The Life of Ivan Petrovich Pavlov

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Abstract

Ivan Petrovich Pavlov was a Russian physiologist who had many accomplishments during his lifetime. He started school late, but excelled enough to start university early; it was there that his true passion, physiology, began to consume him. He was given the opportunity to direct a laboratory and conduct experiments. While working there, he met his wife who he had four children with. He became the Chair of Physiology and changed the way of teaching. Soon he was interested in conditioned reflexes and devoted the rest of his life to studying them in animals (mainly dogs). He died at the age of 86 in Leningrad but his teachings live on in his writings and his students.

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**The Life of Ivan Petrovich Pavlov**

Ivan Petrovich Pavlov was born in September 26, 1849. He was born in Ryazan (Liddel, 1936), a small town about 150 miles outside of Moscow (Gray, 1979). His father was a priest in this parish. In this time, the life of the priest had changed little since Russia was mostly an agricultural country merely 100 years before. The priests worked the land on church property, just as the peasants worked their land. Poverty was a way of life because the clergy usually had big families. Pavlov’s father, Peter Dmitievich Pavlov, had an intellectual curiosity throughout his life. Despite living in poverty, he would try to purchase books, which he would always read at least twice to understand it better. Because of the agricultural circumstances in which he was brought up, Peter had a love for working on the land; he expressed this by working in a vegetable garden and an orchard he had in Ryazan (Babkin, 1949).

Pavlov received his love of learning from his father. He had favorite topics that he would explore. He read not only scientific writing but also literature. He did not read for leisure, but to satisfy his need to know and comprehend something new. He also received from his father a love for gardening and often helped with the garden and orchard (Babkin, 1949).

When he was a boy of nine, Pavlov was in poor condition from a fall off of a fence onto a brick floor, seriously injuring him. Seeing Pavlov in such a pitiful condition on one of his visits to the family, his Godfather, the Abbot of St. Trinity’s Monastery near Ryazan, brought Pavlov with him back to the monastery to attend to him. The Abbot helped Pavlov recover by making certain he had enough exercise, good food, and fresh air. In return, Pavlov helped with the garden at the monastery. He was greatly influenced by the seemingly constant labor of his Godfather. He was convinced for a long time that his Godfather didn’t sleep because he always seemed to be working. Seeing the simplicity of the monastery also affected him. The Abbot was nourished only with bread and water. If he became ill he allowed himself the indulgence of tea with honey. Pavlov took this example of simplicity for the rest of his life and did not have many material requirements (Babking, 1949).

As with most clergy, Pavlov’s family was large. The oldest children were Pavlov himself, Dmitri, and Peter. They were one year apart from the one before them and were in good health. A succession of six children were born and died in early childhood from disease. Two more children were born, Sergei and Lydia. Pavlov’s mother, Varvara Ivanovna, suffered poor heath after bearing all of her children. Perhaps in response to their mother’s health the youngest children were not as strong of health as their older siblings (Babkin, 1949).

**Seminary School and University**

Pavlov was behind in school, having missed two years because of the fall he had. He and the eldest brothers entered the seminary school at Ryazan (Liddel, 1936). While in seminary school, Pavlov read the writings of the writer and critic Pisarev. It is because of these writings that Pavlov chose natural sciences to study at university (Babkin, 1949). He had decided not to pursue a theological career, but instead enter the University of St. Petersburg (Liddel, 1936). About a year later, Dmitri also began attending the university and lived cheaply with Pavlov (Babkin, 1949).

In his third year at university, Pavlov decided to become a physiologist by the influence of the professor of physiology, Ilya Cyon (Banting, 1936). Pavlov was rewarded with a gold metal on his first experimental work on the pancreas (Liddel, 1936). Cyon suggested the subject matter to Pavlov. Because of his experimental work, he had to take an extra year to graduate, which he did in 1875 (Babkin, 1949).

After graduation, Pavlov was going to accept an assistantship at the laboratory at the Medico-Chirurgical Academy under Cyon, who had transferred there as the professor of physiology before Pavlov’s graduation. While working under Cyon, Pavlov wanted to study medicine. The assistantship never occurred however, because of Cyon’s retirement. The assistantship was still offered by Cyon’s replacement, but despite living in hardship Pavlov declined, having a dislike of the new professor of physiology from an incidence on an earlier occasion (Babkin, 1949).

Pavlov did accept an assistantship under Professor Ustimovich in the Physiological Laboratory in the Veterinary Institute from 1876-1878. Here he studied blood circulation and digestion. In the summer of 1877, Pavlov traveled abroad to Breslau to the Physiological Laboratory of Professor Heidenhain (Banting, 1936). There he published his first work on the effects of ligation of the pancreatic ducts in rabbits (Babkin, 1949).

During his assistantship, while he worked with Ustimovich, Pavlov focused solely on the circulatory system. His work was based on the blood vessels change in reaction to different volumes of blood without drastically changing the pressure of the blood. In his experiments, he increased and decreased the amount of fluid in superficial arteries on the inner side of the knee joint of dogs. He then measured the blood pressure several times a month. It stayed fairly constant, never going more than 20 millimeters in either direction. This was done on unaesthetized, average animals, with little to no pain to that animal (Babkin, 1949).

In his M.D. thesis, Pavlov came to the conclusion that the heart is supported by four kinds of nerves controlling the rhythm and strength of the contractions. The first two kinds of nerves are (1) nerves that inhibit and (2) nerves that weaken its contractions; these nerves end up at the heart with the vagus nerve. The last two kinds of nerves come from the sympathetic nervous system; (3) nerves that accelerate, and (4) nerves that augment contractions. It was thought that only the vagus and sympathetic nerves on the heart cause these effects.

Pavlov explored these effects by separating fibers connecting to the heart of a dog using one of two methods. His first method used the tincture of the lily of the valley, inserted intravenously. This allowed him to separate the fibers of the vagus nerve that inhibited and that weakened constriction. Upon stimulation of the vagus nerve, only blood pressure was affected, not heart rhythm. The other method Pavlov used was one of isolation. He separated different fibers of the sympathetic cardiac nerves and the vagal nerves. He studied the result of the nerves’ faradization; stimulating these nerve fibers separately did not yield pure results toward weakening (or augmentation) and inhibition (or acceleration) but a mixture. In 1886 Pavlov returned from Leipzig and continued directing Botkin’s Laboratory at the Military-Medical Academy. Near the end of his directorship, he became interested in digestion. (Babkin, 1949).

Pavlov graduated from the academy in December 1879. He was granted a scholarship to do postgraduate research at the academy, then abroad for two years for further study. He still wanted to be a physiologist, but with the current professor, it was not possible there. Luckily, on the recommendation from a friend, Dr. Stolnikov, after reading his work on blood circulation, Pavlov was asked by Professor Botkin to head the newly opened experimental laboratory connected to where he was doing postgraduate research (Banting, 1936). Botkin gave Pavlov complete control over investigations; the results were interpreted by Botkin (Liddel, 1936). Pavlov used in his experiments his knowledge he gained studying medicine in clinical environments. He especially emphasized that these two studies should not be mutually exclusive (Babkin, 1949). He received the degree of Doctor of Medicine on May 23, 1883 (Liddel, 1936).

**Married Life**

Pavlov married Seraphima (nicknamed Sara) Vasilievna Karchevskaya in 1881 while still directing the Botkin Laboratory. Sara was born in 1855. She studied at the Pedagogical Institute at St. Petersburg, and met Pavlov in 1878 or 1879. Pavlov and his brother Dmitri, who was the assistant in the Department of Chemistry at the University, were living together in a small apartment when they met. For the first nine years of marriage, their life was difficult financially. It was not rare that the two had to live apart, accepting hospitality on whoever would allow them to stay. In 1890, after receiving the Chair of Pharmacology in the Military-Medical Academy and in 1891 the Directorship of the Department of Physiology in the Institute of Experimental Medicine, did the financial burden begin to lift (Babkin, 1949).

Pavlov liked to take walks with Sara. Though he walked so fast, she often had to run to keep up with him. When expecting her first child, Sara miscarried from the overexertion of running after Pavlov. The next time Sara was pregnant, Pavlov made sure she did not exert herself at all, not even allowing her to walk up the stairs, but instead carried her up the four flights the their apartment. Their son Mirchik was born, but they had no money to raise him in St. Petersburg. It was decided Sara and the baby would stay with her sister in the south. While there, Mirchik died suddenly from a summer’s disease. Sara and Pavlov ended up having four children: Vladimir, Victor, Vsevolod, and Vera. It is because of her highly held religious values and spiritual-wellbeing that Sara was able to stay happy in her marriage to Pavlov (Babkin, 1949).

Pavlov was dependent on Sara when he was at home. She was in charge of the cleaning and the money in the household. Pavlov also relied on her for news. He never read any newspapers or articles, but trusted his wife to tell him any news of the outside world. Because she was responsible for everything at home, he was free to be absorbed in his work (Banting, 1936).

**The Perfect Job**

In April 1890, Pavlov was appointed Chair of Pharmacology at the University of Tomsk in Siberia but left after only one day because he had been elected by the Conference of the Military-Medical Academy as their Chair of Pharmacology. He found the conditions much more suitable at the Academy. In June 1891, he was asked to direct the Physiological Department of the Institute of Experimental Medicine that had opened (Babkin, 1949) the previous year at the same institution (Liddel, 1936).

After the Chair of Physiology, Cyon’s replacement, was dismissed, the Principal of the Academy appointed Pavlov for the position on May 29, 1895. He took the opportunity of being Chair of Physiology to change the method of teaching to the students. He did experiments during his lectures to teach the students by showing them what he was describing. Pavlov was actually nervous at the sight of blood and always kept the wound dry of blood. Because the lecture experiments were the basis of teaching, the absence of practical work became apparent. Since there was no space or money for the practical classes of Physiology, Pavlov felt that his lecture experiments would suffice (Babkin, 1949).

He created a new way of experimenting on animals. Where before they were killed after only one experiment (Banting, 1936), painlessly of course, Pavlov introduced the method of aseptic operation. Once the animal comes out of anesthesia, it is cared for until it recovers, and then used for painless experiments, keeping a normal or near normal state. These experiments can take place over many years (Babkin, 1949).

During his assistantship at the institute in St. Petersburg University, Pavlov developed a better method for preparing a permanent pancreatic fistula to collect pancreatic juices (Babkin, 1949). An evolution of the Heidenhain’s pouch, Pavlov developed a way to keep the nerves in the stomach intact, allowing for more gastric juices to be gathered. (Gray, 1979). He used this method in his lecture experiments and helped the laboratory gain at least 2000 rubles (1000 dollars) a year by extracting quantities of pure gastric juices from his lab animals and using the extractions for people who had an insufficient flow of gastric juices.

The gastric juice was collected from six to eight dogs which had undergone esophagotomy (a special operation to the gullet) and were equipped with a gastric fistula. The dogs were fed meat, and because of the operation, the meat fell out of the dog and into a dish. The dog continued eating the same meat continuously, but grew hungrier because it never reached the stomach. This method of false eating and could produce up to 1000 cc of gastric juices uncontaminated with saliva or food. This is a reflex from the mouth cavity on the gastric glands. This process of collecting gastric juices was not performed everyday so the dog could restore the nutrients it lost from the procedure. (Babkin, 1949).

**From Digestion to Conditioned Reflexes**

After the turn of the century, the hormone secretin was discovered by Bayliss and Starling, which also contributed to the secretion of gastric juices (Banting, 1936). Pavlov’s theory was based solely on nervous system involvement and did not account for the hormonal influence that was discovered. Now scientists have shown that the endocrine glands, glands that produce hormones, are controlled by the nervous system, so in part he was correct (Gray, 1979). “Of course,” Pavlov said to Babkin, “we may continue to study with success the physiology of digestion, but let other people do it. As for myself, I am getting more and more interested in the conditioned reflexes” (Babkin, 1949, p. 231).

When studying gastrointestinal tract, Pavlov noticed that the sight, smell, or sound of food caused salivary and gastric secretions (Babkin, 1946). This type of secretion had always been called psychic. Starting in 1902, Pavlov started working on research on conditioned reflexes with Dr. Tolochinov to see if what the psychologists called psychic (higher functions of the brain) phenomena could be studied purely physiologically (Babkin, 1949). It was influenced by Sechenov and Jackson that the cerebral cortex, though the center of consciousness, is subjected to reflex actions, just as the nervous system is. Lower centers of the brain can elicit an unconditioned response, but for conditioned response the cerebral cortex is needed (Babkin, 1946).

Pavlov received the first Nobel Prize ever given to a physiologist or to a Russian (Gray, 1979). In December 1904, Pavlov journeyed to Stockholm to receive the Nobel Prize for physiology from the King of Sweden. Pavlov lost all of his money from the Nobel Prize because he deposited it in the St. Petersburg branch of Nobel’s Russian firm. During the Revolution of 1917, the Bolsheviks liquidated all stocks and bonds of value. He applied for a refund, but the firm had also lost all of its money and could not refund it (Babkin, 1949).

Pavlov’s laboratory expanded in 1905 by the building of the Physiological Laboratory at the Military-Medical Academy. From 1910-1913 the Institute of Experimental Medicine, with help from the Society for Furthering the Progress of the Experimental Sciences and Their Practical Application allowed Pavlov to build a laboratory that had soundproof rooms to study conditioned reflexes in dogs. From 1902-1936 Pavlov studied the functions of the cerebral cortex through conditioned reflexes and by 1910 all of his energy had switched from digestion to conditioned reflexes (Babkin, 1949).

A conditioned reflex, a concept that he is remembered for, is an unconditioned response to a stimulus that did not cause the response at first, but had the same effect as the unconditioned stimuli after being paired with it repeatedly. A conditioned reflex is not permanent and will diminish over time (Morgulis, 1914). The cerebral cortex allows the dog to respond to stimuli using secondary senses (sight, smell, sound) instead of primary (taste). This is significant because if the cortex were removed, the dog would respond to food only if it was already in its mouth. It could not find the food, even if it was right in front of him, with his other senses, and would eventually starve to death (Babkin, 1949). Damaging certain parts of the cortex can destroy certain conditioned reflexes while others are unaffected. Damaging or removing the whole cortex would extinguish all conditioned reflexes (Morgulis, 1914).

It was discovered by an experiment that these reflexes are from the life experiences of the animal and was not an inborn response (Babkin, 1946). In order to make a conditioned response, a specific receptor and some other sense must be stimulated at the same time. After several times, the conditioned stimulus evokes secretatory and motor reactions. Pavlov mainly focused on salivary secretion reflexes (Morgulis, 1914) because it gave quantitative results (Babkin, 1949). In addition to the innovative pouch, Pavlov also developed a salivary fistula that allowed him to measure salivary gland secretions in much the same way as gastric juices. He used numerous different stimulations to bring about a conditioned response: different intensities of light, sounds including buzzers and bells, and touchers that touched the dog at one point of its body that Pavlov chose (Gray, 1979).

**Death of Pavlov**

Although Pavlov Pavlov is most known for conditioned reflexes and as one of the founding fathers of experimental psychology, he also began two other branches of behavioral science: biological basis of personality and neurosis by experimentation. It was not uncommon for Pavlov to keep a dog he was experimenting on for many years, so its personality also came to be known. His dogs were not known by number, but instead by name; the name often pertained to the temperament/personality of the dog. He defined neurosis as different kinds of breakdown in different animals resulting from the same treatment because of the difference in the animals’ personality. In studying personality, Pavlov became interested in psychopathology. He would visit psychiatric wards several times a week (Gray, 1979).

In 1935, Pavlov’s youngest son, Vsevolod, died at the age of 40 from pancreatic cancer. An autopsy revealed an inoperable malignant tumor of which no one was aware. It was a serious blow to the Pavlovs, especially Vsevolod’s wife. Also in 1935, Pavlov became sick with grippe that turned into full-blown pneumonia. He recovered by April. The next year, in late February the whole family caught grippe, the first to get sick was Pavlov. After three days all the symptoms but a cough went away. On the evening of February 21, Pavlov went to bed much earlier than usual. He woke up with a wheezing in his chest, and a doctor diagnosed him with bronchitis. Two days later, he had pneumonia. On the 26th of February, Pavlov passed away at the age of 86 (Banting, 1936). He was buried next to his son Vsevolod who had died the previous year (Babkin, 1949).

A monument of Pavlov has been placed one of the central squares of Leningrad for all of his contributions. His books were translated into several languages to make his teachings more widespread. The Brain Institute in Moscow was given his brain to be preserved for study. Sara was also given a stipend of 1000 rubles a month for the rest of her life (Banting, 1936).

Ivan Petrovich Pavlov lived a life of great accomplishments. He was born into a poverty-ridden family, but he excelled in school and rose above that to become a world-renowned physiologist. He is known for his many contributions about classical conditioning in the psychology field. Experimenting in this subject occupied nearly three decades of his life. Sara and Pavlov shared a home together with four children whom he loved dearly. He earned the respect and devotion from all of the students he taught and through them his name will continue to live on.

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