LOUIS BOLK INSTITUTE

Anatomy

Morphological Anatomy from a Phenomenological Point of View

Guus van der Bie MD

BOLK'S COMPANIONS FOR THE STUDY OF MEDICINE

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About the Author

Guus van der Bie MD (1945) worked as a lecturer at the Department of Medical Anatomy and Embryology at Utrecht State University, Holland from1967 to1976. Next to his practice as a general practitioner since 1976, he continued to educate physicians and therapists, and medical students at Utrecht State University and the University of Witten/Herdecke, Germany. He is a member of the Medical Section of the School of Spiritual Science at the Goetheanum, Dornach, Switzerland.

About the Project

The project *Renewal of Medical Education* aims to produce Companions that demonstrate how the insights of current biomedical science can be broadened by using the Goethean phenomenological method. This method innovates current concepts and expands the understanding of biochemical, physiological, psychological, and morphological factors in living organisms and their development in time and space, and in health, illness, and therapy. The project is commissioned by the Kingfisher Foundation, which aspires the development, application, and publication of the Goethean phenomenological research method in the widest sense, to complement and innovate the accepted scientific view and research method.

BOLK'S COMPANIONS FOR THE STUDY OF MEDICINE complement current medical education, specifically disclosing human qualities in the fundamental biomedical sciences of today.

BOLK'S COMPANIONS FOR THE PRACTICE OF MEDICINE contribute to a scientific phenomenological basis for integrative medicine and integral psychiatry.

6. The Morphology of the Airways

6.1. Introduction

The airways have a unique physiological position within the organism: it is the only organ system through which substances from the outside world enter the organism essentially unchanged. In contrast to the intestines, the airways can take air in without digesting it. In the healthy situation, oxygen can be directly absorbed from the alveolar air into the blood system during gas exchange. The intestines, however, meet ingested nutrients with a destructive digestive process before it is allowed to enter the internal milieu of the organism.

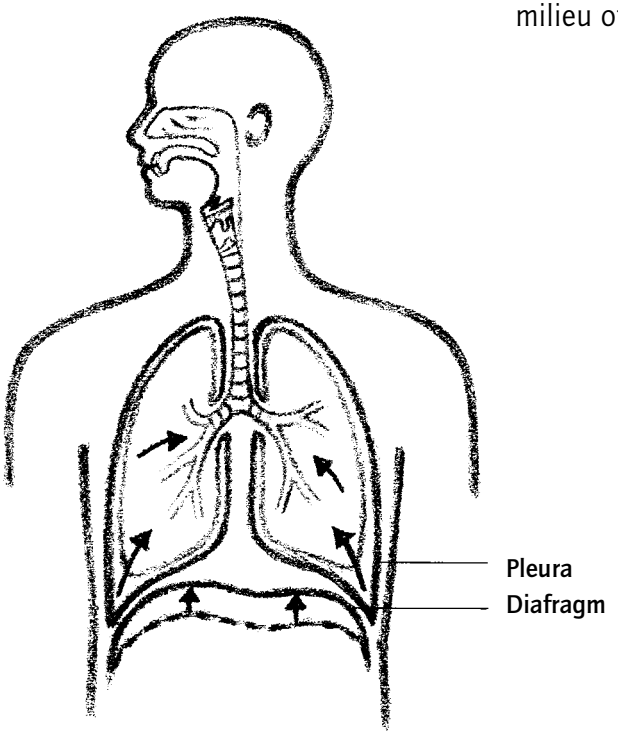

Fig. 6.1. The airways (Rohen 1998)

6.2. Development of the Airways

The airways (figure 6.1.) start their development during the embryonic stage but continue to grow until puberty. This applies particularly to the respiratory units, alveoli, and, to a lesser extent to the paranasal sinuses. The primitive airways of the organism begin their development in the rhythmic area of the human organism (primitive lung buds) and later extend into the cranial (sinuses) and caudal (alveolar) areas.

6.2.1. The Paranasal Sinuses

The paranasal sinuses (fig 6.2.) develop primarily postnatally. The aeration of the paranasal sinuses occurs during the first years of life. The frequently occurring ear, nose, and throat problems among young children are often the result of an insufficient aeration of the paranasal sinuses and the tympanic cavity.
The total capacity of the paranasal sinuses in the adult cranium is surprisingly large. If we include not only the paranasal sinuses, but also the nasal cavity, the tympanic cavity, and the mastoid cells as part of the airways, the volume becomes even more impressive.
The maxillary sinus, the ethmoidal air cells, the mastoid cells, and the tympanic cavity are comparable in shape: they are like air bubbles in a fluid. *Morphologically*, we can speak once again of the dynamic of the spherical form that is characteristic for the head.
The air from the sinuses is absorbed by their mucus membranes.

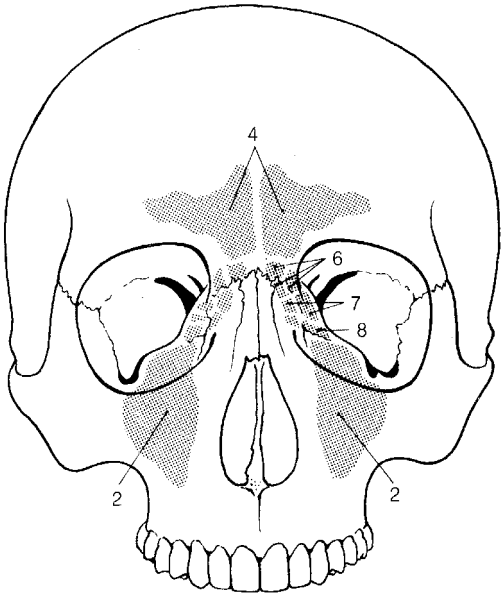

Fig. 6.2. The paranasal sinuses (Feneis 1983)

Functionally, the paranasal sinuses are essential for the healthy functioning of the senses, such as the organ of smell and that of hearing, and for the nervous system in its function for thinking. In a more general sense, free air in the cranium is important for healthy, conscious mental activity. An active sinusitis will significantly hinder the ability to think.

➔ *The upper airways are morphologically and functionally related to the morphological and functional characteristics of the head.*

6.2.2. The Alveolar Areas of the Lung

The most caudal portion of the airways is formed by the respiratory units (fig. 6.3). It is important to note the maturation process and the growth pattern of the respiratory units. The so-called alveolar period of development of the lung *continues far into puberty*. Until this time, new respiratory bronchioles and primitive alveoli are developed which mature and become functional in gas exchange. Postnatal growth forms the major part of lung development.

This process corresponds to the development and maturation of the limbs far into puberty: the dynamic of *divergence towards the periphery*.

The *morphology* of the alveolar space is adapted to the purpose of *gas exchange.* There is hardly a more beautiful example of an organ which is so literally *involved in metabolism* in the sense of the exchange of physical substances. The removal of carbon dioxide from the blood and the absorption of oxygen into the body is pure *metabolic activity.*

By breathing, the surrounding world is changed: oxygen disappears from the atmosphere and carbon dioxide and water vapor are added to it. If breathing were to be limited to that portion of the airways that extends up to the respiratory units, there would be no change in the surroundings. Through the exhalation of alveolar air, the atmospheric surroundings undergo a change in temperature, humidity and carbon dioxide concentration. The exhaled air flows into the world and changes it.

The alveolar space is *constantly moved* by the diaphragm and the thoracic wall, and gas exchange results from this.

A third characteristic of the lower airways is the *dichotomous branching* of the bronchial tree. In the extremities, we could still express this divergence in the increasing number of bones from proximal to distal. In the bronchial tree this can hardly be expressed in numbers anymore. The bronchial tree subdivides in the peripheral direction into a multitude of bronchioles (24 generations).

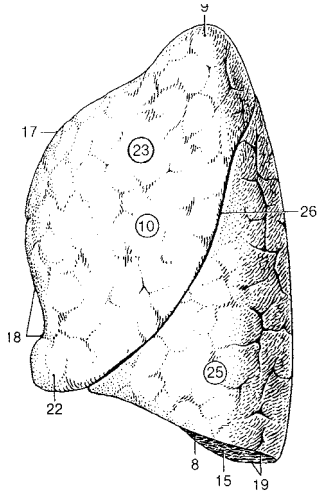

Fig. 6.3. The alveolar space of the lung (Feneis 1983)

➔ *The alveolar region is morphologically en functionally related the characteristics of the limbs.*

6.2.3.The Trachea and the Bronchial Tree: Rhythmic Air

The mid-section of the airways is formed by the trachea and the bronchial tree. *Morphologically* characteristic is here, once again, the *metameric* structure of the trachea and the bronchial tree which is manifested in the presence of, among other things, the horseshoe-shaped tracheal rings. In this case, the rings are not numerically related to the spinal column, as is the case with the spinal cord, but have their own structure and number. The cartilage of the tracheal rings originates from mesoderm.
The characteristic mobility of the bronchial tree and the trachea is related to the smooth muscles that are present which are autonomously innervated. The bronchial tree and the trachea have a *rhythmically* variable width, influenced by the breathing: in the chest they dilate upon inhalation and constrict upon exhalation; in the neck the trachea constricts upon inhalation and dilates upon exhalation. The air shuttles rhythmically back and forth. In this part of the airways, there is no gas exchange.

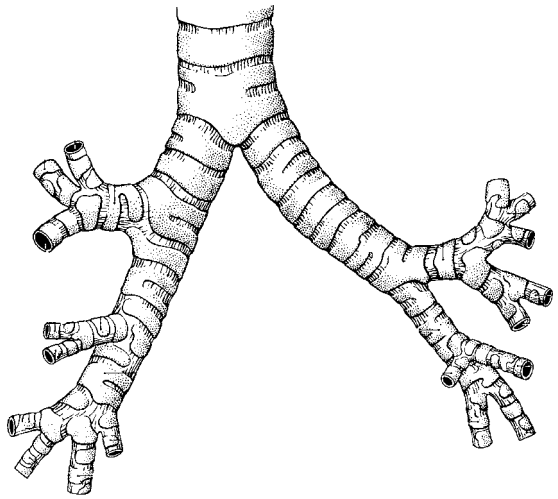

Fig. 6.4. The trachea and the bronchial tree (Feneis 1983)

6.2.4. The Larynx

The skeleton of the larynx consists *morphologically* of cartilage originating from *ectoderm (neural crest cells*). The larynx musculature is innervated by the *recurrent nerves* which originate in the *somamotoric* core of the vagal nerve. The larynx

develops from the fourth, the fifth and sixth branchial arches and forms the entrance to the trachea, thereby becoming the *most cranial portion of the mid-section of the airways*.
The human larynx has an important *function* in the human organism. It is the central organ of speech and singing. When talking - and even more, when singing - all movement of the speaking or singing human being converges in the dynamic of the larynx. The laryngeal musculature and skeleton allow an elegance of movement that is unparalleled at any other place in the organism. In this function, the larynx has a close relationship to consciousness. With the aid of the larynx we can express thoughts and feelings.
Ultimately, the healthy functioning of the larynx depends upon the vocal cords. They can adopt infinite variations of movement, and can bring air into a great variety of states of *vibration*. The larynx combines, in a unique manner, the integrative and formative effects that we know as part of the dynamic of the head and the intracranial nervous system with the rhythmic activity that we recognize as part of the dynamic of the thorax

6.3. Goethean Aspects

6.3.1. Intracranial Air: Spherical Form and Centripetal Dynamic

The *morphology* and physiology of the air compartments of the skull are an *integrated* part of the morphology of the skull and the physiology of the *senses* (smell, taste and hearing). In particular the paranasal sinuses, the tympanic cavity, and the nasal cavity strive, morphologically, for a spherical shape. The air in the sinuses is practically immobile and there is no gas exchange.
The *centripetal dynamic* that is so typical of the morphological characteristic of the head can be recognized in the slow absorption of air in the sinuses and middle ear.

6.3.2. Alveolar Air: Centrifugal (Divergent) Dynamic

In the area of the airways that is most peripheral, the respiratory units, we find true gas exchange. Gas exchange changes the human organism and the surrounding world equally.

In this part of the airways the lung excursions occur which are connected with the *active movements* of the thoracic wall and the diaphragm.

6.3.3. Rhythmic Air Movements

Starting at the larynx, rhythmic phenomena dominate the trachea and the greater bronchi, both functionally and structurally.

➔ *In the morphology and in the dynamic qualities, the respiratory tract displays a morphological and functional trichotomy related to the trichotomy that is seen in the skeleton.*

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Can we give a scientific basis to our feeling that the human being has unique human features? Are the human mind and the human body 'nothing but' another variation of animal life? Can we find answers for these questions that satisfy both our head and our heart?

How these questions are answered depends on the scientific method we use. In this publication two methods are used: the current scientific method to learn about anatomical facts and the phenomenological method to understand the meaning of these facts.

Human morphology can then be understood as an expression of the unique and characteristic qualities of the human being. This results in new possibilities for understanding the relation between consciousness, psychology, behavior, and morphological aspects of the body.