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Information flows in the human brain. Roger Guillemin is 100 years old

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Abstract: The paper presents brief biographical information for the 100th anniversary of Roger Guillemin, a distinguished American scientist who won the 1977 Nobel Prize in Physiology or Medicine. He shared half of the prize with Andrew W. Schally “for their discoveries concerning the peptide hormone production of the brain”; the other half went to Rosalyn S. Yalow “for the development of radioimmunoassays of peptide hormones”. The paper briefly describes the main scientific achievements of R. Guillemin in the development of neuroendocrinology. He isolated somatotropin (growth hormone), identified molecules of thyrotropin-releasing hormone thyreoliberin, which controls all thyroid functions, as well as dozens of other molecules from the hypothalamus. His research has led to the development of treatments for diseases ranging from infertility to pituitary tumors. With his discoveries of certain information flows in the human brain, he contributed to deciphering the code of human life. Guillemin's early training in the construction of radio receivers and transmitters was of great importance, and his serious experience with computers has led him to become one of the pioneers in digital painting. R. Guillemin retired from active scientific life only three years ago.

Keywords: Nobel Prize winner in physiology or medicine Roger Guillemin; human brain; neuroendocrinology; information flows.

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Информационные потоки в мозге человека. Роже Гиймену – 100 лет

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Аннотация: Представлены краткие биографические сведения к 100-летию выдающегося американского ученого, лауреата Нобелевской премии по физиологии или медицине 1977 года Роже Гиймена. Он разделил половину премии с Эндрю В. Шалли «за открытия, касающиеся производства пептидных гормонов в мозге», вторую половину получила Розалин С. Яллоу «за разработку радиоиммунного анализа пептидных гормонов». Даны описания основных научных достижений Р. Гиймена в создании нейроэндокринологии. Он выделил соматотропин (гормон роста), идентифицировал молекулы тиреотропин-высвобождающего гормонатиреолиберина, который контролирует все функции щитовидной железы, а также десятки других молекул из гипоталамуса. Его исследования привели к разработке методов лечения самых разных заболеваний – от бесплодия до опухолей гипофиза. Своими открытиями некоторых информационных потоков в мозге человека он способствовал расшифровке кода человеческой жизни. Большое значение в этом имела

юношеская подготовка Гиймена в области конструирования радиоприемников и передатчиков, а его серьезный опыт в работе с компьютерами привел к тому, что он стал одним из пионеров в цифровой живописи. Р. Гиймен лишь три года назад отошёл от активной научной жизни.
Ключевые слова: лауреат Нобелевской премии по физиологии или медицине Роже Гиймен; мозг человека; нейроэндокринология; информационные потоки.

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In Nobel studies, there are several cases where Nobel laureates lived to see their centenary, with almost all of them occurring in the 21st century, and one of the reasons for the increase in creative longevity is the activities of the laureates themselves, including the 1977 Nobel Prize in Physiology or Medicine laureate Roger Guillemin (Fig. 1). He shared half the prize with Andrew W. Schally "for his discoveries concerning the production of peptide hormones in the brain", and the other half went to Rosalyn Yallow "for the development of a radioimmunoassay for peptide hormones". The results of their research have made a significant contribution to increasing human life expectancy.

Roger Guillemin [1, 2] was born on January 11, 1924 in the city of Dijon, the capital of Burgundy (France). Despite the occupation of Dijon by the Germans from 1940 to 1944, he managed to graduate from primary school and lyceum, receive a medical education and, in 1949, a doctorate in endocrinology. Having met Hans Selye, Guillemin received a scholarship from his foundation and moved to the Institute of Experimental Medicine and Surgery at the University of Montreal (Canada). It was there that he completed his doctoral research, and in 1953 he earned his PhD in physiology. Then he moved to the USA, until 1970 he taught at Baylor College of Medicine in Houston (Texas), moved to the Salk Institute for Biological Research in San Diego (California), where he founded the world's first laboratory of neuroendocrinology, developed his main discoveries and is still listed as an emeritus professor [3]. There he celebrated his 100th birthday (Fig. 2). R. Guillemin is the generally recognized founder of neuroendocrinology, a study of the interaction of the endocrine and nervous systems, i.e. regulation by the brain of the body's hormonal activity. His research into brain hormones led to the development of treatments for diseases ranging from infertility to pituitary tumors. In fierce competition with a native of Poland, E.V. Schally ("Many years of aggression and cruel revenge" [4, 5]), which is even called the "third neuroscientific war" [4], R. Guillemin managed to discover somatostinum, a regulator of the functioning of the pituitary gland and pancreas, isolate endorphins - brain molecules that act as opium alkaloids, identify cellular growth factors, discover the role of the brain in regulating hormones – molecules that act as chemical messengers between different parts of the body and regulate body functions.

These studies were incredibly painstaking and lengthy, without much hope of success. Suffice it to say that in four years (1964-1967) in Houston,

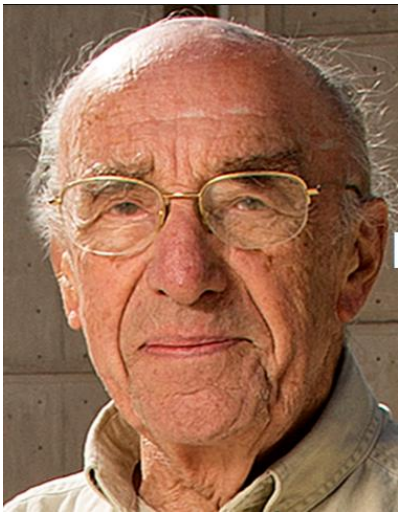

Fig 1. R. Guillemin at the age of 90 (© Courtesy of Salk Institute)

Fig. 2. R. Guillemin at the celebration of his 100th birthday (© Courtesy of Salk Institute)

more than 5 million pieces (50 tons) of sheep hypothalamus had to be collected, and the purification and determination of the chemical structure of the first neurohormone thyrotropin-releasing factor (TRF) took seven years and was successfully completed in 1969 Subsequently, R. Guillemin calculated that 1 kg of purified TRF cost 2.5 times more than the same weight of soil delivered from the Moon. This success led to the isolation of somatotropin (growth hormone), the identification of the thyrotropin-releasing hormone (TRH) molecule, thyrotropin-releasing hormone, which controls all functions of the thyroid gland. The use of the radioimmunoassay method developed by R. Yalow played a huge role in further work. Later, R. Guillemin and E. Schally (both received American citizenship in the 1960s) and their colleagues isolated other molecules from the hypothalamus (now many dozens of them are known) that control all functions of the pituitary gland, for example, gonadotropin-releasing hormone (GnRH) – A hormone from the hypothalamus that causes the pituitary gland to release gonadotropins, causing the release of hormones from the testes or ovaries. This discovery led to advances in the treatment of infertility and prostate cancer. It became clear that the human brain is the most important gland of the body.

Fig. 3. Four Nobel Prize laureates in physiology or medicine (from left to right; years of award in brackets) at one conference: R. Dulbecco (1975), R. Guillemin (1977), R. Holley (1968) and F. Crick (1962) (© Courtesy of Salk Institute)

Thus, R. Guillemin joined a small circle of outstanding scientists, each of whom, with their discoveries of individual information flows in the human brain [6], contributed to deciphering the code of human life (Fig. 3).

R. Guillemin was an amazingly versatile personality. Even in childhood and adolescence, he persistently developed not only his brain, but also his hands, creating, for example, radio receivers and transmitters. In his mature years, he transferred his many years of experience with computers from neuroendocrinology to art and became one of the pioneers in digital painting; he is also known as an avid collector of French and American paintings and sculptures, Papuan and pre-Columbian ceramics. Several keyboards and stringed instruments form part of the pleasant furnishings of his happy home. Having retired from active scientific work, R. Guillemin spent the last three years in Del Mar (California) and devoted all his time to his family. He had five daughters, a son, four grandchildren and two great-grandchildren. His wife Lucienne, to whom he was married for 69 years, died in 2021 at the age of 100!

At the centennial celebration, the current president of the Salk Institute, Gerald Joyce, said: “Roget is one of the world's greatest minds and at the same time one of the kindest people you will ever meet” [3].

Unfortunately, when the article was already in print, the sad news came about the death of Roger Guillemin on February 21, 2024.

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Conflict of interests

The authors declare no conflict of interest.

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