

## ***Biography***

Ivan Pavlov, the son of a Russian Orthodox priest, was born and raised in the small peasant village of Ryazan. As a youngster, Pavlov expected to follow his father into the priesthood. Pavlov was forced to enter school later than normal because of a bad fall. His uncle, an abbot, cared for him for two years at a nearby monastery while he was recovering. The abbot's example of hard work and perseverance stuck with Pavlov. Pavlov attended the local church school, which was relatively immune from Count Tolstoy's campaign against science education in the state supported schools. Thus, he received a well-rounded education. Pavlov matriculated at St. Petersburg University the same year that Sechenov resigned. Ilya Cyon was Sechenov's successor and he quickly established a reputation as tough teacher. Pavlov, however, prospered under him and stayed an additional year in order to complete a research project on the pancreas, one that won him a gold medal and a scholarship. Pavlov had long been interested in the physiology of digestion; his training at St. Petersburg further focused him on the goal of elucidating all of the physiological aspects of that complex process. Cyon arranged a postdoctoral assistantship for Pavlov but it never materialized because Cyon left Russia for France. Instead, Pavlov took another assistantship, this one in veterinary medicine. The components of his later career were lining themselves up.

Soon after, Pavlov met Sergei Botkin, another Russian physiologist of Sechenov's generation. He and Sechenov had been classmates in Du Bois-Reymond's laboratory in Germany. Botkin had revolutionized the study of physiology in Russia and because he was so busy needed someone to supervise the graduate students in his animal laboratory. Pavlov got that job and, thanks to Count Tolstoy's policies, had many graduate students to supervise. They all needed hands-on research experience in order to graduate. Pavlov successfully managed the laboratory and its students,

gaining valuable experience in supervising research in the process. While he was working for Botkin, Pavlov married. His new wife, Seraphima Vasilievna Karchevskaya, was totally devoted to him allowing him to spend nearly all of his time at the laboratory. The only things she required of him were that he never drink alcohol and that he leave the laboratory and socialize during the weekends. Pavlov was only too happy to agree and developed a near monastic and rigid work routine.

In order to improve his surgical skills, he took leave from his work in Russia to spend two years in Germany studying with Carl Ludwig. After he returned, he won another gold medal for his own research and completed his medical training. An appointment at the Military Medical School in St. Petersburg followed which finally took him and his family out of the near-poverty conditions under which they had been living. He also was named director of the Physiology Department of the newly founded Institute of Behavioral Medicine, modeled after the Pasteur Institute in France and funded by a rich Russian patron. Pavlov now held two appointments, one at the Military Medical School and one at the new Institute. Finally, he possessed all of the facilities and funds required to conduct his research in digestion.

### ***Contributions***

For seven years he and his students (who included women and Jews, both unusual in Czarist Russia) worked out the details of the digestive process using living dogs. Unlike other researchers, Pavlov developed physiological techniques that allowed him to collect data on how dogs digested their food in real time. His student, Yekaterina Shumova-Simonovskaya pioneered the surgical creation of gastric pouches, or flaps designed to catch food swallowed before it reached the stomach (sham feeding), and the successful insertion of tubes (fistulas) into the various glands of the digestive system (Hill, 2019). Slowly but surely, he and his coworkers

became internationally known, and in 1904 he won the Nobel Prize for Physiology and Medicine, the first Russian to receive a Nobel Prize.

Beginning in 1897, however, and following an interesting discovery, the direction of the laboratory's research became behavioral. Windholz (1989) identified Pavlov's students and their contributions. One of them, Ivan Tolochinov, first noticed that dogs began to salivate to non-food cues; that they were learning to anticipate food when it was paired with a neutral stimulus. The evidence was that the dogs began to salivate to stimuli such as color and odor alone. All that was required was the close pairing in time of such neutral stimuli followed by a food stimulus. Very quickly, Pavlov shifted his laboratory's research direction to study this new **Pavlovian conditioning** process. The question of how to theoretically account for it caused dissention between him and one of his students. After some thought and many arguments Pavlov rejected any explanations for conditioning that involved introspective elements. In his Nobel lecture Pavlov (1904) said:

We decided to take an entirely objective point of view also towards the psychical phenomena in our experiments with animals. Above all, we tried to discipline sternly our way of thinking and our words and ignored completely the mental state of the animal; we restricted our work to careful observation and exact formulation of the influence exerted by distant objects on the secretion of the salivary glands. The results were according to our expectations: the observable relations between external phenomena and variations in the activity of glands could be systematically analyzed; they appeared to be determined by laws, because they could be reproduced at will.

Note the use of the word “we” above. Pavlov was one of the first researchers to embody and practice “big science” (Hill, 2019), meaning the establishment of a large and cooperative group of researchers working together to solve related scientific questions. More recent examples of big science include the Manhattan Project of World War II, The Human Genome Project, and efforts to combat HIV/AIDS. The Covid-19 pandemic has mobilized another worldwide big science mobilization to understand and, hopefully, defeat that virus.

Pavlov was convinced that the only way to approach an understanding of psychology was through the elucidation of underlying physiological laws. He and his students soon discovered other now familiar conditioning phenomena: extinction, generalization, and spontaneous recovery (Windholz, 1989). These phenomena, too, seemed to rise to the level of scientific laws. Plus, they could be investigated in the laboratory without requiring any recourse to consciousness or introspection. By 1930, Pavlovian conditioning was well known to American psychologists. Behaviorists, especially, found conditioning to be a powerful way to explain the acquisition of new responses so they emphasized the study of learning as a new, central focus for psychology in the United States (see chapter 11). Interestingly, Pavlov and his group were more interested in how conditioning could be inhibited or suppressed. Most likely that interest derived from the long history of the study of physiological inhibition begun by Sechenov. In Pavlov’s laboratory research concentrated on the conditioning of autonomic responses such as digestion, and nearly always, surgery of some type was required.