *sun's energy* with our *atmosphere*, as well as by *cosmic particles*, *lightning*, *storms*, *winds*, the *evaporation* and movement of *water*, and low levels of *radioactivity* coming from the earth.

"Thousands of scientific studies have shown that *ions*, especially negatively charged ones—those which carry an extra electron—are extremely important to our health. In commenting on research that was done in France in 1966, for example, one author writes that "in the lungs the presence of *negative ions* favors the passage of *oxygen* through the *air cell membranes* so that this *oxygen* is more efficiently absorbed by the blood. At the same time, the removal of *carbon dioxide* is also made easier. … Negative ions have been shown to increase brain *serotonin*, a neurotransmitter associated with more relaxed moods" Dennis Lewis *The Tao of Natural Breathing,* p. 79. As it could be supported by the research the *oxygen* and *ions* inhaled as *Heavenly Qi* work together on behalf of *well being* of an organism.

Oxygen is Qi since it performs all its major functions such as: *transformation, transportation, protection and warming*

In Chinese philosophy the process of *transformation* happens with *aggregation* and *dispersion of Qi*. *Oxygen* enters our body as gaseous *inorganic compound*, O_2 subsequently it *transforms* into and exits lungs as *organic* CO_2. To be more precise, when *oxygen* enters Lungs in the form of *gas* it then *aggregates* by binding to a *hemoglobin* molecule in an *erythrocyte*, thus becoming the integral part of blood. Then in the body organs it performs the *transformation* function, known as *cellular respiration* where cell's *mitochondria* transforms *sugar* and produces *ATP*.

In this nature, the *mitochondria* of a digestive tract cells uses *oxygen* to break down the food. This *transformation* occurs when *oxygen* is combined with *carbon* (from food) in a slow-burning fire. The *energy* released from the interaction of *oxygen* and *carbon* is transferred to energy storage molecules, ATP.

Likewise the *smooth muscles* that line the digestive tract use *ATP* for their contraction thus *transporting* nourishment through the intestines. Similarly the *mitochondria* in tubuli cells in kidneys *transform* water into "pure part" that goes back to plasma, to *intercellular* as well as *extracellular fluid*, while "waiste part" is sent down to bladder and is then excreted as the urine. The waste products of this *aerobic respiration* are then *transformed* to form H_2O and dispersed again as CO_2.

The ancient Chinese view on body's physiology was thousands years ahead when it postulated that *transformation* is a process where material, dense forms of matter ex food / fluids need the power of *Qi* to be transformed into more subtle forms of matter, thus:

* Stomach-Qi rots and ripens food
* Spleen-Qi transforms food into *Gu-Qi* then is transformed into *Zong Qi*
* Kidney-Qi transforms *fluids*
* Bladder-Qi transforms *urine*
* Heart-Qi transforms Food-Qi into *Blood*
* Lung-Qi transforms air into *True Qi, Zhen Qi*

In TCM *warming* is provided by *Yang-Qi,* whose source is *Kidney-Yang* and *Minister Fire* primarily. This fire gets replenished by *oxygen* acquired from the process of *respiration*.

The oxygen *warming function* can be observed in cell's biology as well. It is known the skeletal muscle cells have the largest (after heart cells) amount of *mitochondria*, hence their great capacity to utilize *oxygen* and *transform* it into its own ATP in order to produce *kinetic energy* (or movement) and *thermal energy* (control of body temperature). The *protection* function of *oxygen* is discussed in sections *Wei Qi and Oxygen is Yang since it protects*

The oxygen could be viewed as an integral part of the following forms of Qi:

Yuan Qi

In TCM this type of *Qi* is a motive force, *Dong Qi* originating between the Kidneys. It represents the *transformation power of Qi* in all *Internal Organs* and result of such *Qi transformation* is the production of *all kinds of Qi*: *Ying Qi, Wei Qi, Blood,* and *Body Fluids*. *Yuan Qi* shares its role (along side Tripple Burner) of providing *heat* necessary to all the body's functional activities. It also provides *heat* for *digestion and transformation of food.*

Likewise, in biomedicine *oxygen* ignites the processes in *mitochondria* activating all *physiological functions* resulting in the *thermal energy* and *kinetic energy* (movement) production in skeletal muscle cells, breaking down of food molecules, replication of the DNA, a new cell birth as well as self sustainment.

Zong Qi

Also called as *'Big Qi of the Chest*, *Zong Qi* derives from interaction of *Gu-Qi* with *air* and collects in the chest area, *'Sea of Qi'* where Lungs and Heart reside.

Zong Qi assists Heart as well as Lungs to *transport Qi* and *Blood* to limbs, especially into the hands since it enhances and promotes:

* Lung's Qi controlling and respiration
* Heart's governing of Blood, blood vessels, blood circulation to extremities.

In TCM *Zong Qi* is treated via Heart and Lung channels as well as *breathing exercises* which are an integral part of *Qi Gong*.

Likewise in the West the *aerobics* is an integral part of body fitness, which implies the lungs increased *elasticity* and in turn its *oxygen intake capacity* as well as heart muscle strength. As aerobic capacity of lungs increases, through training, the strength of heart muscle increases, along with the openness of blood vessels, the pulse rate goes down. With each heartbeat pumping more blood, and blood of higher quality, fewer beats are needed to supply the needed oxygen. Thus the health of heart and lungs is ensured.

Ex A typical decrease in resting rate of 75 heartbeats a minute to 60 a minute. With a drop "from 75 to 60, you'd have 15 beats per minute fewer, 900 beats per

hour" fewer1 211600 per day and 7,884, 000 per year.

Wei Qi

According to TCM, *Wei Qi* is a coarse form of True Qi, *Zhen Qi* (the *Qi* that circulates in the channels and nourishes the organs) and is *Yang* in relation to *Ying Qi*. *Wei Qi* is diffused under the skin, thus falling under Lungs' control. It circulates in outside channels in *cou li space* (space between the muscles and skin), that constitutes the *'Lung-Defensive Qi Portion'*. *Wei Qi* warms, moistens, and protects **ex** *Ying Qi* is in the Interior and nourishes. It partially nourishes skin and muscles, is mixed with sweat in *cou li space*, regulates opening/closing of pores, thus controlling *sweating*, body *temperature* and *protecting* our organism from outside coming pathogenic factors.

Protection which is primarily executed by *Wei Qi* (beside ying qi and kidney-essence) by irrigating into *exterior energetic layers* of the body could be supported by body's anatomy and physiology, where protective function of *oxygen* lies within its being an integral part of *Wei Qi*.

Alike *Wei Qi, oxygen* travels in/out of the cells by *diffusion***.** The quality of the air that finally reaches the bloodstream is controlled, to some extent, by protective mechanisms contained in *air passages*. Mucus in the nasal passages, trachea, bronli, and bronchioles traps some of the foreign particles in these airways.

In addition, the bronchioles have *smooth muscle*, which can contract and expand to control the amount of air passing and from the *alveolar*. *Sneezing* and *coughing* mechanisms, as well as *bronchiole contraction*, provide the ways of clearing the airways of foreign matter. Certain *antibodies* also populate the linings of the airways and, to some extent, can neutralize respiratory *bacteria* and *viruses*. All of these mechanisms help safeguard the airways or the passage of life-giving *oxygen*.

The *protective* function of *oxygen* **in** biomedical research was also recognized when *fatigue* (a result of insufficient energy production of mitochondria, that uses *oxygen* as a primary source for their function) was observed as a major symptom nearly of all *viral infections*. Viruses depend upon the *energy* of other entities in order to sustain themselves since they have no energy-producing mechanisms. Once inside the cell they quickly tap into *mitochondria* that are the source of all *biological energy*. Viruses divert this energy i.e., to fuel their own reproduction, inflicting harm both by draining our *energy* and by damaging our cells as they multiply.

The data published in *Biological Psychiatry* confined that *futile breathing* can result in a decrease in the ratio of *T-lymphocytes*, both the *helper type T-lymphocytes* of the *suppressor type*. This is the sort of situation that, in extreme, may lead to AIDS and, in milder form, constitutes the compromised *immunity*, that makes one more vulnerable to a wide range of *infections*. S.S. Hendler, *The Oxygen breakthrough*

As it was previously stated *peroxisomes* can eliminate viral infection by consuming small amounts of *oxygen*. Additionally *phagocytosis* in immune cells happens through engulfment of *pathogenic material* (viruses, bacteria, dead tissue cells, cell debris), which is facilitated by the *actin-myosin* contractile system, which in turn fully depends on *oxygen* presence.

To summarize one could draw a conclusion by saying that *oxygen* as a *refined energy* and *functional activity* of the *Internal Organs* manifests when *oxygen* after entering the body by the power of *oxidation* process is *refined* into the energy of *ATP*, which in turn is used by cells for the *functional activity* of the *Internal Organs.*

The research held by *Department of Acupuncture and Massage, Hubei University of TCM* could serve as a support to the above stated correspondences between the *Qi* and that of *oxygen.* The relationship between *oxygen metabolism* and the concept of *meridianal Qi* was investigated by applying the theory of *TCM, biomedicine* and *experimental medicine*. The *hypothesis* concerning this relationship was expounded and verified by *experimental* and *theoretical analysis*, where according to the knowledge of *oxygen metabolism* and the *theory of meridians* and *meridianal Qi*, it is held that both *Qi* and *oxygen* have extreme high similarity in both *physiology* and *pathology* on *material*, *functional* and *informational* level, namely:

" * the essence of meridian qi in Chinese medicine is closely related to *oxygen* and the *metabolism of oxygen*

* the specific distribution of oxygen metabolism-related substance and its function may be one of the *essence* of the meridians and *meridian qi*

* *oxygen* and *vertebrate globin* are probably the main contents of the "*qi-blood*" in Chinese medicine

* the mechanism of qi regulation with acupuncture-moxibustion may be fulfilled by the regulation of general and local state of *oxygen metabolism*"

http://www.ncbi.nlm.nih.gov/pubmed/22493934

Chapter 4. Oxygen and the Yin –Yang theory

Oxygen is Yang since it has function and properties of Qi

According to the ancient Chinese thought, Yang is *immaterial* and *produces energy*. It is also a *functional activity* of the *Internal Organs*, it *generates*, creates *light* executes *warming, protecting,* and *transforming* Yang/Qi.

Oxygen is Yang as it gives light and warmth

Most *oxidation* produces large amount of *energy* Yang. By the law of chemistry a result of any chemical reaction where *oxygen* is present, is *energy* production with an obvious presence of a *thermal energy* Yang. Additionally, the chemical test for *oxygen* is to put a glowing splint into the *gas*. If the *gas* is *oxygen* the splint will relight Yang. *Oxygen* will also make anything already burning in air burn much more efficiently Yang within Yang or Yang in its outmost Yang .

Oxygen is Yang since it protects

Similarly to Yang, an ethereal substance that raises the *oxygen protective* function is expressed in *superior* Yang and *exterior* Yang layers of the body. This biological phenomenon can also be observed in the very high parts Yang of the atmosphere, where about 12 -24 km above the Earth's surface, *ultraviolet radiation* from the sun causes some of the *oxygen*, O_2 to react and form *ozone*, O_3. This layer of O_3 absorbs *UV light* and reduces the amount that reaches earth's surface and that can damage *DNA*, causing *cell mutation* and the *destruction* of a living organism.

In TCM, the *Lungs*, the uppermost organ in the body are called as a *Magnificent Lid*. By descending its *Qi, Lungs* ensure that the *Wei Qi* and *Body Fluids* diffuse to *cou li space* (the most exterior part of the body), thus *protecting* from *exterior* pathogenic factors and that all organs receive nourishment of *Qi, Blood* and *Body Fluids*.

Oxygen is an integral part of *Wei Qi* (as discussed previously) . The *yang-protective* function of *oxygen* could also be supported by the fact that one of the body's *defense systems* comprises *macrophages* that are present in most abundant amount in *mucus membranes* of *respiratory organs* as well as lungs' *alveoli*.

An *alveolar macrophage's* (or *dust cell*) activity is very high, because they are located at one of the major boundaries between the body and the outside world. One of the most important roles of the *alveolar macrophage* is the removal of *necrotic* cellular debris (by-products of a human metabolism as well as genetically programed dead cells). Through activation of membrane *enzyme* systems that lead to a stimulation of *oxygen uptake* Yang (known as the *respiratory burst*), and *oxygen's* reduction to *reactive oxygen species* Yang substances that are *highly toxic* for the microorganisms *(ex H_2O_2) alveolar macrophage*s perform intracellular killing of viruses, bacteria, fugae and *metabolic wastes* of *intracellular respiration.*

Additionally, the *Langerhan cells*, are the types of *lymphocytes* that are carried to *epidermis* (part of *cou li space*) by *lymphatic system* (part of *Body Fluids* (in Latin *lympha* means "water goddess")) to prevent microorganisms from entering the body. *Langerhan cells* are also found in *lymph nodes.* It is useful to note that, according to a biomedical research, *lymphatic flow,* hence the supply of tissue with *lymphocytes* is stimulated by active usage of lungs, i.e., *deep breathing*.

Lymphocytes use *oxidation* Yang as its first line of defense against harmful *bacteria, viruses, fungi* and *parasites*. Moreover adequate *breathing* (*oxygenation*) balances *blood ph* thus ensuring protection Yang against *cancerous* cells, that cannot survive in the presence of oxygen, as well as accumulation of by-products of human *metabolism* that can be potentially toxic.

Oxygen in mitochondria (powerhouses) is at its outmost Yang (or acts as Yang within Yang)

It is interesting to note that the whole idea behind the process of *ATP* production is to get as much *ATP* out of *glucose* (or lipids and proteins) as possible. In most tissues, the "*powerhouses*" consume 90 % of the *oxygen* that enters the body. If we have no *oxygen* (as in *anaerobic breathing*), we get only 4 molecules of ATP for each *glucose* molecule (in *glycolysis*). However, if we have *oxygen* (as in *aerobic breathing)*, then we get to run the *Kreb's cycle,* which produces many more *hydrogen* ions that can run *ATP* pumps. From the *Kreb's cycle* we get 24-28 ATP molecules (plus the 4 molecules we got out of glycolysis). Thus, one can appreciate how much more *energy* Yang we can get out of a molecule of *glucose* if our *mitochondria* have oxygen Yang.

Oxygen is Yang but contains its opposite, the seed of Yin

By description of the science of chemistry *oxygen* gas Yang is colorless, odorless, and tasteless. Liquid and solid Yin *oxygen* is pale and blue Yin.

The primary effect that *breathing* has on the body is *oxidation* where *oxygen* combining with other substance results in the transformation of both. The product of *oxidation* Yang include: *burning* Yang, *respiration* Yang, and *combustion* Yang but also *corrosion* Yin or *decay* Yin.

Oxygen enters our body as a gas Yang and exits the body as either organic gas, CO_2 Yin within Yang (i.e. there are 2 gas molecule + 1 carbon molecule) or as water H_2O Yang within Yin (i.e. there are 2 two water molecules + one gas molecule)

We inhale air, O_2 yang needed for chemical processes (metabolism) Yang inside the body Yin. O_2 diffuses yang through membranes of *alveolae* into red blood cells. The *heme group* of *hemoglobin* in erythrocytes, binds O_2, changing blood's color from bluish red Yin within Yang into bright red Yang within Yang . This chemical process depends on the amount of O_2 molecules that bind to each *hemoglobin* molecule. That is why arterial blood that nourishes tissues is soaked with O_2 and is lively bright red but while passing the capillaries surrounding our organs blood gives away 25% of oxygen thus making venous blood dark and bluish Yin.

Ex molecule is bright red when it is saturated with O_2 (4 oxygen molecules per 1 hemoglobin molecule). Molecule is bluish when it has not bound O_2

While *oxygen* supports our life [Yang], and "oxidizes" or "burns" food to create energy and heat for our bodies, certain types of altered *oxygen* molecules called *free radicals* which are ever-present in our bodies, damage our own cells and even DNA, causing *degeneration* [Yin] and diseases such as *cancer*. A prominent feature of *free radicals* [Yin] is that they have extremely high *chemical reactivity*, which explains not only their normal *biological activities* [Yang], but how they inflict damage [Yin] on cells. There are many types of *radicals*, but those, that cause degeneration [Yin] the most in humans, are derived from *oxygen*, and known as *reactive oxygen species, ROS* [Yin] (ex *superoxide anion, hydrogen peroxide, hydroxyl radical)* .

However *oxygen radicals* are not only "bad". *Oxygen-derived radicals* are generated constantly as part of normal *aerobic life* [Yang]. They are formed in *mitochondria* as *oxygen* is reduced along the *electron transport chain. Reactive oxygen species* [Yin] are also formed as necessary intermediates in a variety of enzyme reactions. For example, situations in which *radicals* are overproduced in cells include *white blood cells* that specialize in producing *oxygen radicals* [Yin], which are used in defense [Yang] against invading *pathogens*. For example, when exposed to a *flu virus*, the *leucocytes* create *free radicals* to destroy it. *Oxygen radicals* [Yin] are also involved in *intercellular* and *intracellular signaling (hormones)*. For example, "addition of *superoxide* or *hydrogen peroxide* to a variety of cultured cells leads to an increased rate of *DNA replication* and *cell proliferation* - in other words, these *radicals* function as *mitogens* [Yang] (i.e. source of propagation)" (N. Altman *The Oxygen Prescription* , p. 12)

Oxygen cannot be Yang without the matter Yin since the interdependence of Yang and Yin, energy and matter constitute two states of a continuum

In TCM *continuum* is defined as an *eternal transformation* of Yin and Yang that form a unity and are *complementary*.

This philosophy can be observed in bioscience as well. Initially, when *anaerobic organisms* dwelling in Earth's water [Yin] began to photosynthesize [Yang], and released large amounts of *oxygen* [Yang] they changed the globe's atmosphere for ever. At that time some *anaerobic organisms* evolved the ability to respire *aerobically* [Yang] consequently giving birth to a new complex life such as animal world[Yin]. In this evolutionary process alike in *eternal transformation* of Yin and Yang, the Earth and its water, accumulation of Yin, transformed to be the energy of Yang, where *oxygen* appeared in turn evolved into Yin anew, here after a new form of life began.

Similarly in our organism *metabolism* of food [Yin] can only be efficient in the presence of O_2 [yang] which through its function provides us warmth [Yang] and mental and physical activity [Yang] Likewise it is only *oxygen* [Yang] that is dissolved in blood's plasma [Yin] and bound to a hemoglobin [Yin] that can diffuse [Yang] into the cells and there perform its function [Yang]. Ex human blood contained only half as much hemoglobin per liter as normal (ex. as in anemia), the oxygen content [Yang] of the blood would be only half as much. In its turn cell's *mitochondria* enlivened by the *oxygen* [Yang] can continuously grow and reproduce a new cell [Yin]. *"...Yang gives life, Yin makes it grow..." The 'Simple Questions'* chapter 2, (Maccioccia)

Oxygen as Yin-Yang of two opposing states of density of matter and of two phases of a cyclical movement

In the process of change of all things in the universe everything goes through phases of a cycle and, in so doing, its form also changes. So does the *oxygen*. Rarefied, immaterial, pure and gas-like state of inhaled oxygen [Yang] in the body becomes dense, material, coarse and solid [Yin]. *Oxygen* is used as an *electron acceptor* [Yin] in *mitochondria* to generate *chemical energy* [Yang] in the form of *ATP* trough the pathway of a *chemical conversion* [Yang] of *dense matter* [Yin] of macromolecules of *carbohydrates, fats* and *proteins* into carbon dioxide CO_2 [Yin + Yang] and water, H_2O [Yin+ Yang].

Through this cyclical movement ethereal *oxygen* [Yang] combines with *iron* [Yin] in the blood thus turning into matter [Yin] and then by the power of the process of *oxidation* [Yang] turns inside *mitochondria* into the different energy [Yang] anew. Likewise in green plant's *light energy* (a form of *kinetic energy*) [Yang] is transformed into *chemical energy* that is stored (as *static energy*) [Yin] by molecules and then is released in the form of *oxygen* [Yang] again. It is this very opposition of Yin and Yang that constitutes the motive force of all the changes, development and decay of things.

Oxygen depends on blood as Yang depends on Yin and blood depends on oxygen as Yin on Yang

In TCM, the *Blood* circulates *Nutritive Qi* which is a form of *Qi* in its very dense and material state. It is inseparable from *Qi* itself since *Qi* infuses life into the *Blood* "*without Qi Blood would be an inert fluid* ".

In TCM Yang controls Yin as *Qi* is the commander of *Blood* for the reason that:

1 qi generates blood when *Gu-Qi* is basis for blood and *Lung-Qi* produces blood

2 qi moves blood when *Ying Qi* flows together with blood in *blood vessels* and *Lung-Qi* infuses necessary qi into *blood vessels* ex saying: 'when qi moves, blood follows', and also 'if qi stagnates, blood congeals'.

3 qi holds blood in blood vessels via spleen-qi mainly and kidney-qi that keeps Blood in Uterus vessels

Likewise Yin controls Yang hence *Blood* is the mother of *Qi* for the reason that:

1 blood nourishes qi

2 blood provides a material 'dense' basis that prevents *Qi* from 'floating' and giving rise to symptoms of Empty-Heat.

On a *biomolecular* level such Yin -Yang interrelation between *Qi* and *Blood* happens when by the process the *oxidation* that occurs as *combustion* [Yang] within the cells generates blood by breaking down the *macromolecules* of food, and the then turns *sugar* [Yin] into *energy* [Yang] . This *energy* in turn consequently gives *mitochondria* of *myocardial cells* contraction and pumping function that moves the blood [Yin] to all the tissues.

On the other hand, *oxygen* can execute its functions[Yang] solely on two major conditions. First, if *oxygen* is transported to the tissues by the *blood* [Yin], that binds it Ex 1 liter of blood can dissolve 200 cc of oxygen . Second, if there is presence of *substrate* [Yin] , in our case it is *glucose* obtained from food, that circulates in blood.

The mutual consuming of Yin and Yang, is reflected by the oxygen consumption in the organism

Yin and Yang are in a constant state: one increases the other is consumed, to preserve the balance. In the nature if the weather becomes unduly hot Yang increase the water in the soil dries up Yin consumption . When the external temperature is very cold Yin increases the body starts trembling Yang consumption in an attempt to produce some heat Yang. When we inhale enough *oxygen* Yang increase the *oxygenated* cells are able to burn molecules of food Yin consumption, thus consuming it and preserving the Yin-Yang balance in our body. This is nowadays is the main principle of a *weight management program*, where deep *diafragmic breathing* (or intense physical activity that increases *breathing*) ensures adequate amount of *oxygen* intake for breaking down of molecules of *glucose* and *fat*.

To conclude on the exploration of Yang properties embraced by *oxygen,* one could readily unite the *eastern* and *western* methodology on *oxygen*, which entering the Body in its *gaseous* Yang form brings it *vitality* Yang/Qi and provides defense Yang.

Chapter 5. Oxygen and the theory of the Five Elements

In TCM philosophy the theory of the *Five Elements, Wu Xing* has many facets and one of the interpretations of the word *Xing* implies *'movement', 'process', 'to go' or 'conduct behavior'.* This theory holds that all phenomena in the *Universe* correspond in nature either to *Wood, Fire, Earth, Metal* and *Water*, that these are in a state of constant *motion* and *change* and are indispensible *materials* for the maintenance of *life* and *production*. The *Five Elements* and their *law of movement* are used to explain *physiological* and *pathological* phenomena, as well as interaction between the *Internal Organs, Zung –Fu*.

The communication between the *Zung –Fu*, each pertaining to a certain *element* is insured by the flow of two types of True Qi, *Zhen Qi*, namely the Nutritive Qi, *Jing Qi* and the Defensive Qi, *Wei Qi.*

The continuous movement of *Jing Qi* - by flowing in all the *primary* (*jing mai*), *secondary* (i.e. *connecting: luo mai, sun luo* and *divergent - jing, bie*) and *extraordinary channels* as well as *blood vessels* - nourishes and synergizes all the *Zang Fu* and marks the circadian 24-hour *Organ Clock*. The cycle starts at the *primary lung channel* and ends at the *primary liver channel,* which in turn connects with the *primary lung channel*, thus closing the cycle.

Wei Qi circulates in the *superficial layers of the body* through the skin and the superficial musculature, warming, nourishing and strengthening them. This circulation is cyclical, changing from day to night and vice versa.

> "At dawn, when the *Yin Qi* is exhausted, the *Yang Qi* pours itself from the eyes and the eyes are opened. As a result, the *Wei Qi* rises from the heel via the (*Yin) Qiao Mai* upwards to the eye to BL-1 *(jingming)* and flows into the whole body like a waterfall by following the six great Yang channels - 'it moves 25 times in the Yang'. At dusk, when the Yang Qi is exhausted, the *Wei Qi* enters the *Interior* of the body and moves '25 times in the Yin', following the *controlling cycle, Ke*: from the Kidneys to the Heart → to the Lungs → to the Liver → to the Spleen → back to the Kidneys." Claudia Focks *Atlas of Acupuncture* p.6

It is interesting to note that both types of *Zhen Qi* are one way or the other related to the *Lungs* (see next section), since *Jing Qi* initiates its circulation from this *organ* , also *Wei Qi* is controlled by the *Lungs* as well.

> Akin the *Five Movements* in TCM the Western medicine distinguishes a number of *biological rhythms* that govern our lives and insures communication (*hormonal signaling)*) between the organs. The most familiar of these relate to the cycles of the sun. This 24-hours cycle or *circadian rhythm* is characteristic for most of our *physiological processes*, such as body temperature, the production of energy in our cells, blood pressure, heart and respiration rate, etc. *Rhythms* covering periods longer than a day (ex female menstrual cycle) are called *infradian rhythms*. Faster *rhythms* some cycling many times a day or even an hour are the *ultradian rhythms* (discussed later in this paper).

Oxygen belongs to a *Metal* since it is governed by the *Lungs*

Since ancient times it was recognized that the *Five Elements* were central in everyday life and reflect the diverse nature of all the phenomena. Thus, for example, character of *Metal* implies *"to descend"* and *"to be clear"* (Cheng Xinnong, *Chinese Acupuncture and Moxibustion*, p.20) the qualities that could be easily attributed to that of *oxygen*. Furthermore, *oxygen* is a part of *Heavenly Qi* that is *inhaled* by the *Lungs*, the organ that belongs to a *Metal* element and that controls all types of *Qi*. In addition, the internal pathway of *oxygen* includes all the *channels* and *blood vessels*, that fall, according TCM, under Lungs' control. "*Lungs control the hundered vessels"* this TCM saying refers to both channels and blood vessels.

> This ancient Chinese "*Lung- Metal"* association is nowadays could be supported by the fact that as soon as O_2 reaches *capillaries* surrounding Lungs' *alveolae*, it binds to a *hemoglobin molecule*, that contains a *metal*. It is the presence of iron, Fe^{2+} in a *hemoglobin* that binds one molecule of O_2 and then releases it while circulating with the *blood* out in all *body tissues* determining the total amount of *oxygen* that will be delivered to the cells, thus igniting all *physiological processes*.
>
> It is interesting to note the coincidence where within the *Five-Element* interrelationship and its *Cosmological Sequence, Metal* is attributed *number 4 (*following, first Water, second Fire and Wood- third). Likewise in a breathing cycle *hemoglobin molecule* in arterial blood turns bright red only when it is saturated with *4 oxygen molecules* per 1 *hemoglobin molecule*.

The *Lungs* are the uppermost organ in the body and are called the *Magnificent Lid*, hence *Lung-Qi* naturally descends. One of the most important functions of the *Lungs* is to control *descending* of *Qi* and *Body Fluids*. Within the *Metal element* the *Lungs* have *yin-yang connection* with the *Large Intestine*. Along the respiration cycle as *Lung-Qi* descends, the *Large Intestine* receives the *Qi power* for its functions.

> It is worthwhile to mention another coincidence that in Western medicine *Irritable Bowel Syndrome*, *IBS* is regarded by most physicians as particularly difficult to treat successfully. However Dr. Sheldon Saul Hendler has treated countless sufferers of this disorder with proper *breathing* techniques for years, and his experience is supported by highly respected medical journal *Lancet* that links this syndrome with *futile breathing* (or *poor oxygenation*).

As Metal *generates* the Water - oxygen nourishes the brain

The *nourishing* of *Water* element, the Kidneys by the *Metal* element, the *Lungs* could be observed in a biological phenomenon. The *Brain*, or *Sea of Marrow*, which in TCM is produced by *Kidney-Essence* controls *intelligence* and *mental clarity, sight, hearing, smell, taste, speech* and is the foremost organ that is dependent on *oxygen*.

> The *brain* represents only 2% of the human body weight but receives 20% of total body *oxygen* consumption. For example, when neurons in a particular region of the brain are highly active, they consume a greater amount of *oxygen*, which results in recruitment of extra blood flow to that region. In *oxygen collapse*, the *brain* is the first organ to die within 2- 5 minutes, since the *Lungs* fail to nourish *Kidney* and therefore the *Brain*. The *mother -child* relationship between *Metal* and *Water* can also be illustrated by the one of the most interesting of the *ultradian rhythms,* the *nasal cycle.*

This peculiar *biological rhythm* was first noted some thousands of years ago. In the Far East the ancient *yogic masters* believed that the *passage of breath* through either the left or the right nostril corresponded to different *physiological, psychological*, and *pathological* states. Some of the most important yogic meditations make use of *nasal-cycle breathing* as a basic healing method.

Recently, the *nasal cycle* has been scrutinized by modern medical science and has been found to correspond with *brain* functioning. "One recent scientific paper reported that at the *electrical activity* of the brain is consistently greater on the side opposite the dominant (less congested) nostril. Tests involving 126 individuals showed a significant relationship between *nasal cycles* and performance on *verbal* and *spatial tasks*. It has long been known that the *right side* of the brain is more strongly associated than the left with c*reative, spatial performance*, whereas the *left side* is more strongly associated with *logical* and *verbal skills*. Investigators found that when the *left nostril* was dominant (less obstructed), the opposite side of brain—the *right side*—was also dominant and tested during periods of left-nostril dominance did better on *creative, spatial tasks*. Similarly, when the right nostril was dominant, so was the left side of the brain, and individuals tested during right-nostril dominance did better on *verbal skills*. *S. S. Hendler, The Oxygen Breakthrough* p. 112

This *nasal cycle* is the result of constricting and expanding of *blood vessels*, structures that are controlled by *autonomic nervous system*, ultimately, the *hypothalamus* in Western Medicine and by the *Lungs* in TCM ("Lungs control 100 Mai"). This suggests that the *nasal cycle* may actually reflective of a great many cycles in the body, and provide further evidence of the impact of *breathing* on all aspects of *physical* and *mental functioning*.

Nowadays *mental performance* can be improved by ''feeding'' the brain with extra *oxygen*. "According to research published today that could have implications for the treatment of *dementia*. *Oxygen* treatments improve *alertness, reflexes, memory* and apparently *intelligence*, and may offer the elderly a new weapon against *senility* and related disorders. Alzheimer's and Parkinson's are reported to be responding to it. Alcoholics who start taking *oxygen* supplement soon lose interest in alcohol." *S. S. Hendler, The Oxygen Breakthrough* p. 112 As it is known in TCM, *alcohol* circulates Qi (qi stagnates as a result of various pathological factors) as soon as *oxygen* is supplied through, for example, *deep breathing* or *oxygen therapy* the *alcohol* as means of relieving *stagnant Qi* becomes futile.

The disruption of mother–child relationship when *Metal* cannot nourish (in our case *oxyginate*) the *Water* could be illustrated by a *physiological* process. In *hyperventilation* (described below) *arteries* in the brain constrict, reducing blood flow and therefore O_2 delivery to the *Brain*. The pathological outcome of this include: *dizziness, faintness, disorientation, vertigo, panic attacks*, and such *phobias* as *agoraphobia* and "*fear of death*" R. Fried, *The Breath Connection* p. 174

As *Metal controls* the *Wood* and the *Lungs* control the *Liver*, oxygen influences the muscles as well as stress (or anger)

The *controlling cycle*, *ke* ensures that a *balance* is maintained among the *Five Elements* and thus within the *Internal Organs* in the body. In TCM, the *Liver* reins *sinews* by the process where *refined essence* from the food goes to the *Liver* and *excess Qi* from the *Liver* flows into the *sinews*, hence giving smooth movement of joints and efficient muscle activity.

According to a *controlling cycle* the *Lungs* can regulate activity of the *Liver*. *Lung-Qi descending* is coordinated with *Liver-Qi ascending*. Lungs govern *Qi*, Liver ensures the *smooth flow of Qi*, hence: Lung-Qi descends → Liver-Qi ascends→ *smooth flow of Qi* in all directions is insured. This way the *Lungs* and the *Liver* balance each other as *balance* existing between *Metal* and *Wood*

Under normal conditions, *Metal* acts on *Wood*. In the case of deficiency of *Metal Qi* (ex poor breathing, lung disease) or hyperactivity of *Wood Qi* (ex. anger, stress), the *Wood* may counteract on *Metal*, causing *hyperventilation*, *breathlessness, coughing, asthma* (i.e. weak *Lung Qi* cannot descend).

The *balance* between the *Metal* and *Wood* is so crucial that for thousands of years it has been the key factor of *Dao Yin* and *Qi Gong* practices whose essence is the synergy of *breath* controlled by *Metal* as well as *movement* and *posture* controlled by *Wood*[3]. Here *breathing* stimulates *Qi flow* within the body and the body is put into such a position that the *meridians* *Mai controlled by Lungs* and *energy gates* *joints* controlled by Liver are fully opened. The intention is to lead *stagnant energy* outward. In Chinese medicine this process is called as *'purging'* the body of *negative Qi*. *Stagnant Qi* sits largely within the body's *joints*. Within each of the *joints* there are numerous *energetic pathways* which the *Daoists* called 'energy gates'. If a person maintains a healthy degree of *movement*, good *posture* and *breathing* throughout their life then the chances are their '*energy gates'* will remain open and *Qi* flow freely. Damo Mitchell, *The Dragon Dao- Yin Exercises* Lotus, p. 10

This interaction between *Metal and Wood* today could be illustrated by a physiological process whereby implying *adequate (*also called *natural or innate) breathing* we can control the *muscle output*. For this purpose *maximum oxygen uptake test* (*VO_2 max test*) is created to measure the *muscle endurance.*

The most important effect of *breathing* is *oxygenation*. If the *oxygenation process* within the body is deficient, the body cannot eliminate *metabolic wastes* adequately. With *aerobic respiration*, we are supplying our body with all the *oxygen* it needs and the only *by-products* of the process are CO_2 and H_2O. When *exercising*, the body may deplete *oxygen* faster than it can be taken to the cells. This causes *oxygen deprivation*. *Muscle cells* can perform *anaerobic respiration* for a limited amount of time when this happens. Also due to *over exercising*, our body cells run out of *oxygen* and respire *anaerobically*. "With *anaerobic respiration* the body has to produce *energy* without *oxygen*, to make it for the insufficiency. *Anaerobic energy* production is only 1/9 efficient as the *aerobic* process, it drains body reserves, causes *hyperventilation* and it generates *fatigue products*, like the *lactic acid* that makes the muscle sore, cause cramping, and tiredness" Ian Jackson *The breath play approach to whole life fitness.* p.13 The given below chemical formula helps to illustrate this:

[3] Dao Yins are an ancient form of Chinese exercise which was developed within the Daoist School of philosophy. Much older than *Qi Gong*, they were practiced high in the Daoist mountains as a form of health-care and personal cultivation.

Aerobic respiration helps to break down *glucose* into water, carbon dioxide and energy in form of ATP. This balanced *cellular respiration* is represented as equation: $C_6H_{12}O_6$ glucose + $6O_2 \rightarrow 6CO_2 + 6H_2O$ + Energy (36 ATPs)

Anaerobic respiration (is observed in some bacteria, yeast and other organisms) breaks down *glucose* in the absence of *oxygen*, resulting in production of *ethanol*, *carbon dioxide* and *energy*. $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$ + Energy

Metal and Wood interaction thorough *breathing* (or *oxygenation*) can also be supported by the discovery that was made by MPS, Drs. Stephen M. Campbell and Robert M. Bennett, both clinicians and research *rheumatologists*, on their research on *fibromyalgia* (also called *fibrositis, a* neurosensory disorder characterized by widespread muscle pain, joint stiffness, and fatigue). They note that "*there is a persuasive body of evidence that indicates that patients with fibrositis are physically unfit in terms of sustained endurance. This is most objectively measured in a human performance laboratory by the maximal oxygen uptake (VO_2max)… Almost all of the fibrositis and myofacial pain syndrome patients exhibit breathing disorders, often made worse by the allergies their respiratory deficits tend to encourage."*

Another aspect of *oxygenation* is *stress* control. In TCM the *Liver* is the most vulnerable organ to this modern life occurrence. As we *stress (pent up anger, frustration, emotionally* and *physically strenuous situations)*, the *smooth flow of Qi* becomes disrupted, hence *Liver Qi stagnates* and/or *Liver-Yang* rises thus becoming excessive which in turn make the *Wood* insult the *Metal*. As a result we seize to *breathe* deeply and rhythmically, in other words we *hyperventilate* (see below). However, if to apply a focused *conscious breathing* (here we can observe the involvement of the *Earth* element which *generates* the *Metal* (discussed in last section) the *overactive Qi of Wood* can be brought under control.

Dr. Hendler as well as other medical doctors nowadays emphasizes the fact that *conscious, deep, rhythmic, diafragmic breathing* ensures *stress management*, and its pathological outcomes (one of most common ones is *migraine headaches* which in TCM fall under pathology of Wood).

The *stress management* through *oxygenation* could also be illustrated by *Metal-Wood* interaction. One of the most adverse affects of *stress* related experiences is *hyperventilation* (a condition when invaded *Lung* cannot descend its *Qi*) namely:

* breathing becomes irregular (inspiration/ expiration ratio shifts)
* breathing becomes shallow (tidal volume decreases)
* breathing rate increases (tachypnea)
* the amount of air flowing in and out of the lungs per minute (minute volume) increases
* end-tidal carbon dioxide decreases, CO_2 (*hypocapnia* [4]) Robert Fried, *The Breath Connection* p. 171

Although air flowing in and out of the lungs per minute increases this, however does not promote the *oxygenation* process, to the contrary it evokes a chain of pathological reactions. In *hyperventilation*, the air flowing out of the lungs increases, as a result CO_2 decreases Lung deficiency and there is a slight shift towards *alkalinity*. This is turn increase in the amount of *calcium* entering the *muscles* controlled by Liver and *nerves*. Excess *calcium* in muscles and nerves makes them *hyperactive* Liver overactive: they will contract more readily, more rapidly, more strongly and for a greater duration than they normally would, this is called *titanic contraction* or in simple words muscle *cramping* or in milder cases *muscle tension.* In TCM this *insulting cycle* could be illustrated as *vicious circle*:

* stress Liver (wood) overactive → hyperventilation Lung (metal) deficient →
* muscle strain wood overactive + diaphragm (which is a muscle) strain → deep breathing is obstructed →
* oxygenation further obstruction further metal deficiency → even more severe muscle strain wood even more overactive

When CO_2 decreases Lung deficiency there is also constriction of the *arteries* in the head, thereby reducing blood flow, and *oxygen* availability to the brain (*hypoxia*). Many researchers have emphasized the role of *low oxygen* in *migraine* Liver overactive: Liver-Yang rising or Live-Fire. "In an article, *Brain Hypoxia: The Turning-Point in the Genesis of the Migraine Attack* the author proposes that an episode of *brain hypoxia* occurs in every attack of *migraine*. His proposal is also supported by well established fact that the *brain wave pattern* (EEG) in *migraine*, almost identical to that in many of the *epilepsies* liver-wind, which has been strongly associated with *hypoxia*…. Low *oxygen-related brain wave patterns* have been reported in 30%-40% of *migraine* sufferers by a New –York research group" Robert Fried *The Breath Connection* p. 203.

From the *Taoist* perspective, the main issue in *breathing* is the movement of the "*breath energy*," the *Qi*, in the organism. One of the perspectives of the movement of *Qi* is the result of the polarity between *inhalation* (yang, active, upward) and *exhalation* (yin, passive, downward), between *filling* and *emptying*.

"As we *inhale*, the *breath energy* moves upward to the head, and that as we *exhale*, the energy moves downward into the whole body. As we *inhale*, we can also draw the *yin energy of the earth*, a powerful *healing energy*, through our feet and upward into our body. As we *exhale*, we can direct any *toxic* or *stagnant energies* downward to our feet and out into the earth. The *Taoists* also maintain that during *inhalation* we can draw the *yang energy of heaven* directly into our body through the crown, the *energy* center on the very top of our head, and that during *exhalation* we can distribute this energy downward throughout our body" Dennis Lewis *The Tao of Natural Breathing,* p 101.

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[4] **U**nder normal condition in balanced *inhalation- exhalation* alongside 21% of O_2 we take in 0,03 % of CO_2 into the blood stream and then after *cell metabolism* this amount is increased to 4%, which is exhaled . A certain volume of CO_2 in the blood stream is necessary and it serves as a natural *vacodialatator*
When we *hyperventilate* we lose more CO_2 (hypocapnia**)** than is necessary and arteries in the body constrict. This results in reduced blood flow and reduced oxygen delivery to all the organs.

When combating stress by *breathing exercises* we may observe, for example, how the extent and comfort of our *inhalation* reflects our readiness and ability to embrace *life* at that moment, and how the extent and comfort of our *exhalation* reflects our readiness and ability to *let go*.

The *Fire* element, the *Heart controls* and *balances* the *Metal* element, the *Lungs* thus promoting oxygen supply into the body tissues

In TCM the *Fire element* contributes to the *Metal* by giving *Wei Qi* warmth that vitalizes its diffusion to the *skin*. Within the same *element* the *Heart* that governs *Blood* distributes *Lung Qi* as well as nourishment all over body.

This ancient Chinese thought today could be supported by the interesting phenomenon. According to a modern biomedical research *laughing*, the activity that in TCM belongs to the *Heart* can control the *Lungs* by giving it an excellent *breathing exercise*. In his landmark book *Anatomy of an Illness,* Norman Cousins tells us that he "laughed his way out of a crippling disease that doctors believed to be irreversible." S. S. Hendler *The Oxygen Breakthrough* p. 115. He found that a good laugh on a regular basis could both alleviate his pain and help him sleep more easily and deeply. "Laughter gives the *diaphragm*, the abdominal muscles, the heart, and other muscles a healthy workout. It brings more *oxygen* into the *lungs* and into the cells." S. S. Hendler *The Oxygen Breakthrough* p. 115.

Dr. William Fry, a psychiatry professor at Stanford University's school of medicine, called laughter *internal jogging*. The muscle activity involved is the same as is involved in *exercising*. Hearty laughter, he reports, can accelerate *heart rate* considerably more quickly than strenuous activity. Fry has done extensive research into the *physiology of laughter* and found that *laughter* has particularly profound effects on *both inner* and *outer breathing*. "Laughter helps rid the body of *carbon dioxide* and makes room for more energy-producing *oxygen*. The blood of laughers is brighter red than that of non-laughers. The brighter red color comes from a richer supply of oxygen" S. S. Hendler *The Oxygen Breakthrough* p. 116

"Chronic laughers often have particularly healthy *skin* (the organ that is in TCM under Lungs' control). Laughers tend to glow, because the capillaries that nourish their skin are oxygen-rich. S. S. Hendler *The Oxygen Breakthrough* p. 116

Also at the turn of the last century Dr. Israel Waynbaum hypothesized that *laughing* gives the cells of the body an *oxygen* bath that elevates *mood* and induces a feeling of *exuberance* that persists for a time even after the laughter has ceased. Among the many benefits he attributed to laughter was the prevention of premature *aging* and *wrinkling* of the face.

Laughter increases *oxygenation* and encourages us to breathe in an optimal fashion. This biological finding could be added today as an additional means by which the *Heart* performs one of its controlling functions on the *Lungs*.

In the *insulting cycle* the *Metal* can counteract the *Fire*, consequently *Lungs* deprive the *Heart* of oxygen

Lungs circulate and govern all types of *Qi*, especially *Zong Qi* in chest region. *Qi* is the commander of *Blood* hence Lungs´ influence extends to *blood vessels* that are under *Heart's* control. Lungs infuse *Qi* into the *blood vessels*, moreover *Zong Qi* assist pushing action of the *Heart*. In other words the *Lungs* are a *Prime Minister* of the *Heart*.

In *hyperventilation* whatever causes it *stress, lung diseases* or *toxic waste accumulation* metal deficient or overactive, when CO_2 decreases below normal, *arteries* constrict. This results in reduced blood flow thus reduced *oxygen* delivery to in the first place the *heart* itself fire deficiency as well as the *extremities*, i.e., hands and feet. Persons with chronic *hyperventilation* frequently report cold extremities R. Fried *The Breath Connection,* p. 173. This is an example of how *Wei Qi,* which is propelled by *Lungs* and *Ying Qi* (which is linked in TCM to Blood), propelled by the *Heart* cannot perform their function when *Heart* and *Lungs* are not harmonized.

Another mechanism that could illustrate such an *insulting cycle* is when by *hyperventilating* the Lungs infuse *Pathogenic Qi*, *Xie Qi* metal overactive into the *Blood*. When *exhaling* too much CO_2, there is an increase in the *alkalinity* Xie Qi of the blood. This causes *hemoglobin molecule,* namely its structural *Fe2+* to favor retention of *oxygen*. *Hemoglobin* molecules are like little magnets. They pick up *oxygen* in the *lungs* and drop it off in the body tissues. The "magnetism" of the *hemoglobin* is, proportional to the *acidity* of the blood. Under normal circumstances when *erythrocytes* get into the tissues, where there is more CO_2 due to a local *metabolism*, *oxygen* is released because the environment in the cells is more *acidic* than the blood. In other words, the "magnetism" of the *hemoglobin* is slightly reduced. But when CO_2 is lost in *hyperventilation*, and blood shifts to greater *alkalinity*, *oxygen* is more tightly bound to the *hemoglobin*, and is not released in sufficient quantity. This results in low *tissue oxygen*, which in mild cases manifest as *cold symptoms* fire (heart – yang) deficient and in extreme instances lead to *brain hypoxia* water element is not nourished.

The next two history-cases could support the *Lung – Heart insulting* relation. In late 1985, a paper appeared in the *British Medical Journal* reporting on a case involving a 62-year-old man who had been admitted to *coronary-care* units with suspected *heart attacks* on fourteen (he had a four-year history of *angina pain*) occasions. The patient had a severe attacks of *hyperventilation* immediately followed by an acute attack of *angina.*

"In *improper breathing* not only can cause *angina* but can actually result in "progressive damage to the heart" as a result of the cumulative effects of repeated *coronary artery spasms.* The author postulated a chain of events in which *bad breathing* triggers *neurological* and *biochemical* factors that result in sensitization and constriction of the *coronary artery*. This, in turn, can result in enlargement of parts of the *heart* and damage to nerves that help regulate the *electric activity* and beat of the heart." S. S. Hendler, *The Oxygen breakthrough* p. 89, 90

Within the *Fire* element, the *Heart* is the residence of *Shen*, Mind. Being one of the three integral parts of the *Three Treasures*, Shen is the most subtle and non-material type of *Qi* embracing all mental-spiritual aspects of a human being*: consciousness, thinking, memory, insight, cognition, sleep, intelligence, wisdom, ideas, affections, feelings, senses*. If the balance between the *Metal* and the *Fire* is disrupted and the pathology of *Lungs* poor oxygenation insults the *Heart* this could evoke adverse mental-emotional consequences as seen in numerous *psychological disorders*.

In TCM there is an overlap between the *Heart* and *Brain* with regard to the *mental clarity.* Similarly in medicine the *psychological disorders* that are associated with *hyperventilation* are due to an insufficiency of *oxygen* delivery to the brain. Dr. Fried states that

"Breathing complaints and *hyperventilation* have been recognized as contributing to psychological disorders for a good many years" R. Fried, *The Breath Connection* p. 177. He cites numerous history–cases where *breathing disorders* are evidence associated with *psychological conditions.* In the *DSM-III*, the third revision of the *Diagnostic and Statistical Manual of the American Psychiatric Association*, *dyspnea* (shortness of breath or air hunger) is the first symptom listed under definition of *panic disorder*:

1.dyspnea 2. *palpitations* 3. *chest pain* or *discomfort* 4. *choking* or *smothering sensation* 5. *dizziness, vertigo,* or *unsteady feeling* 6. *feeling of unreality* 7. *paresthesia* (tingling in hands and feet) 8. *hot* and *cold flashes* 9. *sweating* 10. *faintness* 11. *trembling* and *shaking* 12. *fear of dying, going crazy,* or *doing something uncontrolled during an attack* (*DSM-III* p. 231)

As listed in the *manual* the *Lung* symptom *dyspnea* [poor oxygenation] comes first bringing the chain of pathological reactions in the *Heart* - (physical: *palpitations*, *chest pain or discomfort, sweating,* mental: *feeling of unreality, doing something uncontrolled during an attack)* - as well as in the *Brain (faintness, dizziness, vertigo, unsteady feeling)* (this pathological condition was previously discussed in section *…Metal cannot nourish Water).*

Metal is *generated* by the Earth thus the oxygenation can be nourished by our intellect (or focus)

In terms of *oxygen* this aspect of the *Five Elements* interaction can be depicted by the attribution of the *Intellect, Yi,* a spiritual aspect of the *Earth* element, to *focus*, *concentration* as well as *intellect, memory* and *thought formation.* The interplay between the *Earth,* that is the *concentration* and the *Metal,* that is the *oxygenation* (or *breathing*) was known for centuries in TCM as well as *recognized* today by biomedicine.

Dr. Friedell was able to obtain astonishing esults when using what he called *attentive breathing exercises*. The *focused* and *concentrated breathing* implies the conscious usage of Lungs and a *diaphragm* that allows to supply extra *oxygen* to the tissues. He and some other researchers had also reported positive effects of *attentive breathing exercises* in case of *coronary thrombosis* and *pulmonary embolism*. He cited numerous papers that revealed a number of mechanisms *muscular, neurological*, and *biochemical* that might be beneficially promoted by *slower, deeper respiration*. "Another favorable factor in *attentive breathing*, he concluded is the improvement in the *arterial oxygen saturation*"

By conscious using of *diaphragm,* that normally during *automatic subconscious breathing* is not activated, makes lungs *alveoli* to contract during focus intentional *exhalation*, thus increasing their elasticity, which in turn allows them to receive more *oxygen* during *inhalation*. *Deep breathing* also reaches the lowest lobes of Lungs where the blood *capillaries* are more abundant. Dr Friedell noted that *focused deep slow breathing* provides more *arterial oxygen* saturation than does *shallow rapid breathing,* even though "the volume of air breathed by shallow, rapid breathing is greater than the volume of slow deep breathing". S.S Hendler, *The Oxygen Breakthrough* p. 89.

Taoist master Mantak Chia calls the *diaphragm* a *spiritual muscle*. "Lifting the heart and fanning the fires of digestion and metabolism, the *diaphragm* muscle plays a largely unheralded role in maintaining our health, vitality, and well being" D. Lewis *Tao of Natural Breathing* p. 10.

Breath-control exercises, are highly developed in the *pranayama* exercises of India and can be found in many spiritual traditions in the East such as *Qi Gong, Tai Qi* and *Dao Yin* . They rely on intentionally *controlling* our *breathing*, involving the altering of the *speed of our breath* or the *length of the inhalation, exhalation* and *pauses* between in order to bring about chemical, hormonal, energetic, or other changes in our body, emotions, mind, and consciousness. *Controlled breathing* also involves techniques such as *intentional hyperventilation*, *fast belly breathing*, *alternate nostril breathing*, *throat locks*, and *reverse breathing.*

Unfortunately, most of us do not experience the full benefit of the *spiritual muscle* because of the two major reasons. First, the movement of the *diaphragm* is adversely influenced as a result of the chronic *stress*, and second, it is also adversely influenced by unnecessary *tension* in our muscles, tendons, and ligaments, as well as by the faulty configurations of our skeletal structure" D. Lewis *Tao of Natural Breathing* p 11 (Here we can one once again recognize the *insulting effects* of the *Wood*).

Fortunately by our ability to implicate the *Earth* element, that is *concentration* and *focus* we can alter the pathological patterns of our *breathing* and promote the vital affects of *oxygenation* by the *breath-control* exercises.

To conclude on the observation of *Law of Movement* among the *Five Elements* as in *nourishing* and *controlling* cycle one could readily agree that alongside the recurring movement of *Ying Qi* and *Wei Qi* the *oxygenation* process insures the constant *nourishment* , *activation* and *protection* of the *Internal Organs*. If the *Law of Movement* of *oxygen* becomes disrupted as seen in the *insulting cycle* the balance between the *Five Elements* goes astray and leads to pathological conditions as in one person, there may be *artery spasms in the head,* with consequent *migraine*. In yet another person, the symptoms are those of a *mental disorder, anxiety* and *panic attacks,* perhaps with *phobias* including *fear of death*, or perhaps *depression.*

If to apply the ancient Chinese knowledge of that of *breathing* and the *movement of Qi* between the *Five Elements* and support it by the modern *biomedical* findings of that of *oxygen* one could appreciate the Taoist believe, that "the process of *breathing* provides an entrance way and support for the various other energies that *animate* human being and have a powerful influence on the quantity and quality of these energies and thus on the quality and direction of our lives" (Dennis Lewis)

Chapter 6: Conclusion

Breathing in the West serves at least two major purposes. First, it brings *oxygen* into the lungs for transportation to the body tissues by the circulatory system where it serves for *life activation* and *sustainment*. Second, it provides the major means for regulating the *acid-base* balance of the body thus constituting the basic means of the human *defense* systems. Today the medical science on the basis of the observation of pathological changes connected to *deprived oxygenation* beginning to agree on the importance of this process.

In *Eastern* philosophy *breath* is a link in the *cosmic energy* in the transformation and exchange of substances in nature's complex metabolism. TCM, without directly referring *oxygen* to either of the *Tree Treasures* (Essence, Qi, Shen) neither to any of the theories of *Qi, Yin-Yang* or the *Five Elements*, nor to the *Vital Substances*, however, emphasizes the prominence of *breathing* as yogis, Qi

Gong practitioners, meditators have known for a long time that especially *conscious breathing* can help reduce stress, increase relaxation, decrease pain, ensure free movement of Qi, thus ensuring life longevity and vitality.

By studying the *oxygen* as a substance in *biomedicine* and attributing it to the ancient knowledge of Chinese medicine, that is the theory of *Qi, Yin –Yang* and the *Five Elements* one can draw central parallels that are presented in the table, given below.

Table 1: central parallels are illustrated by similar numbers, ex.: **1**. East postulates that Qi… **1** West postulates that O_2… :

Qi properties/functions

*** East postulates that Qi:**

1 is (also) associated with a spiritual aspect *Po*, which manifests through *breathing = life*
2 takes several forms: *different degrees of materiality, manifestations, things, situations*
3 is a *refined energy*
4 is a *functional activity* of the Internal Organs
5 is formed after birth
6 is replenished 12-13 times a minute as we inhale
7 flows in brief *cycles*
8 moves /changes quickly
9 nurtures the *energy* and in itself is *life energy*
10 is inhaled as *Heavenly Qi*
11 performs: *transformation, transportation, protection, warming*
12 manifests as *Yaun Qi:* represent *transformation power of Qi*, produces *all kinds of Qi*
13 manifests as *Zong Qi*, which can be influenced by acupuncture of Heart and Lung channels points as well as Qi Gong
14 manifests as *Wei Qi*: is diffused into exterior to perform *protective function*

*** West postulates that O_2:**

1 is associated through the function of *breathing* with *spirare/ spirit /respiration = life*
2 has *mass*, occupies *space*, is convertible to *energy*, can be material *matter: proteins, lipids, carbohydrates*
3 is immaterial *energy*: *kinetic, thermal, biological (ATP)*
4 activates all bodily functions
5 is inhaled after birth
6 is replenished easily on a day-to-day basis
7 *oxygenates* the body in *cycles* (ex respiratory cycle is 11-13 breaths per minute)
8 diffuses rapidly into the cells as O_2 in *inhalation* , changes into CO_2 in *exhalation*
9 nurtures *life*, *birth*, *growth*, *development*
10 is inhaled together with *negative ions*
11performs *transformation of* food macromolecules into ATP → ATP produces *kinetic /thermal/ biological energy*
12 manifests as organs' *physiological functions: thermal energy*, *movement* , *breaking down of food, replication of the DNA, new cell birth, self sustainment*
13 can be influenced via *aerobic exercise*
14 is an integral part of the *defence system*, where *peroxisomes* consume *oxygen* to create H_2O_2 as a detoxifying agent for invading pathogens as well as body's own wastes of *cellular metabolism*

Yang properties /functions

*** East postulates that Yang:**

1 is *immaterial*
2 produces *energy,* creates *light*, *warmth,* implies *activity*
3 is *functional activity* of the *Internal Organs*
4 *generates, produces*
5 *protects*
6 *transforms*
7 contains the seed of Yin

*** West postulates that O_2:**

1 is *gas* (in all its natural forms: O_2, CO_2, O_3)
2 when participating in chemical reactions produce *thermal energy, kinetic energy, light, electricity*
3 is an *ignition key* in cells mitochondria that *activate* and *sustain* the functions of all the body organs
4 is the most important factor in *mitotic cell division*, without *oxygen* cells can never reproduce
5 is the factor in human *defense* mechanisms, since:
* *Ozone* absorbs UV light
**peroxisomes* detoxify the *internal* (cancerous cells, metabolic by-products) and *external* (bacteria, viruses, fungi, parasites) pathogens
* *alveolar macrophages* via *respiratory burst* perform intracellular killing of the *internal*/*external pathogens*
* *Langaerhans cells* in epidermis and lymph nodes use *oxidation* as its first line against *external pathogens*
6 *transforms* energy stored in *food macromolecules* into the *ATP molecules* as the only form of *energy* recognized by the cells
7 can cause *corrosion*, *decay, degeneration*, *death* (when is formed into *free radicals*)

Five element properties / interaction

*** East postulates that Metal element:**

1 embraces *Lungs*

2 as a governor of Qi, communicates with other organs via cyclical flow of *Ying Qi* and *Wei Qi*

3 has among its characteristics such properties as: *"to be clear" "to descend"*

4 in cosmological sequence, is attributed *number 4*

5 nourishes the *Water* element (the Kidney-Essence, Brain)

6 *controls* the *Wood* element (Liver: smooth flow of qi, sinews, anger, Liver-Yang/ Fire rising, Liver -Wind)

7 is *controlled* by the *Fire* element (Heart: blood transport to tissues, laughing)

8 can *counteract* the *Fire* element → Lungs fail to perform the functions of the Prime Minister and infuse Qi into Blood, hence *palpitations* and *Shen* (*Brain*) suffers

9 is promoted by the Earth element (which implies *intellect, focus*, *concentration*, *memory, thought formation)*

*** West postulates that O_2:**

1enters /exist the body through the *Lungs*

2 as a fuel for ATP, insures *CNS* and *hormonal communication* between the body organs

3 has among its chemical characteristics *colourless gas* that is transported *down* to body tissues

4 its *4* molecules binds to one hemoglobin molecule

5 nourishes the *brain* via *nasal cycle*

6 through its adequate intake (breathing) can control: *muscle output*, *muscle pathology*, ex., cramping, and fibromyalgia; *stress management*; *migraine*; *epilepsy*

7 its intake and transportation to the tissues is promoted by *laughing*

8 its failed transport caused by Lungs *hyperventilation* can cause *dyspnea,* progressive damage to the *heart*, *brain hypoxia* and *panic disorder*

9 can be promoted by *controlled focused attentive breathing*

Bibliography

1 **Altman**, Nathaniel *The Oxygen Prescription: The Miracle of Oxidative Therapies*; Rochester, Vermount Healing Arts Press, 2007

2 **Berlitz** Publishing/APA Publications GmbH & Co. *Mandarin Chinese Compact Dictionary,* Verlag KG Singapore Branch, Singapore , 2011

3 **Guangde**, Zhang, *Dao Yin Yang Sheng Gong*: *Nourish the Blood, Tonify the Qi to Promote Longevity, and Calm and Concentrate the Mind to Regulate the Heart*; Singing Dragon, 2011

4 **HarperCollins** Publishers *Science (A-Z essential facts and definitions), 2005*
5 **Hendler**, Sheldon Saul M.D., Ph.D., *The Oxygen breakthrough* PROTEUS, Inc , 1989

6 **Focks**, Claudia *Atlas of Acupuncture*, Churchill Livingstone, Edinburgh London New York Oxford Philadelphia St Louis Sydney Toronto 2008

7 **Jackson**, Ian *The Breathplay Approach to Whole Life Fitness;* Dolphin Book, Doubleday & Company, Inc. Garden City, New York *1986*

8 **Lewis**, Dennis *Free your life, Free your Breath*; Shambhala Boston and London Press , 2004
9 **Lewis**, Dennis *The Tao of Natural Breathing: For Health, Well-Being, and Inner Growth,* Rodmell Press, Berkeley, California, 2006

10 **Maciocia**, Giovanni *The Foundations of Chinese Medicine,* Lsevier Churchill Livingstone, *2005*
11 **Mitchell**, Damo *The Dragon Dao- Yin Exercises* , Lotus Nei Gong Publishing 2010

12 **Fried**, Robert *The Breath Connection ,* Hunter College, City University of New York and Director, Stress and Biofeedback Clinic Institute for Rational-Emotive Therapy New York, Plenum Press · New York and London, 1990

13 **Wesson**, Kevin, Nesta Wiggin, Graham Thompson, Sue Hartigan *Sport and PE, a complete guide to advanced level study,* Hodder & Stoughton 1998

14 **Widmaier**, Eric P., Raff, Hershel, Strang, Kevin T, *Vander, Sherman, Luciano's Human Physiology: The Mechanisms Of Body Function,* ninth edition*, MC Graw Hill Higher, Education 2004*

15 **Xinnong**, Cheng *Chinese Acupuncture and Moxibustion* Foreign Languages Press Beijing, 1999

http://www.ncbi.nlm.nih.gov/pubmed/22493934 (research of Department of Acupuncture and Massage, Hubei University of TCM)
http://en.wikipedia.org/wiki/Chemical_elements_in_East_Asian_languages
http://en.wikipedia.org/wiki/Free_radicals
http://en.wikibooks.org/wiki/Human_Physiology/Cell_physiology#Peroxisomes
http://en.wikibooks.org/wiki/Human_Physiology/The_respiratory_system
http://wiki.answers.com/Q/What_is_the_function_of_oxygen_in_your_body#ixzz1zJaxUjja
http://www.cytochemistry.net/Cell-biology/mitochondria_1.htm
http://en.wikipedia.org/wiki/Dust_cell
http://en.wikipedia.org/wiki/Oxygen

http://scienceray.com/biology/human-biology/the-role-of-oxygen-in-the-human-body

http://www.shen-nong.com/eng/principles/kidneyyinyang.html

http://www.oxygen-review.com/human-body.html
http://education.jlab.org/itselemental/ele008.html
http://medical-dictionary.thefreedictionary.com/fibromyalgia
http://www.buzzle.com/articles/chemical-reactions-in-everyday-life.html
http://www.vivo.colostate.edu/hbooks/pathphys/misc_topics/radicals.html

http://www.chem1.com/acad/webtext/geochem/11txt.html#OXYGEN