# L. Bolk *1866-1930*

# 18

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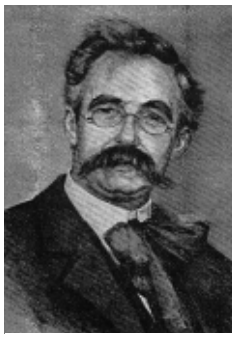

*Figure .*
*Lodewijk Bolk*

Louis (officially Lodewijk) Bolk was born on December , in Overschie, a village near Rotterdam. After primary school, he visited the gymnasium, but left before the final examination, without a diploma. In he began working in the office of a notary public in Waalwijk, a small provincial town, and in he passed his baccalaureate examination. However, he was not satisfied with this work, as he felt more attracted to medicine.

He enrolled to study medicine in at the University of Amsterdam and he passed the baccalaureate examination three years later. As a student he was awarded the gold medal in for a prize-winning investigation on the origin and peripheral distribution of the nerves in the human lower extremity. As a medical student, Bolk already published some important papers on innervation of the skin and segmentation ( , ). In he passed his final examination as a doctor of medicine. He became assistant to the German anatomist Professor Georg Ruge ( - ) in , however, Professor Ruge left Amsterdam the very same year because he had accepted a nomination at the University of Zürich. Ruge had proposed his prosector and nephew, Dr. O. Seydel, also a German, as his successor. This aroused opposition in the Municipal Council of Amsterdam which had the right of nomination; Ruge's predecessor, Max Fürbringer ( - ), Professor of Anatomy from - , had also been German and both had left Amsterdam earlier than had been agreed for nominations elsewhere. The younger professors of the faculty, too, felt that it was high time to nominate a fellow-countryman, if only to lessen this risk.

One of the persons interested in this vacancy was Eugène Dubois ( - ), pupil of Fürbringer and (after his medical study) his prosector. In , Dubois became lector in human anatomy with a good chance of becoming Fürbringer's successor. However, after a disagreement with Fürbringer, Dubois took his leave. He went to the Dutch East Indies as a military doctor in . There he made his famous discovery of fossil bones of 'the missing link', which he called the Pithecanthropus erectus, which earned him the honour of doctor *honoris causa* of the Amsterdam University in . However, he did not get sufficient support for his (half-hearted) efforts for the chair of anatomy. Instead, he was appointed Professor of Geology at the University of Amsterdam, in , probably as an ointment for his hurt feelings (Shipman ).

After some lobbying actions by the students, a fierce paper war in the daily newspapers and in *Propria Cures*, the proposed short-list of candidates was discarded and Bolk, aged , who had figured second on the list, was nominated. He held the inaugural lecture 'De morphotische eenheden van het menschelijk lichaam' [The morphotic entities of the human body] on May , . In this lecture, Bolk, in a rather philosophical manner, unfolded his ideas about evolution and the planning of his own future work. He praised Ruge's scientific spirit, but did not waste a single word on their human and social relationship.

In the second half of the th century and the beginning of the th century, segmental anatomy, which had its origin in older theories of metamery (Lubosch ), was a focus of interest of many anatomists, physiologists and clinicians (van Rijnberk , Hansen and Schliack ). Experimental work had been done by Sherrington ( , ) on monkeys to elucidate the radicular innervation of the skin (dermatomes) and muscles (myotomes).

Bolk used the dissection method to follow the root-fibres from the brachial and lumbosacral plexus to their periphery, unravelling the composition of the plexus, delimiting dermatomes and myotomes. With this method, it was only possible to follow the fine fibres of the dorsal root to the subcutis. Therefore, Bolk's dermatomes are smaller than those established by Sherrington, because with Bolk's method the 'overlap' is less conspicuous, which is, in fact, an advantage in clinical practice.

From observations of the cutaneous eruptions of herpes zoster, a chart of dermatomes was composed by Head and Campbell ( ), which were similar to those after dorsal root section to alleviate spasticity and pain (Foerster ).

Bolk's *Das Cerebellum der Säugetiere* [The cerebellum of mammals] ( ) was composed of three papers on the comparative anatomy of the cerebellum, published earlier in a new anatomical journal, *Petrus Camper*, founded by Bolk and Winkler in . The journal appeared for only a few years. In this monograph, Bolk presented a new subdivision of the cerebellar lobi and lobuli and attempted to correlate their size with the functions of muscle groups. This relationship of form and function led him to the idea of a somatotopy in the cerebellar cortex, such as was known for the Rolandic area.

Bolk's division of the cerebellum and his ideas on localisation were accepted by Winkler, who described them in detail in his *Handboek der Neurologie* ( ).

These ingenious but speculative conclusions on cortical cerebellar localisation were based solely on embryological and comparative anatomical data. Nowadays they are mainly of historical interest (Clarke and O'Malley , Finger ).

Bolk's ideas gave an impetus to new research of the cerebellum (Larsell , Larsell and Jansen ) and also to much criticism from physiologists and clinicians. "My observations consequently lend no support to a circumscribed or focal representation of different portions of the body in the cortex of the cerebellum etc." (Gordon Holmes , ).

Electrophysiological experiments in the last decades have refuted most of Bolk's ideas on somatotopy, though in some experiments a certain somatotopy in the cere-

bellar cortex and nuclei has been found, homolaterally as well as heterolaterally and even bilaterally, on afferent and efferent stimuli (Dow and Moruzzi , Brodal , Groenewegen et al. , Glickstein and Voogd ).

Bolk received a second doctor *honoris causa* distinction and, moreover, was offered the vacant chair of anatomy by the University of Leiden in . This offer induced the University of Amsterdam to accelerate the building of a new laboratory for anatomy and embryology, which had been promised to Bolk earlier; in this way Bolk was persuaded to stay at the Amsterdam University. The Central Institute of Brain Research was built at the rear side of the laboratory and was opened on June , . Dr. C.U. Ariëns Kappers was its first director and Dr. C.T. van Valkenburg, the vice-director.

Winkler and Bolk had instigated the building of the Brain Institute; they represented the Dutch branch of the International Brain Commission, which aimed at creating central institutes for brain research, in its broadest sense, all over the world or to link up with already existing neurological institutes.

In the same year, the Society of Amsterdam Neurologists was founded (June ); an initiative of Van London, Ariëns Kappers and Van Valkenburg. Bolk was also one of the founding fathers (Winkler ).

After his work on the cerebellum, Bolk became interested in odontology, an interest he maintained to the end of his life, and which resulted in a series of papers. Close to his anatomical institute, a cemetery was cleared and all the exhumed material, skeletons, skulls, teeth etc., was taken to the institute and furthered his interest in physical anthropology. He also investigated the teeth of other primates, mammals and reptiles. The results led him to postulate the so-called 'Dimer-theory', which proposed that the teeth of mammals, especially in primates, were originally composed of two components that had melted together.

In later years, Bolk occupied himself with and work on the evolution of man. As Rector Magnificus of the Amsterdam University ( - ), he read a lecture on January , (on the anniversary of the university), with the title 'Brain and Culture'. In an extended form, this lecture was presented in to the German Anatomical Society in Freiburg with the title 'Das Problem der Menschwerdung' (The Problem of Human Evolution). In adult form, the human body retains some fetal characteristics, which are also seen in the foetus of the chimpanzee. However, in this primate, these features are only temporary and are no longer present in the adult chimpanzee. Bolk called the process of retaining these foetal features in man 'foetalisation'. One example of this is hairlessness, seen in the foetal stage of man and chimpanzee and also in the adult state of man. However, the adult chimpanzee's body is covered with hair. Another example is the place of the foramen magnum in relation to the skull and other features of the skull. The foetalisation theory implies the principle of retardation in the development of man. As a consequence, the different stages of life are prolonged.

In Bolk's evolution theory the principle of foetalisation of the form is a necessary consequence of the retardation in the development of the form: "evolution is not a

result but a principle." A similar view is encountered in later works of Dubois (Pat Shipman ), who was not a friend of Bolk.

Bolk's ideas have been largely forgotten and are rarely mentioned in textbooks. Keith ( ), who was a friend of Bolk, wrote an essay 'Foetalisation as a factor in human evolution', which contains the essence of Bolk's ideas.

The principle of foetalisation holds true for some somatic characteristics, but not for its link with the endocrine system (Kloek ). Nor can it be reconciled with the development of the brain in man (weight, cortical surface) compared to that of the chimpanzee (Changeux ).

Bolk was a prolific writer; he wrote about many aspects of physical anthropology, congenital malformations, anatomy of primates, etc., and he may be considered the greatest Dutch anatomist since Petrus Camper (Ariëns Kappers ). Several of his pupils occupied the chairs of anatomy at Dutch universities.

For the neurologist and neuroscientist, his most significant work is in the field of segmental anatomy, the cerebellum, the brain of primates, but also in his ideas about human evolution.

Bolk was painted by the Amsterdam artist Lizzy Ansingh (fig. ), and later, in , by Monnickendam in the classical Dutch setting of an anatomical lecture (see p. chapter ). He is surrounded by three of his former pupils, Professors Boeke at the right side of Bolk, Professor v.d. Broek on his left side and Prof. Barge standing (Baljet ).

Bolk never married; he was busy being a workaholic. The last years of his life were difficult and tragic. In his right leg had to be exarticulated on account of femoral osteosarcoma. Between and two operations for recurrences of the tumour were necessary. He died in .

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* Dr D. Moffie died on November , . J.A.M. Frederiks executed the final editing of the complete manuscript.

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A complete list of Bolk's publications may be found in the obituary by Prof. A.J.P. v.d. Broek: Morphologisches Jahrbuch ( ) - .