

Thomas Willis' legacy on the 400th anniversary of his birth

O legado de Thomas Willis no 400° aniversário de seu nascimento

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Arq. Neuropsiquiatr. 2022;80(7):759–762.

Abstract

To celebrate the 400th anniversary of the birth of Thomas Willis, his main contributions to the development of neurosciences, in particular neurology, are presented. Willis coined the term neurology and contributed significantly to the field of neuroanatomy, with the description of the arterial circle—located at the base of the brain—, which bears his name. He also described the striatum and cranial nerves. Furthermore, as a clinical neurologist, Willis participated in the description of various diseases, including myasthenia gravis and restless legs syndrome.

Keywords

- ▶ Neurosciences
- ▶ Neurology
- ▶ Circle of Willis
- ▶ Neuroanatomy

Resumo

Na comemoração dos 400 anos de nascimento de Thomas Willis, são apresentadas as suas principais contribuições para o desenvolvimento das neurociências, em particular a neurologia. Willis cunhou o termo neurologia, contribuiu significativamente na área de neuroanatomia, com a descrição do círculo arterial localizado na base do cérebro, que tem o seu nome, além da descrição do corpo estriado, e de nervos cranianos. Da mesma forma, como neurologista clínico, Willis participou da descrição de várias doenças como a miastenia gravis e da síndrome das pernas inquietas, entre outras doenças.

Palavras-chave

- ▶ Neurociências
- ▶ Neurologia
- ▶ Círculo Arterial do Cérebro
- ▶ Neuroanatomia

received
March 21, 2022
accepted
June 2, 2022

DOI <https://doi.org/10.1055/s-0042-1755278>.
ISSN 0004-282X.

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Thieme Revinter Publicações Ltda., Rua do Matoso 170, Rio de Janeiro, RJ, CEP 20270-135, Brazil

INTRODUCTION

The year 2021 marked 4 centuries since the birth of Thomas Willis (1621–1675), a polymath and eminent British neuroscientist.¹ Among his numerous contributions to neurology, particularly in neuroanatomy, the discovery of the arterial circle located at the base of the skull, which bears his name—the circle of Willis—stands out.^{1–3}

However, several other contributions by Willis in the field of clinical neurology are noteworthy.^{1–3} This study reviews Thomas Willis' main contributions to neurology and discusses his legacy.

SHORT BIOGRAPHY

Thomas Willis (► **Figure 1**) was born in Great Bedwyn, Wiltshire, United Kingdom, died in London, and was buried in the Westminster Abbey.^{1–5} He enrolled at the University of Oxford in 1637, initially studying at Christ Church College and obtaining the degree of Bachelor of Arts (Chemistry) in 1639 and Master of Arts (Chemistry) in 1642.

That year, Willis began his medical studies, but his education was interrupted after the English civil war started and Oxford was turned into a garrison town. He sided with



Figure 1 Thomas Willis (1621–1675). Licensed under a public domain mark. Source: The Wellcome Collection.

the royalists, and for his loyalty was granted the degree of Bachelor of Medicine in 1646, despite not having a traditional medical education (he only had 6 months of formal medical education).¹ In 1660, he received the title of Doctor of Medicine and Sedleian Professor of Natural Philosophy at Oxford (1660–1675). He was elected an Honorary Fellow of the Royal College of Physicians of London in 1664 and became a fellow of the Royal Society of London 3 years later.^{1–5}

Initially dedicated to the study of neuroanatomy, Willis later developed a career as a clinician, when he expressed interest in the diseases of the nervous system. In Oxford, he started his practice at The Angel on Oxford High Street, and later in London, becoming a prestigious physician with a widespread reputation, often considered “the most famous doctor in Europe”^{2,3}.

THOMAS WILLIS AND NEUROANATOMY

Recognized as one of the most important neuroanatomists, Thomas Willis conducted several studies on the anatomy, physiology, and pathology of the nervous system. Most of his original publications were written in Latin and later translated into English.^{1–7}

His contributions to the anatomy of the central and peripheral nervous systems were numerous. In addition to the famous circle of Willis, he described several structures of the brain, such as the striatum, the internal capsule, the cerebellar peduncles, the anterior commissure, the claustrum, the nucleus inferior olivary, the thalamus, pyramids, and various cranial and peripheral nerves, devising a new classification of the cranial nerves.^{1–10}

He presented these discoveries in his *magnum opus*, the book *Cerebri Anatome* (► **Figure 2**), containing 29 chapters and 29 illustrative figures. Published in 1664, this manuscript became known worldwide. For this book, Willis received important help from his closest collaborators, such as Sir Christopher Wren (1632–1723), Sir Thomas Millington (1628–1703), and especially the intense collaboration of Richard Lower (1631–1691).^{1–3,5,9,10} Of the seven books published by Willis, the fifth book, entitled *De Anima Brutorum*, is a landmark in the field of comparative neuroanatomy.^{1–3,5,9,10}

THOMAS WILLIS AND THE BEGINNINGS OF NEUROLOGY

Willis' habit of taking detailed histories combined with astute clinical observations and postmortem studies has left a body of work that still provokes thought and debate.¹

His many contributions to clinical neurology include articles on headache, epilepsy (presenting one of the first descriptions of temporal lobe epilepsy), stroke, paralysis of the insane, narcolepsy, intellectual disability, and hysteria.^{1,5}

The initial description of myasthenia gravis, in 1672, in a female patient with dysarthria/anarthria, defined by him as “seedlings like a fish” is paramount,^{1–3,5,9–11} and Willis

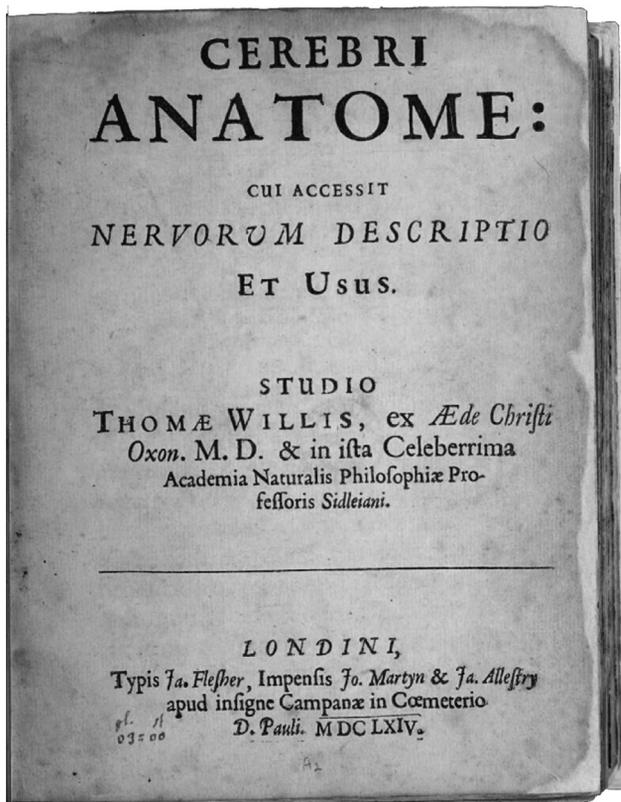


Figure 2 Cerebri Anatomie (1664). Licensed under a public domain mark. Source: The Wellcome Collection.

established the clinical picture of symptom fluctuation and fatigability.¹¹

In 1672, Willis presented the first description of restless legs syndrome. This condition—later studied and refined by Karl-Axel Ekbom (1907–1945)—is currently named Willis-Ekbom syndrome.^{1–3,5,9,10,12–14}

In the field of cognition, Willis discussed the concept of the body-brain-soul relationship and the differentiation of these functions between humans and animals. In this area, his contribution is opposed to that of René Descartes (1596–1650), his contemporary, who launched his work entitled *Traité de l'homme*, creating a dualist theory of body and mind.^{1–3,5,10,15,16} Willis is regarded as the first contributor to the field to propose that the higher cognitive functions of the human brain stem from the convolutions of the cerebral cortex.^{1–3,5,15,16}

THOMAS WILLIS AND THE FOUNDATION OF NEUROLOGY

Thomas Willis coined the term *neurology* to designate the doctrine (or teaching) of the nerves.^{1–5,9,10} There is a consensus that Willis was the leader of the first multidisciplinary team in the field of neurological science.^{1–3,5,10}

As a result of Willis' expressive contributions to the development of neurosciences, both in basic science and clinical neurology, several authors, including Feindel, con-

sider Willis the founder of neurology. Likewise, Feindel defined Oxford as the birthplace of both neurology and neurosciences.³

Nevertheless, John Hughlings Jackson (1835–1911) is considered the father of English neurology. Among the other paragons of British neurology, we should mention William Richard Gowers (1845–1915), David Ferrier (1843–1928), Kinnier Wilson (1878–1937), Sir Gordon Holmes (1876–1965), and Sir Charles Sherrington (1857–1952).^{17,18}

Due to its great importance in the history of medicine, Willis' input to neurology could be compared with the magnanimous contributions of Charcot, the most celebrated Professor of Neurology of the 19th century, considered the father of modern neurology.^{19,20} Jean-Martin Charcot's (1825–1893) works also range widely, including the fields of pathology (with particular emphasis on his anatomoclinical method), neurology (clinical descriptions of amyotrophic lateral sclerosis, multiple sclerosis, Parkinson disease, and locomotor ataxia), internal medicine (descriptions of gout, diabetes mellitus, cholangitis, and peripheral arterial disease) and psychiatry (with a particular interest in the subject of hysteria).^{19,20}

In conclusion, Thomas Willis, four centuries after his birth, must be remembered as a great neuroanatomist and a leading clinical neurologist. His important contributions to neuroscience earned him a rightful place in the pantheon of the founders of neurology.

Authors' Contributions

HAGT: conceptualization, investigation, writing – original draft, supervision; LC, CHFC, RPM, OW: investigation, writing – review & editing.

Conflict of Interest

The authors have no conflict of interests to declare.

References

- Molnár Z. On the 400th anniversary of the birth of Thomas Willis. *Brain* 2021;144(04):1033–1037
- Arráez-Aybar LA, Navia-Álvarez P, Fuentes-Redondo T, Bueno-López JL. Thomas Willis, a pioneer in translational research in anatomy (on the 350th anniversary of Cerebri anatomie). *J Anat* 2015;226(03):289–300
- Feindel W. The beginnings of neurology: Thomas Willis and his circle of friends. In: Clifford Rose F. *A short history of Neurology. The British contribution 1660–1910* Oxford, Butterworth Heinemann 1999:1–18
- Finger S. Origins of Neuroscience. A history of explorations into brain function. In: Finger S. *Changing concepts of brain function*. Oxford University Press Oxford, UK 1994:23–24
- Hughes JT. *Thomas Willis 1621–1675: His life and Works*. Rimes House 2nd edition Oxford 2009
- Donaldson IML. Cerebri anatomie: Thomas Willis and his circle. *J R Coll Physicians Edinb* 2010;40(03):277–279
- Choudhari KA, Sharma D, Leyon JJ. Thomas Willis of the “circle of Willis”. *Neurosurgery* 2008;63(06):1185–1190, discussion 1190–1191
- Willis T, Meyer A, Hierons R. A note on Thomas Willis' views on the corpus striatum and the internal capsule. *J Neurol Sci* 1964;1(06):547–554

- 9 Rengachary SS, Xavier A, Manjila S, et al. The legendary contributions of Thomas Willis (1621-1675): the arterial circle and beyond. *J Neurosurg* 2008;109(04):765-775
- 10 Rose FC. Chapter 39: an historical overview of British neurology. *Handb Clin Neurol* 2010;95:613-628
- 11 Hughes T. The early history of myasthenia gravis. *Neuromuscul Disord* 2005;15(12):878-886
- 12 Willis T. *The London practice of physick*. London, England: Basset and Crooke; 1685
- 13 Chaudhuri KR, Appiah-Kubi LS, Trenkwalder C. Restless legs syndrome. *J Neurol Neurosurg Psychiatry* 2001;71(02):143-146
- 14 Allen RP, Picchietti DL, Garcia-Borreguero D, et al; International Restless Legs Syndrome Study Group. Restless legs syndrome/Willis-Ekbom disease diagnostic criteria: updated International Restless Legs Syndrome Study Group (IRLSSG) consensus criteria—history, rationale, description, and significance. *Sleep Med* 2014;15(08):860-873
- 15 McNabb J. Thomas Willis: the faculties and his two cognitive frameworks. *Brain Cogn* 2014;91:131-137
- 16 Hunting P. 'To unlock the secret places of Man's Mind'. *Thomas Willis (1621-1675)*. *Journal of Medical Biography* 2022;30(03):202-204. Doi: 10.1177/09677720211000728
- 17 Critchley M, Critchley EA, John Hughlings Jackson. *Father of English Neurology*. Oxford University Press Oxford 1998
- 18 Scott A, Eadie M, Lees AJ, William Richard Gowers 1845-1915. *Exploring the Victorian brain*. Oxford University Press Oxford 2021
- 19 Goetz CG, Bonduelle M, Gelfand T, Charcot. *Constructing Neurology*. Oxford University Press Oxford 1995
- 20 Teive HAG, Almeida SM, Arruda WO, Sá DS, Werneck LC. Charcot and Brazil. *Arq Neuropsiquiatr* 2001;59(2-A):295-299