Jan Evangelista Purkyn? (1787-1869) [1]


Jan Evangelista Purkyn?, also called Johannes or Johann Evangelist Purkinje, studied cells in the **cerebellum** [7], fibers of the heart, subjective visual phenomenon, and germinal vesicle, in eastern Europe during the early nineteenth century. His investigations provided insights into various mechanisms and structures of the human body. Purkyn? introduced techniques for decalcification of bones and teeth, embedding of tissue specimens, and eye examinations. He was one of the first to adopt the **microtome** [8] in his experiments and to use the term protoplasm when describing the contents of young animal embryos. Purkyn? identified structures in the eggs of chickens, such as the germinal vesicle, from which he hypothesized the female reproductive cell (**ovum** [9]) developed, and around which he said an embryo developed. Purkyn?’s results helped others locate ova in mammals.

Purkyn? was born on 17 December 1787 in Libochovice, Bohemia, later called the Czech Republic, to Rosalie Safranek and Josef Purkinje (Purkyn?). His father managed one of Karl Johann Alois?s, Prince of Dietrichstein, estates in northern Bohemia. Josef Purkyn? stimulated his son’s study of nature, but he died when Jan was six. Aided by the local schoolteacher and parson, Purkyn? at the age of ten attended a Piarist monastery as a choirboy in Mikulov (Nikolsburg), in southern Moravia, at another of the Dietrichstein estates. When admitted Purkyn? only spoke Czech, but soon learned both German and Latin. In 1806, in preparation for university studies, such as theology, law, and medicine, Purkyn? went to the Piarist Philosophical Institute in Litomyšl, located in eastern Bohemia. After he studied with the Piarist monks, Purkyn? took the first step, or orders as a novitiate, to becoming a monk. After he read the work of contemporary philosophers, including Johann Gottlieb Fichte and Friedrich Wilhelm Joseph Schelling, who both lived in Germany between the mid-eighteenth and mid-nineteenth centuries, he abandoned an ecclesiastical career and pursued philosophy at **Charles University** [10] in Prague, Bohemia. There he studied medicine and natural science. Purkyn?’s 1819 inaugural doctoral dissertation focused on the visual phenomena of individuals.

Following Purkyn?’s graduation in 1819 with a doctorate in medicine, he worked at the **Charles University** [10] as an assistant in anatomy and physiology. Professor of surgery, Johann Nepomuk Rust, and, professor of anatomy, Karl Asmund Rudolphi at the **University of Berlin** [11] in Berlin, Germany, helped him get appointed in 1823 as professor of physiology at the **University of Breslau** [12], Breslau, Prussia, later called Wroclaw, Poland. In the same year, Purkyn? published a classification of fingerprints and their use in identification, and later in 1823. In 1827, at the age of forty, Purkyn? married Rudolphi’s daughter, Julia Rudolphi, and her death in 1835 eight years later left Purkyn? with their two sons.

Between 1818 and 1825, Purkyn? researched subjective sensory phenomena by experimenting on his own senses and conducted his work in his home laboratory. University officials’ didn’t meet his request for space and equipment. He studied visual sensations after
applying pressure on his eyeball. He used galvanic stimulation, in which he applied an electric
current to stimulate his muscles to contract. Purkyn? observed the blood vessels in retinas [13]
by directing a narrow beam of light at the corner or white part of the eye, called the sclara.
The light causes shadows of the blood vessels to fall on neighboring sensitive areas. The
phenomena is called the Purkinj? tree because of the branching pattern. Purkyn? also
observed that when the illuminating intensity of light decreases, different colored objects, with
equal brightness, appear to be unequally bright. For instance, in dim light or in light of less
intensity, a blue object appears brighter than a red object. Furthermore, in bright light or in
light of high intensity, the red object appears brighter than a blue object. Researchers later
called those phenomena the Purkynj? phenomenon, or Purkyn? shift. Later Purkinj? described
the threefold images of an object that one sees in the eye of another person, known as the
Purkynj? images. The images are reflections from the cornea and lens of the eye. Purkyn?
recommended that, to examine the interior of the eye, a concave lens should reflect light into
the eye. In 1851 Hermann von Helmholtz [14], at the University of Königsberg, in Königsberg,
Prussia, used this method with his ophthalmoscope.

Purkyn? also studied vertigo, partly because of reading Erasmus Darwin´s Zoonomia.
Erasmus Darwin, the grandfather of Charles Darwin [15], lived and worked in Lichfield,
England, in the eighteenth century. Erasmus described the effects after viewing, rotating, and
translating motions, but he described no after-effects. Purkyn? observed such after-effects as
the change in the apparent motion of one´s surroundings after stopping the body´s rotation
around an axis. Purkyn? induced the effect of vertigo by experimenting on himself in a
specially designed chair. He found that the position of the head determines subjective motion
and that the cerebellum [7] plays a major role in vertigo. His description of the relationship
between the position of the head and perceived direction of motion was later called Purkynj?´s
law of vertigo.

Between 1825 and 1832, Purkyn? studied the development of avian eggs in the body of
female chickens before they laid the eggs. He isolated the germinal vesicle, later identified as
the nucleus [16] of the fertilized egg [17]. Prior to his work, researchers argued about whether the
embryo originated in the egg [18] or somewhere else. Some hypothesized that the embryo
originated in the egg white, or in the yolk [19], or in the white ovalbumin component, called
chalazae. After Purkyn? obtained an achromatic microscope [20], which eliminates the colored
fringes that appear around objects viewed under the microscope [20], he examined female
germ cells [21], which he had removed from chicken [22] ovaries that he had dissected. He
observed a white elevation on the surface of the yolk [19], and he used a needle to pry the
structure apart, revealing the vesicle, or nucleus [16]. He concluded from his observations that
the vesicle must be the egg [18] cell, which he called the germinal vesicle, from which the
embryo develops. Purkyn? proposed that the ovum [9], or egg [18] cell, develops around the
vesicle. Moreover, Purkyn? theorized that while the vesicle is present in unripe ova, it
dissolves after fertilization [23]. He described his observations in his essay entitled Symbolae
ad ovi avium historiam ante incubationem (Contributions to the history of birds´ ova before
incubation), which he published in 1825.

Purkynj?´s work influenced other scientists. He corresponded about his work with Ernst Karl
von Baer in Königsberg, Germany, who later discovered egg [18] cells in mammals. Purkyn?´s
results, along with his finding of cellular structures he called granules in the animal and plant
tissues, contributed to the development of cell theory. To describe the content of cells,
Purkyn? introduced the term protoplasm to identify the substance first formed in the
development of an animal or plant cell. Furthermore, in the 1830s, Theodor Schwann, working
in Berlin, Germany, built on these observations to construct the concept of cellular structure.

From 1829 until 1845, Purkyn? investigated other phenomena. He introduced the conception of physiological pharmacology in 1829, when he described the experimental effects on humans of camphor, opium, belladonna, and turpentine, and studied the digitalis toxicity on himself. His research of phonetics, through observations on himself, influenced the work of Johann Nepomuk Czermak at Breslau, Prussia, and of Ernst Wilhelm von Brücke, in Berlin, Germany, during the mid-nineteenth century. Purkyn? contested what he termed the speculative methods of physiology used by many researchers in central Europe, and he argued that physiology should be an experimental science. In 1839, he created one of the earliest departments of physiology at the University of Breslau, and then he created one of the earliest independent physiological laboratories in 1839, later called the Physiological Institute, in Breslau.

Purkyn? used microscopes to study various features of bodies. Purkyn? and his student Gabriel Valentine, working at the University at Breslau in the 1830s, described ciliary motion in what they called higher animals, along with its independence from control by the nervous system. They published an article about the ciliary motion in 1835. Ciliary motion occurs in tissues and results from hair-like organelles that line the surfaces of some cells and beat in rhythmic waves to move substances along the tissue. In 1837, Purkyn? described the branched nerve cells located in the brain of animals like sheep, calf, pig, horse, and human, and he described the fibers that form a network in the heart of those same animals in 1839. He examined the number and distribution of nerve fibers according to their diameters in the roots of both spinal and cerebral nerves in organisms from several animal species. He theorized that thick fibers had different functions than thin fibers.

Purkyn? studied the skin of humans and described the skin´s sweat glands. In addition, he studied the structures of bone, teeth and their development, cartilage, arteries, and veins. Purkyn? showed that pancreatic extracts digest proteins, and he compared the cellular structures in plants and animals. He promoted the use of microscopes and was one of the first to teach microscopy as part of a university course. Purkyn? introduced techniques and tools to examine tissues with microscopes. He constructed an apparatus for flattening tissues between glass plates, called a compressorium, and he developed decalcification and grinding techniques to help the study of bones and teeth. Purkyn? was one of the first to adopt the microtome, an instrument capable of slicing tissues into thin samples.

Moving to Charles University in Prague in 1849, Purkyn? established a second Institute of Physiology in Prague. After 1850, as a professor at Prague, he advocated science and learning among his countrymen who spoke only Czech. As education was available only to those who knew German or another common language, in 1853, Purkyn? began publishing a scientific journal called Ziva in the Czech language. To make science more accessible to his countrymen, He strove to get Czech accepted as a language of instruction at the University of Prague. In 1850, he was elected as a Foreign Member of the Royal Society of London, England.

Purkyn?´s written work is collected in the first twelve volumes of Opera Omnia (Total Works). The thirteenth volume contains his autobiography. Several of his works are in Opera Selecta (Selected Works). Purkyn? died in his eighty-second year on 25 July 1869.
Sources

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3. Encyclopedia Britannica Online, "Jan Evangelista Purkynje [34]." 


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**Subject**


**Topic**

People [53]