Riverbank Laboratories

1512 Batavia Avenue

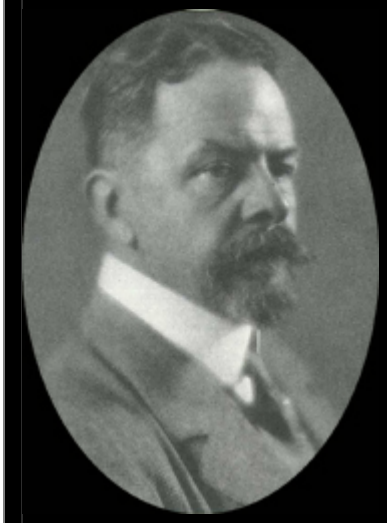
Geneva Local Landmark
Designated on February 1, 1999

The Riverbank Laboratories, located at 1512 Batavia Avenue in Geneva, have for over 80 years been the site of groundbreaking scientific and literary research and work. Its significance extends locally and nationally. Once part of the sweeping 350 acre Riverbank Estate of George and Nelle Fabyan, the laboratories continue today to be major contributors in the scientific world. The entire laboratories site was recently purchased by private individuals and is undergoing substantial rehabilitation.

Many different research activities occurred at Riverbank, including decoding and deciphering enemy messages during World War I, deciphering alleged secret messages in the works of William Shakespeare, research in the field of architectural acoustics, groundbreaking research in the field of cryptology, fieldwork in the use of hand grenades and military trenches, research and development of tuning forks, and studies of human fitness and anatomy. The list is varied and fascinating. Teams of researchers lived and worked at Riverbank, devoting years of their lives to the furthering of science. Many scientists from around the nation and world have visited Riverbank and stayed at The Lodge. The United State's military successes in World War I and World War II have a direct relevance to Riverbank. And Riverbank can be considered to be a direct lineal

predecessor of the National Security Agency and Central Intelligence Agency.

George Fabyan and his Riverbank Estate



In 1905 George Fabyan and his wife Nelle Wright Fabyan purchased 10 acres of the Joel Harvey farm outside of Geneva and began what we now know as the Fabyan Estate. The estate, which grew to encompass 600 acres at its largest, comprised everything from a zoo, an 1864 Dutch windmill, greenhouses, stone sculptures, 18,000 chickens, a Japanese garden, a Roman-style swimming pool, a lighthouse, a boathouse, formal gardens, and an old farmhouse that was redesigned by Frank Lloyd Wright in 1907. The Fabyans also owned a dairy herd which supplied milk to Geneva and several greenhouses which supplied fresh flowers to Chicago.

George Fabyan came from a distinguished Boston family. His father had been head of the Bliss Fabyan Corporation, then the largest cotton goods organization in the world. After running away and being disinherited, Fabyan began working for Bliss Fabyan under an assumed name, and when his remarkable sales record piqued the interest of his supervisor, he was introduced to the head of the firm, his father. He was then brought back into the family, and later inherited three million dollars and control of the Chicago office. It was during this time that he began purchasing land in Geneva which would become Riverbank Estate.

Fabyan was very active in serving Governor Richard Yates, and was a member of the governor’s military staff. He was also a military diplomat for President Theodore Roosevelt, serving on the team which negotiated the Portsmouth Treaty, ending the Russo-Japanese war in 1905. This association resulted in a number of military projects being conducted on the estate, including digging trenches to study trench warfare, which led to the development of trench mortar and a triton hand grenade.

These trenches were constructed on land to the north of the Laboratories, which is now a residential subdivision.

Fabyan, later honored with the title of Colonel by Illinois Governor Yates, also had a variety of scientific interests. Being a wealthy man, he strove to bring researchers and scientists to Riverbank to further explore those areas that were of interest to him. He once said,

> ***"Some rich men go in for art collections, gay times on the Riviera, or extravagant living. But they all get satiated. That's why I stick to scientific experiments, spending money to discover valuable things that universities can't afford. You never get sick of too much knowledge."***

The beginning of what was to become Riverbank Laboratories started with an interest in codes and ciphers. Fabyan likely became interested in codes and ciphers in connection with the transmittal of information and prices in his business activities. It was a common practice at that time. He therefore had a common interest with Mrs. Elizabeth Wells Gallup, whom he was introduced to by some wealthy Boston friends. She believed that William Shakespeare was a fictitious person and the actual author was Sir Francis Bacon and had been trying to prove that Bacon had left coded messages in the text claiming this and other stories.

Elizabeth Wells Gallup and the Baconian Theory

In 1899 Mrs. Gallup published the first report of a Baconian cipher message hidden in printed books. This was the "Bi-literal Cypher of Sir Francis Bacon Discovered in his Works and Deciphered by Mrs. Elizabeth Wells Gallup." Mrs. Gallup studied Shakepeare's First Folio to see if the differences in variations of

type represented Bacon's use of the biliteral cipher. One of the messages she deciphered was:

> ***Queen Elizabeth is my true mother, and I am the lawful heir to the throne. Find the Cypher storie my books contain; it tells great secrets, every one of which, if imparted openly, would forfeit my life. F. Bacon***

Second and Third editions appeared in 1900 and 1902. In 1907 she sailed for England to search for manuscripts but did not find any. Around 1912 she was hired by George Fabyan to work at his Riverbank Laboratories to decipher the manuscripts there, with the assistance of a staff and photographic equipment for enlarging letters of the First Folio.

It had been known for some time that Francis Bacon belonged to a secret society called the Rosicrucian Society. They believed in conducting scientific experiments that in those times was often considered witchcraft. Due to Bacon's position with the Queen of England, he ran the Queen's printing press, and had devised what was called a biliteral cipher utilizing wide and thin letters to represent the alphabet.

Colonel Fabyan also believed in the Baconian theory. Mrs. Gallup believed Bacon was the real Shakespeare for two reasons: 1) Bacon had invented the biliteral cipher and used it in printed publications, and 2) the original printed folios of Shakespeare's plays used a variety of different typefaces.

Colonel Fabyan was introduced to Mrs. Gallup and persuaded her to move to his estate to continue her work. Her exact arrival date at Riverbank is not known, but it is thought to be around 1912 or 1913. Fabyan provided her and her sister living and working conditions, staff, and an excellent library of the works of Shakespeare. It is believed that she began her research at Riverbank in the Engledew Cottage, which has since been demolished. She and her sister later lived and worked in The Lodge.

One of the scientific experiments documented by Sir Francis Bacon was a levitating machine. The machine was a wooden tube with metal strings attached to it, around which fit another wooden tube with metal strings attached to the inside of it. The center tube was supposed to spin and by sympathetic vibration cause the strings on the outer tube to vibrate. The resonance from the striking would create a force field, which would levitate the outer tube off of the ground. Colonel Fabyan hired Bert Eisenhour, an engineer from Chicago, to construct this machine at Riverbank. Though the machine was constructed, it did not work. Eisenhour was convinced that the strings were not tuned properly, and suggested they consult someone knowledgeable in acoustics.

Wallace, Paul, and Hale Sabine

Wallace Sabine

Fabyan contacted his brother at Harvard University and was put in contact with Wallace Clement Sabine. Sabine traveled to Geneva several times and though the levitating machine never worked, he and Colonel Fabyan became good friends. When Fabyan was introduced to Wallace Sabine in 1913, he was conducting pioneer work in architectural acoustics as a physics professor at Harvard University. He was studying the phenomenon of reverberation, its causes and control. Professor Sabine was only able to make his tests when everything was quiet, which was after the street cars had stopped at midnight and before the milkmen started in the morning with their carts rattling over the cobble stones. Thus, Colonel Fabyan said, "I'll build you a place out in Illinois on the prairie where there just isn't any noise."

Wallace Sabine began working on devising a plan for the new reverberation chamber. Because both Fabyan and Sabine were involved in various war projects, the laboratory was not completed until 1918. Sabine became a staff member of the Bureau of Research for the Air Service of the American Expeditionary Forces and provided services for the British Munitions Inventions Bureau in England, the French fleet at Toulon in the Mediterranean, and Italy on the Italian front.

One of the professor's developments that involved Riverbank was the use of cameras in airplanes for aerial reconnaissance. Because of this work, the French awarded him the French Legion of Merit Medal for locating hidden German airfields. Glass negatives of photographs taken by Sabine discovered in one of Riverbank's laboratories in 1980 showed aerial views of sections of actual World War I trenches at the front. The trenches had been later duplicated at Riverbank for training purposes. The Riverbank project focused on the effectiveness of new explosives and weapons, including a special type of trench mortar, in and around the artificial ditches.

Fabyan and Bert Eisenhour, with the guidance from Professor Sabine, supervised the building of the Sabine Acoustical Laboratory on a day-to-day basis during 1917 and 1918, without any fixed drawings or plans. Because of this, no two outside walls are the same thickness. To this day, the reverberation chamber is an outstanding example of such a facility, and is still regarded as one of the best in the world. The chamber is completely insulated from the outer walls so far as sound transmission is concerned. Separate foundations are used for the inner and outer buildings, and felt insulation was employed wherever the walls came close together to form a connecting doorway. Sounds produced in the reverberation chamber can be tested with the utmost precision. Here Sabine calculated the Sabine Formula, universally used today to determine sound absorption coefficients.

Sabine returned to Washington in 1917 and in the fall of 1918 was able to see his new laboratory in Geneva for the first time and take a set of absorption measurements. In 1919 Wallace Clement Sabine died at the age of 50. Wallace Sabine is today considered to be the father of the science of architectural acoustics. His formula for sound absorption is still used in many standard acoustical tests, and the unit of absorption now bears his name, "sabin."

Paul Sabine

After Sabine's death Fabyan again turned to Harvard University to find someone to direct the new Riverbank Laboratory. Fabyan was referred to Paul Sabine, a distant cousin of Wallace. Fabyan offered the position to Paul Sabine at Riverbank.

Paul Sabine held a position at the Case School of Applied Science in Cleveland, Ohio. Fabyan convinced Sabine to come to Riverbank, and he arrived in 1919. He began his research by utilizing Wallace Sabine's formula for measuring sound absorption. Because there was very little equipment at the time, a set of organ pipes was used to provide sound, and an observer conducted experiments from within a wooden box in the chamber, with only his head exposed. This would prevent his

clothing from interfering with the accuracy of the readings. At the time, the "man-in-the-box" test was still the most reliable method used.

Paul Sabine's early areas of investigation involved many different areas of acoustics. Besides calibration and absorption, he continued Wallace Sabine's experiments on plastered walls. This work developed into "Sabinite", an absorptive acoustical wall plaster. He also worked on the development of a mechanical voice synthesizer and listening devices. Sabine spent twenty years studying the human ear. He was later instrumental in the development of the electronic hearing aid. Also, as early as 1921, Sabine recognized the importance of noise control, still a relevant topic today.

Sabine began providing services as an acoustical consultant in 1922. One of his early clients was the Fox-Case Corporation. He was assigned to work on the design of the first sound motion picture studios in New York and the first Hollywood sound stage. In 1928 he presented a paper to the Society of Motion Picture Engineers relating the idea of synchronizing sound and picture later rather than relying on the quality of on-location recording.

Sabine was also active in the local community. He served for a period of time as a Geneva Alderman for the First Ward in 1924 and 1925, served on the Geneva Library Board, and worked on various projects, including zoning.

Sabine was on the Executive Council of the Acoustical Society of America (ASA), which was formed in 1929. The Acoustical Committee of the National Research Council, a small group of scientists, met at Riverbank in 1920 and formed the basis for the later formation of the ASA. In 1933 the Acoustical Materials Association was formed to assist in the formation of standardized acoustical testing being promoted and researched by Paul Sabine. Riverbank was designated as the official AMA laboratory for product testing.

Paul Sabine completed and published many articles on acoustics and sound absorption over the years, including a book entitled "Acoustics and Architecture," published in 1932. During the 1940s he was involved with the National Noise Abatement Council and was asked to investigate the noise created by airplanes flying over Manhattan. Sabine advised that, "because of the problems associated with the world situation, the most advisable and immediate solution to try to enforce is to ask for specific flight paths and approaches at higher altitudes."

Sabine retired in 1947. Upon his retirement, the management of the Research Laboratories was taken over by the Illinois Institute of Technology Research Institute (IITRI). The building has continually been updated and expanded and today has six reverberation chambers. Riverbank Acoustical Laboratories is an internationally recognized laboratory.

After retirement he continued as a consultant, including the acoustical testing during the remodeling of the House and Senate Chambers in the U.S. Capitol in 1951. His main subjects of research during the 1950s, however, were the relationship between science and religion. He wrote two books on the subject, "Modern Science and the Will to Believe," and "Atoms, Men and God." Sabine became best known for the latter book.

The contributions of Paul Sabine and his successors have established a solid reputation for the Riverbank Acoustical Laboratories in the field of architectural acoustics. Sabine's efforts in standardizing acoustical testing gave the field increased validity and thus he made a significant contribution in making a science of architectural acoustics.

Paul Sabine died in 1958 and is buried in Geneva.

Hale Sabine

Paul's son Hale Sabine came to Riverbank in 1957. Although he had periodically dedicated his time, effort, and services over the past 38 years to further the development of Riverbank Acoustical Laboratories, he was never officially on the payroll. He was a senior physicist for the Armour Research Foundation (now the Illinois Institute of Technology Research Institute), and he was involved with acoustics.

Hale Sabine also contributed a number of articles in the field of acoustics, including a book entitled, "Less Noise, More Hearing," in 1941. Hale Sabine died in 1981.

Bert Eisenhour

Bert Eisenhour was brought to Riverbank from Chicago in the early 1900's to assist Fabyan in the construction of the Baconian Acoustical Levitation Device. From 1917-1918, he directed the construction of the Riverbank Acoustical Laboratories and from

1922-1923, he was the principal engineer and inventor who established the tuning fork operation.

Riverbank Laboratories, Inc., Department of Engineering, followed the directions of Bert Eisenhour's talents in making high-quality tuning forks. Mr. Eisenhour and his staff developed temperature-compensated tuning forks, an innovation followed by many domestic and foreign manufacturers. The invention of the bimetallic temperature compensated tuning fork by Mr. Eisenhour, which was patented in 1932, represented a major breakthrough in audio-frequency control technology, being the first significant advancement in tuning fork design in over 200 years.

The rapidly advancing technology in the field of electronics demanded an improved precision audio frequency source for control of frequency/time in such applications as watch rate recording, geophysical exploration, facsimile, wire and radiophoto picture transmissions. Eisenhour's inventions laid the groundwork for the first cross-country wire photos used by news wire services. This branch now designs and produces electro-mechanical frequency control devices as well as standardized medical tuning forks designed in cooperation with the country's leading otologists.

William Friedman

In 1915, Fabyan began searching for someone to run a genetics laboratory to further research the improvement of wheat strains and livestock. Due to his east coast connections he was referred by a professor at Cornell University to a graduate student in genetics named William Friedman. Friedman had begun his academic career at the Michigan Agricultural College in East Lansing before transferring to Cornell. Friedman agreed to come to Riverbank and began in September of 1915 as the new head of the Department of Genetics. One of the projects Friedman was requested to study was the effects of moonlight on crop growth, and so he experimented with the planting of wheat during the phases of the moon.

Friedman, who had become somewhat of an amateur photographer, was asked to assist Mrs. Gallup in her research. She needed photographs of the Shakespeare documents so they could be enlarged for study. During this period Friedman discovered an adeptness and interest in codes and ciphers. He recalled years later, "When it came to the cryptology, something in me found an outlet." He soon became the director for the Department of Ciphers as well as the Department of Genetics at Riverbank. He and Elizebeth Smith, Mrs. Gallup's assistant, fell in love during this period and the two were married in May of 1917.

With the onset of World War I, Colonel Fabyan offered the services of his Department of Codes and Ciphers to the Federal Government. Due to the fact that the government had no existing department for this kind of work, they accepted. Riverbank began receiving encoded messages to work on breaking which had been intercepted by the government from unfriendly sources. For many, even today, codes and ciphers are an unknown entity. When the Friedmans began to research sources on codes and ciphers to assist them on the Baconian theory, they realized there was very little written about it. Thus, their work was groundbreaking in developing literature in the field.

As Friedman and his staff in the Riverbank Department of Codes and Ciphers worked on solving messages coming in from various federal agencies and foreign governments, they became the first unofficial cryptologic organization in the United States. It was still many months before Military Intelligence was formed as the nation's first official cipher bureau.

One of the most famous cases the Riverbank staff worked on was the Hindu plotters. The Germans had been encouraging the Hindus to work towards independence with the hopes of distracting the British government and siphon their strength from the war. Some of these radicals lived in the United States, and they had been passing cryptic messages around regarding arms shipments and internal politics. They were trying to purchase arms in the U.S. and ship them from the West Coast. Based on the format of the codes, the Friedmans deduced that the codebook was a dictionary. The frequent use of certain numbers indicated common words like "and", "the", and "of." Eventually they managed to decipher nearly every word without the dictionary. They eventually found the book, a German-English dictionary published in 1880, which was helpful during the trial of 135 Hindus in San Francisco where Friedman testified.

The federal government asked Riverbank to provide cryptologic training to assist in building up a reserve of officers knowledgeable in the field. Friedman did most of the teaching of a class of Army officers sent to Riverbank's Department of Codes and Ciphers in the fall of 1917 to learn cryptology. Three classes totaling about 80 officers were taught by Friedman and his wife, with the officers being housed in the Aurora Hotel in Aurora. For instruction in these courses, he turned out a series of technical monographs. He completed seven before he went overseas in 1918, and he wrote the eighth on his return in 1920. Known collectively as the Riverbank Publications, the series broke new ground in the study of cryptology, and the information they first set forth is still regarded as the prerequisite for a higher education in cryptology. Because Riverbank had issued other publications, the cryptologic series began at Number 15. Number 22, written in 1920, must be regarded as the most important single publication in cryptology.

No. 15 A Method of Reconstructing the Primary Alphabet from a Single One of the Series of Secondary Alphabets.

No. 16 Methods for the Solution of Running-Key Ciphers

No. 17 An Introduction to Methods for the Solution of Ciphers

No. 18 Synoptic Tables for the Solution of Ciphers and a Bibliography of Cipher Literature

No. 19 Formulae for the Solution of Geometrical Transposition Ciphers

No. 20 Several Machine-Ciphers and Methods for Their Solution

No. 21 Methods for the Reconstruction of Primary Alphabets

No. 22 The Index of Coincidence and Its Applications in Cryptography

Friedman invented the words "cryptanalysis" and "cryptology", the first being code-breaking, and the latter being the overall term used to describe the science.

Friedman was sent to France after he enlisted in 1918 where he worked on the solution of German code systems during the final months of the war. In 1921 he became head of the Signal Corps's Code and Cipher section. The Army's cryptanalytical work during the 1920s was centered in the so-called American Black Chamber under Herbert Yardley, who had organized it as part of Military Intelligence in World War I. At the same time, the Army's cryptologic research and code-compiling functions were handled by Friedman and one assistant under the War Department.

In 1922 he became Chief Cryptanalyst of the Signal Corps in charge of Code and Cipher Compilation Section, Research and Development Division, Office of the Chief Signal Officer. His job involved testing new systems of cryptography. Most difficult was the machine invented by Edward Hebern. Friedman devised a solution to the machine in 1925. This work was of the utmost importance, for it laid the groundwork for the solution of the Japanese Purple machine, and for the many solutions of modern rotor machines.

In 1929, he became widely known as one of the world's leading authorities on cryptology when the Encyclopedia Britannica published his article on "Codes and Ciphers."

The Black Chamber was dissolved in 1929 and the Signal Intelligence Service was created with William Friedman as its first director. His first task was to set up an adequate program to provide training for officers in cryptology. The result was the Signal Intelligence School. He also wrote three textbooks on military cryptography for these courses. These comprise the finest, most lucid exposition of the solution of basic ciphers that has ever been published.

In the 1939 the Japanese Foreign Office had distributed a new diplomatic cipher machine to replace their earlier one known by the SIS as Red. The new machine was codenamed Purple. The Purple machine was extremely difficult to decipher. By the end of 1940, Friedman's team of cryptologists had managed to create a perfect clone of the Japanese Purple machine without ever having seen it. This allowed the U.S. to read all Japanese messages prior to the bombing of Pearl Harbor, an incredibly important event in the war.

By 1940, Friedman, as director of the SIS, was overseeing the School, the 2nd Signal Company, and Sections A, B, C, and D, which variously designed and deciphered codes.

After solving the Japanese Purple machine, Friedman was admitted to Walter Reed General Hospital in 1941 for a nervous breakdown. Upon his recovery, he served as Director of Communications Research for the SIS throughout the rest of the war.

In 1943, the United States and Great Britain signed the BRUSA Agreement, which established for the first time intimate cooperation on all communications intelligence of the highest level. The cooperation, procedures, and security regulations set out in the BRUSA Agreement serve as landmarks in the history of communications intelligence. Even in recent times, they form the fundamental basis for all Signal Intelligence activities of the NSA and Great Britain's Communications Headquarters. Friedman was charged with keeping this cooperation successful through the 1950s, and later helped draw up the postwar blueprint of the UKUSA Agreement as he had with BRUSA. The UKUSA Agreement supplemented the BRUSA Agreement in 1947, establishing the United States as first party to the treaty, and Britain, Canada, and Australia-New Zealand as second parties. Other NATO nations signed on as third parties. The existence of the UKUSA Agreement has never been officially acknowledged by any country, even up to 1983.

Upon creation of the Armed Forces Security Agency in 1949, he became chief of the technical division. When this agency was supplanted by the National Security Agency (NSA) in 1952,

Friedman became chief technical consultant, and two years later, special assistant to the director. He had also been, since 1947, the Cryptologist of the Department of Defense. He retired in 1955, remaining as a consultant.

By 1980, 50 years after Friedman hired his first three assistants for the SIS, the NSA had become the largest single espionage factory in the free world, with its own city of 3,500 people at Fort Meade in Maryland. Within the NSA headquarters is the 500-seat Friedman Auditorium, named after William F. Friedman, whose bust is encased at the entrance.

Friedman received three of the highest honors awarded at different levels by the federal government. In 1944 he received the Commendation for Exceptional Civilian Service. In 1946 he received the Medal for Merit conferred on him by President Truman. In 1955 he received the National Security Medal, conferred on him by the Director of Central Intelligence. He was one of only five to receive such honors up to 1981.

In the late 1950s, after his retirement, Friedman engaged in several secret missions for the NSA in regards to arranging some type of "deal" with Crypto A.G., the world's largest supplier of crypto equipment to foreign governments, based in Switzerland. It will probably never be known exactly what these meetings entailed, but that they likely dealt with the supply of cipher machines to NATO.

After retirement, he and his wife returned to the Baconian ciphers. They proved false the Baconian theory in an incisive report that won them the Folger Shakespeare Library literary prize in 1955. This work was published in 1957 as "The Shakespearean Ciphers Examined."

In 1956 Friedman was awarded $100,000 in compensation by the government for profits he had been unable to realize due to security measures for nine cipher machines he had invented for the government from 1933 to 1944. Three were patented and six remain secret.

While Herbert Yardley may be the best known cryptologist, uncontestedly the greatest is William Friedman. Friedman's theoretical contributions and his practical attainments exceed those of any other cryptologist. His theoretical studies, which revolutionized the science, were matched by his actual solutions, which astounded it. Single-handedly, he made his country preeminent in his field. And finally, the vast cryptologic establishment of today is a direct lineal descendant of the little office in the War Department that Friedman started, with his knowledge and research in the field having been cultivated at Riverbank Laboratories. His life's work confers upon William Friedman the mantle of the greatest cryptologist.

Elizebeth Smith Friedman

Elizebeth Smith, who had graduated from Hillsdale College in Michigan with an English degree and had moved to Chicago to look for work, was recruited by Fabyan to assist Mrs. Gallup in the Baconian deciphering. She joined the Department of Ciphers at Riverbank in 1916. According to a written account from Smith on her arrival,

> ***"On one side of the highway, there was a high stone wall with impressive gates. He told me that his own residence, swimming pool and stables were in that part of the estate. Our car, however, turned off on the opposite side of the highway and we shortly reached a house known as The Lodge. This was where Mrs. Gallup and her sister, Miss Kate Wells, resided and where they had all of their accouterments to prove their certain claim that Francis Bacon was the author of the Shakespeare plays and sonnets. This lodge was staffed with servants and it was there that I was to spend the night in a guest room."***

Friedman also assisted her husband in training the army classes and in the preparation of several of the Riverbank Publications.

After the Friedman's had left Riverbank in 1920, Elizebeth Friedman was hired as a cryptanalyst for the Coast Guard in 1927. Her task was to decipher codes of smugglers or "rumrunners" during prohibition. In one famous case, she connected a major company, the Consolidated Exporters Corporation, to actual rumrunning operations. This resulted in a highly publicized trial in New Orleans in which she had to be under armed guard to appear for testimony. She solved over 12,000 messages in her first three years for the Coast Guard, the Bureau of Customs, the Bureau of Narcotics, the Bureau of

Prohibition, the Bureau of Internal Revenue, and the Department of Justice.

In 1934, some of her earlier solutions helped extricate the U.S. from an embarrassing diplomatic tangle with Canada and helped to establish a point of international law. The *I'm Alone*, a smuggling ship, was sunk in international waters after being chased from U.S. waters by the Coast Guard. Being a Canadian ship, Canada pressed for an apology and remuneration. Her solutions helped tie the ownership to an American. The resulting law — which resembles allowing a policeman who begins chasing a speeder in his own state to arrest him in another state — became effective for international borders.

In the 1950s, she worked with her husband on "The Shakespearean Ciphers Examined."