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Medicine in Stamps

Johannes Evangelista Purkinje (1787-1869): 19th century's foremost phenomenologist

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"The most important problem of a physician appears to me not his effort to renew a life already shattered, or to sustain a life a little longer, but efforts towards the support of evolving life; to protect it from harm; to bring it to the peak of perfection and beauty... The physician who assumes this task may be called an artist. Otherwise he merely performs the task of a repairman..."
Purkinje's inaugural oration in Breslau, December 1823

The early 19th century ushered in a host of medical contributions by the likes of Laennec, Virchow and Pasteur. Many of the discoveries took place in Germany, France and other parts of Western Europe. Yet the distinction of the century's foremost physiologist arguably belongs to Johannes Evangelista Purkinje (proper Czech spelling is Purkyně), a Czechoslovakian physiologist. Born on 17th December 1787, Purkinje's legacy is well known to all physicians. His name is associated with conduction fibres in the heart, neurons in the brain, and colour phenomena in the eye.

Purkinje began his adult life in a Catholic monastery but disappointment caused him to forsake his final priestly vows. He then trained as school teacher, tutor and philosopher before beginning his medical education in 1814 at the University of Prague. His 1819 dissertation *"Contributions to the Knowledge of a Subjective View of Vision"*, earned him the attention of Germany's greatest poet and writer, Johann Wolfgang von Goethe, who had a great impact on Purkinje's subsequent career.

Purkinje commenced his career working as an intern for four years in the anatomy and physiology department at the University of Prague. In 1823, Breslau University appointed him professor of pathology and physiology amidst controversy as he was not German. How Purkinje was able to obtain this offer and whether Goethe was responsible remains debatable. What is evident however was his friendship with Goethe to whom he dedicated his second book, *New Subjective Reports about Vision*, which was published in 1825. Purkinje was interested not only in scientific work, but also in poetry, and he translated some of Goethe's and Friedrich von Schiller's poetry into his own native tongue.

Purkinje's chief interest was clinical research rather than medical practice. He founded the Physiological Institute of Breslau in 1839, the first of its kind in the world. In 1850, at the age of 63 years, Purkinje was appointed to the Chair of Physiology in Prague. There, he likewise established a physiological institute, became the founding editor of a Czech scientific journal, and served as an electoral member of the Bohemian Parliament (1861-1866).

Purkinje was first and foremost an "exceptional phenomenologist". By his astute and careful observations of natural happenings around him, he was able to formulate various hypotheses and conduct experiments including self-experimentation that ultimately led to scientific conclusions. His contributions covered many specialties, especially ophthalmology, cardiology and neurology.

Contributions in Ophthalmology: Purkinje enjoyed strolling along the blossomed Bohemian fields at dawn, and it was during one of his long walks when he noticed that red flowers looked more bluish-red as dawn approached. Purkinje correctly hypothesised that as light intensity decreases, red objects faded faster than blue objects. This important observation of the dark adaptation phenomenon came to be known as the "Purkinje effect", which he first described in 1819. Purkinje subsequently published two books on subjective visual phenomena in 1823 and 1825 *(Observations and Experimentations Investigating the Physiology of Senses and New Subjective Reports about Vision),* in which he wrote: *"The intensity of illumination has a marked effect on the brightness of*

the perceived colors. In order to convince ourselves of this fully, let us place before us (spectral) colors at daybreak, when it just begins to dawn, be it ever so slightly."

Purkinje went on to describe a number of other visual phenomena such as "Purkinje tree" (the shadows of the retinal vessels are seen as dark lines on a reddish field when light enters the eye through the sclera). "Purkinje-Samson images" are the threefold reflections seen in the eye of another person, caused by an object reflecting from the corneal surface and both sides of the lens. Purkinje also observed that we still see a latent image of an object a fraction of a second after it disappears from our visual field. This came to be known subsequently as "Purkinje persistence of vision" or an "after image".

Contributions in Cardiology: Although Purkinje's discoveries in vision physiology are scientifically more substantive, he is nonetheless best known for the description of the famous subendocardial Purkinje fibres of the heart. At the time of discovery in 1839, Purkinje did not fully comprehend their physiological significance. He wrote: *"For the time being, I'm inclined to regard this new tissue as cartilage, although I do not understand its efficacy, considering its delicacy in view of the relatively enormous muscle mass of the heart"*. It was some 60 years later before Tawara described the atrioventricular (AV) node and showed the connection between the AV bundle and the Purkinje fibres as an integral part of the heart's electrical conduction system. Purkinje also described the manner by which the heart facilitated venous return (increased size of the right atrium as a result of tricuspid valve movements), as well as the pharmacological effects of digitalis.

Contributions in Neurology: In 1837, two years before his discovery of the Purkinje network in the heart, Purkinje described neuronal cells in the middle layer of the cerebellar cortex which had long dendrites and a single thin axon. These are now known as Purkinje cells. Additionally, from his personal observations of how his body responded and adapted to rotational movements (while rollicking on the swings in Prague's amusement parks), he developed Purkinje's Law of Vertigo, which describes the relationship of the head's perception of position to the body's rotational movements.

Other Discoveries: Utilising new fixing and staining techniques, Purkinje made numerous histological observations of bone, cartilage, teeth, skin, sweat glands, and the germinal vesicles (Purkinje vesicles). He described ciliary movement and the digestion of tissues by gastric juice, and was the first to provide a general concept of the role of the stomach in food digestion and to introduce the scientific terms "protoplasm" and "plasma".

Purkinje was one of the first to recognise the unique nature of a person's fingerprints, cataloguing "nine important varieties of patterns of rugae and sulci, though the lines of demarcation between the types are often obscure." However, he failed to associate fingerprint with personal identification, and the forensic science of fingerprinting had to await an additional 70 years before Sir Francis Galton promulgated its use in 1892.

Self-experimentation: Purkinje believed that experiments performed on oneself were more valuable than those performed on cadavers or animals. He performed a total of 35 self-experiments, deliberately overdosing himself with various drugs, and graphically recording their visual and other effects. Purkinje tested belladonna by putting drops into his eyes, describing its visual disturbances and subsequently ingested an overdose to experience dry mouth and tachycardia. His experiments led to the subsequent discovery of atropine. Purkinje also poisoned himself with digitalis for four consecutive days to study its visual effects, and he self-experimented with opium, ipecac, turpentine, nutmeg and camphor.

A sad personal life: Despite the wide scope of his scientific discoveries, Purkinje never compiled his accomplishments, and to this day, there is no single text that provides a comprehensive coverage of the works of this Czech genius. A glaring omission is his early description of ophthalmoscopic techniques to view the inner chambers of the eye, years before Helmholtz's classic treatise on the subject. Some have attributed his aversion to writing and publicity to his "unassuming, self-effacing, even naïve" personality, and his disinterest in "personal glory or personal gain." Did it have something to do with his sad personal life? His father died when he was only six, and of his four children, two daughters died untimely deaths in 1832 from cholera. Three years later, his wife died from typhoid. Purkinje never remarried and brought up his remaining two sons on his own. He eventually stopped all self-experimentation. A scholar to the end, Purkinje is said to have begun learning Hungarian at the age of 80 in order to translate a libretto. He died at 82 years of age, in his native land of Czechoslovakia, on July 28, 1869.

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