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Thomas Willis: physician who described the circle of Willis, the arterial anastomosis at the base of the brain

Thomas Willis is known for the discovery and description of the circle of Willis, but his contributions to the development of medicine were much broader, including the first use of the term 'neurology'.

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Every medical student and nurse in this country will, I hope, be familiar with the term 'the circle of Willis', the beautiful anastomosis on the ventral aspect of the brain. It is located between the terminal branches of the internal carotid arteries anteriorly and the basilar artery behind, itself formed by the junction of the vertebral arteries on either side. Many will have seen in their textbooks its original illustration, drawn by none other than Sir Christopher Wren, at the time a colleague of Willis at Oxford. Sadly, I would suggest that only a minority could tell you much more about Thomas Willis, yet he was one of the most brilliant medical observers of the 17th century. Willis was second only to William Harvey, who documented the circulation of the blood, in his contributions to the science of medicine of those times.

This year marks the 400th anniversary, of the birth of Thomas Willis in 1621. His father was a farm steward at Great Bedwyn in Wiltshire. His birthplace can be seen there to this day. Thomas attended school in Oxford, matriculated at the age of 16 years and entered Christ Church to study Latin and Greek. He graduated with a Bachelor of Arts in 1639, proceeding to the degree of Master of Arts in 1642.

His subsequent career would probably have been in the Church, but 11 days before he could receive his degree, on 1 June 1642, Parliament delivered its '19 propositions' to King Charles I. The king's rejection of the document led directly to the outbreak of the English Civil War. Willis's studies were interrupted by his service in the King's forces in the Royalist regiment of members of the University, and then by his change to the study of medicine. He gained personal experience of the fevers that plagued the military of those times, such as 'camp fever'.

Willis completed his formal medical education in December 1646, when he received the degree of Bachelor of Medicine. However, Willis was relatively inexperienced and did what was customary for a novice. He visited the markets in the small towns around Oxford (he especially favoured Abingdon). Here he would take a history from the patient, or from a relative, and then examine a sample of the subject's urine, the only form of investigation then in use. The sweetness of the urine in patients with diabetes enabled the physician to distinguish this disease from other causes of polyuria. His practice flourished and he eventually became the most popular (and wealthiest) physician in Oxford.

In addition to his medical practice, Willis carried out scientific experiments in his rooms at Christ Church. He was fortunate to have as his friends and collaborators a coterie of distinguished scientists and physicians. These included Sir Christopher Wren, later the architect of the rebuilt St. Paul's Cathedral and numerous other important damaged buildings in London, Robert Boyle, who carried out fundamental studies on gases, Thomas Millington, who became President of the Royal College of Physicians, and Richard Lower, who carried out the first successful blood transfusions in dogs.

In 1667, after the Great Fire, Willis moved to London at the invitation of Gilbert Sheldon, who had been his patient in Oxford and was now the Archbishop of Canterbury. In the metropolis, Willis set up a flourishing practice in Westminster.

Willis's contributions to the anatomy, physiology and pathology of the nervous system can hardly be exaggerated. Indeed, the very word 'neurology' first appears in his book

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Cerebri Anatome, which was published in 1664. This book includes not only the description of the arterial anastomosis on the ventral aspect of the brain, but abounds in further accurate observations. In his discussion of neurology, he observed that the cerebral ventricles contained CSF, which he believed collected waste products from the brain. He believed that voluntary movements came from the cerebral cortex, while involuntary movements were localised to the cerebellum, and noted the tree-like arrangement of the white and grey matter in this structure,

Apart from his neurological studies, Willis made important original observations in other fields of medicine. Willis described a patient with undoubted achalasia of the oesophagus and devised a means of treatment. This was in 1674, when he described 'a strong man, otherwise healthy' suffering from repeated vomiting, usually casting up 'whatsoever he had just eaten'. Medicines were of no avail, 'he languished from hunger and was in danger of death'. Willis fashioned a rod from whale bone and attached a sponge to the tip. The patient, having eaten and drunk, would pass the instrument through his mouth into the stomach, allowing the food to pass into that organ 'By this means, he has taken his sustenance for 15 years and is yet alive and well when otherwise he would have perished from hunger'. To this day, bouginage is one way of treating this problem.

Willis was familiar with diabetes mellitus, 'the pissing evil', recognised the sweetness of the urine and the distinction from the polyuria of renal disease. He also described what was probably diabetic neuritis.

Thomas Willis died in 1675 aged 54 years, of pleurisy and pneumonia, at the height of his powers as a physician and writer, and was buried in Westminster Abbey. Together with William Harvey, he must be recognised as one of the two physicians of his time who laid the ground for the development of scientific medicine in this country.

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