

## **MODULE 4: THE SCIENCE OF BREATHING**

### **LESSON 1: THE MECHANICS OF BREATHING**

*"A human being is breath contained in form."*

In this module, we will explore how the mechanics of breathing relate to the chemistry, neurology, psychology and mystical aspects and how the architecture of the human system is designed to facilitate the flow of life force.

What makes the human body so incredible is that even though each system has its own unique structure and function, they all work synergistically to support harmonious balance and optimum functioning of the whole.

You may find that the deeper you delve into the study of human form and function, especially as it relates to the breath, the more you will begin to appreciate the absolute miracle that it is. You will sense that there is an intelligence at work that coordinates and orchestrates the functioning of the 37 trillion cells that make it up. This is something beyond what we can see under a microscope.

For our purposes, let's call this 'something', the body's innate wisdom...

As we explore the physical constructs of the body and biomechanics of breathing, we will begin to deepen our awareness of how it is related to the chemistry, neurological aspects, psychology and laws of nature.

#### **The Respiratory Tract**

The respiratory tract is a highly sophisticated and organised system that, on a physical level, facilitates the delivery of oxygen molecules to every single cell in the body. It consists of passage-ways that filter incoming air and carry it to the lungs.

Here, in the microscopic air sacs, exchanges take place between the external environment and the internal body environment. The respiratory system consists of the following parts, divided into the upper and lower respiratory tracts.

**Upper Respiratory Tract**

- Nose, mouth and nasal cavity
- Pharynx
- Larynx

**Lower Respiratory tract**

- Trachea
- Bronchi
- Bronchioles
- Alveoli
- Diaphragm

**Let's begin with the nose.**

The mouth and nose are the airways cavities most directly in contact with the outside environment. In an adult, 18 000 to 20 000 litres pass through the nose each day. The nose and nasal cavities have been designed in a way to process and filter the air from the outside environment before it enters and encounters the delicate tissue of the lungs. It prepares the air so that it is warm, humid and pure enough to be absorbed into the blood.

The nostrils are found at the entrance of the nasal cavities, which two parallel airways separated by cartilage are called the nasal septum and bone towards the top.

The entrance of the nose or nares are covered by large hairs which serve to trap the biggest dust particles from the air. The nasal cavities are lined with a respiratory membrane with little vibrating hair or cilia which trap the dust particles entering the nose as well as mucous glands that not only trap the smallest particles, moisten and humidify the air, but also play an anti-infection role.

Part of the function of nasal breathing as it relates to the immune system can be attributed to the production of Nitric Oxide in the nasal cavity and respiratory airways. Nitric oxide has antifungal, antiviral, antibacterial and anti-parasitic effects. Nitric oxide also acts as vasodilator which supports the transport of oxygenated blood to the tissues.

The inside of the nostrils have an interesting shape, containing three folds that make up the turbinates which are funnel-like structures that serve to channel and spiral the air as it enters the nose, giving the air more time to be warmed, moistened, and filtered before it gets absorbed by the delicate tissues of the lungs.

Because the nostrils are smaller than the mouth, the air that is exhaled through the nose creates a back pressure when one exhales, slowing the air escape so that the lungs have more time to extract oxygen from them.

Take a deep breath through your nose and then through your mouth and you will find that it takes a longer time to fill your lungs when you breathe only through the nose.

Other functions of the nose:

- Another major function of the nose is that it is the primary organ of smell. When we smell, say a rose, the molecules carrying the scent arrive in the nose and bind to the receptors on a small patch of tissue at the top of the nose called the olfactory epithelium, which then connect to the nerves in the olfactory bulbs which are located directly in the gap between the eyebrows. From there, the signals are sent to the brain.
- It forms part of what we need to produce sound. Try this experiment: close your nostrils and try to hum. You will find it impossible!

For your interest, please check out [www.jalanetipot.com](http://www.jalanetipot.com) to learn more about Neti, the oldest and most researched method of nasal and sinus irrigation.

*"Through the nose we breathe in life sustaining oxygen so our relationship to life is reflected here. Whether we feel at ease with what we are breathing in, or if we want to opt out for a while; whether we feel clear or blocked. The nose also symbolises those times when we push ourselves into areas where we are not welcome – nose issues may indicate a need to respect other people's privacy and boundaries. Perhaps we need to stop being so nosey and give others more space. The nose also enables us to take in both sweetness and the pungency of life. The function of breathing in oxygen is vital yet not always welcome. There are many times when life becomes overwhelming and we just don't want to take in anymore. We can't stop breathing but we can put up a resistance so that everything is shut out, as in a blocked nose. Is something getting up your nose? Is there something or someone you want to push away or resist? Are you wanting to pull back from life for a while? Or are you blocking something within yourself - getting stuffy and airless in your attitude? Are you being particularly prejudiced or closed? What do you need to do to open up and breathe freely again?" - Your body speaks your mind by Debbie Shapiro.*

### **What about the sinuses?**

The sinuses are air-filled spaces in the head around the nose area. There's a pair under the eyes, a pair behind the bridge of the nose and another in the forehead just above the eyes. They make the skull lighter, help the voice resonate and provide protection for the brain in case of an impact.

They are lined with the same kind of mucous membrane that lines the inside of the nose. Mucous from the sinuses also has a system of drainage into the nose.

*"Sinusitis implies either a pushing away of that which inspires or nourishes us or an overload of mental work without enough creative energy. Sinusitis means you are feeling irritated or inflamed by something or someone or even yourself and this irritation is highlighting a sense of being emotionally or creatively stuck.*

*Are you feeling blocked or limited, unable to break free of stuck patterns? Are you resisting inspiration and nourishment? Sinusitis is also connected to repressed grief and unshed tears, especially as there can be intense pain and a high temperature. The pain is expressing the inner anguish; the temperature shows the heat of emotion."* - *Your body speaks your mind* by Debbie Shapiro

## **The mouth**

The mouth is part of the digestive system but is also another channel that is used to inhale and exhale air.

As we can see from the anatomy of the nose, at rest it is ideal to breathe through it, as the nose has a structure to filter and prepare the air through the lungs, but there are certain circumstances when it is necessary and normal to breathe through the mouth.

- When the nose is blocked
- During vigorous exercise to supply more oxygen
- Naturally when we yawn and sigh
- In breathwork (we will go into this in more detail at a later stage)

## **The TM Joint**

The Temporo Mandibular Joint does not form part of the respiratory system per se, but while we're at the mouth, and because of its relevance and importance in breathwork, let's look at it here.

The TM joint is a small joint located at the front of ear where the skull and lower jaw meet. This tiny joint and the big masseter muscle (chewing muscle attached to it) is often where so much stress is unconsciously stored. Many people, when they are dealing with anxiety, clench or grind their teeth at night, causing painful spasms and in severe cases "lock jaw".

## The Pharynx

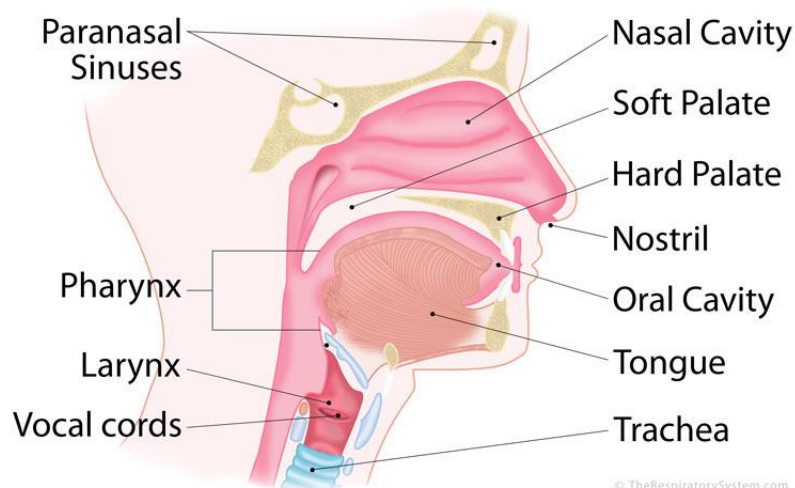
The pharynx is where the back of the nose meets the back of the mouth and it has a very important role: it can decide when a piece of food must go through the food pipe (the oesophagus) or when the breath of air must go through the larynx (voice box). There is a small flap of cartilage called the epiglottis that prevents the food from entering the trachea. After passing through the pharynx, the warmed, moistened and cleansed air is ready to enter the respiratory passageways.

## The lower respiratory tract

The respiratory tract is shaped like an upside-down tree, with the trachea or windpipe being the trunk, the bronchi and bronchioles being the branches and the alveoli being the leaves where oxygen exchange takes place. It's so incredible that even on a functional level they are perfect opposites, with trees inhaling carbon dioxide and exhaling oxygen that we then inhale.

It's a perfect system!

# Upper Respiratory Tract



## **The Trachea**

The main passageway of the respiratory tract is the trachea, an open tube extending to the lungs. The first part of the trachea is the larynx. The vocal cords are an important component of the larynx and are therefore also known as the voice box where sound is generated. It also helps to protect the trachea by producing the strong cough reflex if any solid objects pass the epiglottis.

*"Difficulties with the larynx are associated with the fear of speaking, or with a repression of feelings. Conflicts arise when it is hard to vocalise our feelings, or if we feel we are always saying the wrong thing. Through our voice we express our needs and ask for what we want. Are you speaking your truth or swallowing it back?" - Your body speaks your mind by Debbie Shapiro.*

The trachea is also known as the windpipe - the tube that carries the air from the throat into the lungs and is mostly situated in the neck and upper part of the chest. It is a flexible cylindrical tube that ranges from 20-25mm in diameter and 10-16cm in length. The inner membrane of the trachea is covered in tiny hairs called cilia, which also catch particles of dust which we can then remove through coughing. The trachea is surrounded by 15-20 shaped rings of cartilage at the front and side which help to protect the trachea and keep it open. They are incomplete circles because the oesophagus sits immediately behind the trachea and the trachea needs to partially collapse to allow for the expansion of the oesophagus when large pieces of food travels down it.

## **The Bronchi**

The trachea divides into 2 tubes called bronchi, which enters each lung. The left bronchus is narrower and more horizontal than the right as it enters the lung. The left lung has 2 lobes and the right lung 3 – probably to make space for the heart (another clever natural design). Irregular rings of cartilage surround the bronchi whose walls also consist of smooth muscle. Once inside the lung, the bronchi split several ways, forming smaller branches.

## **Bronchioles**

Smaller bronchi divide even further to form even smaller tubes or bronchioles, which are less than 1cm in diameter. They have no cartilage, and end in a bunch of grape-like air sacs in the lung called alveoli.

## **The Lungs**

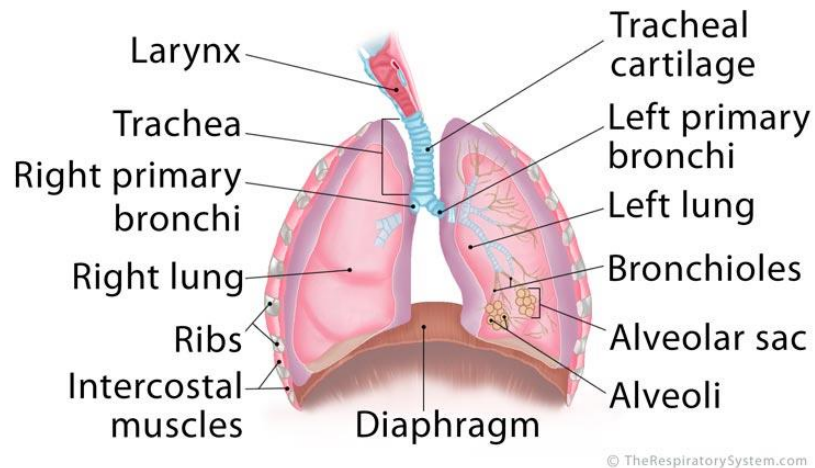
In the lower respiratory tract, the trachea, bronchi and bronchial tree lead to the main organ of gaseous exchange, the lungs. The left and right lungs are separated in the middle by the heart and mediastinum and are enclosed by the thoracic cage and diaphragm. Each lung is surrounded by a double membrane called pleura. The inner layer of this membrane or visceral pleura is firmly attached to each lung which then folds back to become the outer layer or parietal pleura. This then forms part of the mediastinum and lines the inner wall of the chest cavity. The space between the visceral and parietal pleura contains serous fluid and is called the pleural cavity. The cone shaped lungs extend from just above the clavicle down to the level of the diaphragm. The right lung consists of 3 lobes, the superior, middle and inferior lobes. The left side has only 2 lobes, the left superior and left middle lobes.

## **Alveoli**

These hollow air-filled sacs are where gaseous exchange between the air and the blood takes place. The air sacs are covered by a rich network of capillaries which facilitate this exchange.

Emotionally the lungs generate grief to allow us to dissolve attachments to people, animals and life situations that are no longer part of our life. The consciousness of the lungs is surrender, because we have to release our attachment to the past as we release each breath. When we hold on, our breathing becomes shallow and we feel suffocated and unable to grow. When we can't grieve, we cry instead into our lungs creating pneumonia and other chest infections. The primary job of the lungs is to allow us to breathe in and accept life and surrender out attachments to people and life situations so that we can make graceful transitions.

# Lower Respiratory Tract



## Exercise:

On the inhalation, follow the path of your breath as it enters the nostril and moves down the back of the throat. Feel the point when the awareness shifts from feeling the sensation of the breath itself to the physical movement of the chest as it responds to the breath.

- Can you deepen your awareness to the subtle sensation of the breath as it is being absorbed by your lungs and then into the cells?
- On the exhalation, when do you first begin to feel the sensation of the breath in your body?
- What is the difference in the sensation of the inhaled and exhaled air?
- What is the difference in the feelings and sensations that arise when we breathe through the mouth as opposed to the nose?
- Which area in your respiratory tract feels blocked?
- Has your relationship to your breath changed now that you have a better understanding of the anatomy of the respiratory tract?