The Origins of The Grass Foundation

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Introduction

In the fall of 1935, Albert M. Grass and Ellen H. Robinson both came to the Department of Physiology at Harvard Medical School (HMS). This entirely fortuitous confluence of their lives led to their marriage, to a commercial endeavor—the Grass Instrument Company—that would provide equipment of high quality to neuroscientists and other physiologists for over half a century, and finally to the formation of The Grass Foundation, which has benefited the neuroscience community since 1955.

The Department of Physiology at Harvard—the seedbed for these accomplishments—had a deep-rooted commitment to providing both financial and moral support to scientists who were at the beginning of their careers. Albert and Ellen clearly benefited from this commitment, for it generated interactions and collaborations that led to and facilitated the success of the Grass Instrument Company and then the Foundation.

Thus, the origins of The Grass Foundation must be sought, not only in the conjoined histories and proclivities of Albert M. and Ellen R. Grass, but also in scientific and educational developments that took place in the HMS Department of Physiology between 1906 and 1935, well before Albert and Ellen met there. This essay is an attempt to dissect those tangled threads; it ends with a discussion of The Grass Foundation’s hallmark program—the Grass Fellowship Program at the Marine Biological Laboratory in Woods Hole, Massachusetts—and the impact that this program has had on neuroscience.

Albert M. Grass and Ellen H. Robinson

Albert Melvin Grass (1910–1992) was born in Quincy, Massachusetts, on September 3, 1910, to Henry J. Grass and Bertha (Martin) Grass. After graduating from Quincy High School, he funded his college education by working at Samson Electric Company testing and installing the amplifiers and systems that provided sound for films (Marshall, 1980; Henry, 1992). He was successful, both academically and financially, and the B.Sc. degree in electrical engineering was duly awarded by MIT in 1934. Albert remained at MIT to work on servo-mechanisms used to simulate earthquakes in the study of strains acting on model water towers and other structures (Marshall, 1980).

In May of 1935, Frederic A. Gibbs—a research fellow in neurology at the HMS Department of Physiology—contracted with Albert Grass to build a 3-channel electroencephalograph (EEG). Albert and his brother Everett worked in the basement of their father’s house and finished the project early in the fall of 1935 (Marshall, 1980; Grass, 1984).

This accomplishment, completed in only three months, led to Albert’s being hired as a part-time Research Instrument Engineer by the HMS Department of Physiology, and he remained in that position from 1935 until 1943. As part of this job, he continued to improve the EEG (Grass Instrument Co., 1971; Grass, 1984) and its applications (Grass and Gibbs, 1938). In addition, he worked closely with scientists, tailoring equipment to their needs (e.g., square wave stimulators and amplifiers; Forbes and Grass, 1937; Marshall, 1980).

Ellen Harriet Robinson (1914–2001) was born in Taunton, Massachusetts, on March 29, 1914, the daughter of Laura (Waldron) Robinson and Francis James Robinson. She graduated from Taunton High School in 1931 and went to Radcliffe College, receiving her A.B. degree in Biology in 1935. She continued her education at Harvard University with Morgan “Kelly” Upton (1898–1984) and received a Masters degree from Radcliffe College in 1936; her thesis was entitled “Three Experiments in Audition.”

On Upton’s recommendation, Ellen decided to immerse herself in “a broader field of brain function” (Marshall,
in 1935; Garceau and Forbes, 1934). Encouraged by
could be used for such recordings (Garceau and Davis,
(1906–1966), had built amplifiers and a portable EEG that
tients, and Hallowell Davis’ engineer, E. Lovett Garceau
(1980–1983) was her initial sponsor on a project entitled
“Auditory Action Potentials” (Fenn, 1963; Brobeck
(1890–1983) was her initial sponsor on a project entitled
“build three channels of EEG amplifiers to drive the West-
ern Union Morse Code inkwriting undulator” (Grass, 1984;
Hughes and Stone, 1990).

The Gibbses went off for the summer to attend the
International Congress of Physiologists in Leningrad and
Moscow, and to visit Berger and engineer J. F. Tönnes in
Germany. In August of 1935, rather late in the summer,
Frederic Gibbs mailed a sketch of Tönnes’ neuromyograph
(designed for A. Kornmüller’s animal studies) to Albert
Grass (Grass, 1984; Hughes and Stone, 1990). By that time,
the EEG machine being constructed by Albert and Everett
Grass in Quincy must have been well along, for when the
Gibbses returned in the fall, it was finished, as mentioned
above. This EEG was used by Lennox, Frederic and Erna
Gibbs, and Davis in their pioneering investigations, which
demonstrated the power of the EEG in the diagnosis of
epilepsy (Gibbs et al., 1935, 1936, 1937; Brazier, 1968).

The demand for EEG machines increased markedly dur-
ing the 1940s. To meet this demand, Albert began to man-
ufacture commercial instruments (Marshall, 1987). Thus,
the small business that started in a basement in 1935 con-
tinued as a partnership between Albert and Ellen Grass, and
ultimately developed and grew to become, 10 years later,
the Grass Instrument Company. The success of the Com-
pany was due to the balance between Albert’s engineering
skills and Ellen’s scientific expertise, which was critical in
the proper design of equipment to meet the needs of neu-
rophysiologists (Fig. 1). Instruments were designed for
“convenience, durability and serviceability” (Morison,
1979).

The Grass Instrument Company was never a typical busi-
ness. In the early years, employees and many of the cus-
tomers were warm and loyal friends of Albert and Ellen
(Morison, 1979), and neurophysiological equipment was
loaned to investigators throughout the world, and especially
to Grass Fellows and courses at the Marine Biological
Laboratory (MBL). To Albert and Ellen, the Company was
always meant to contribute “to the development of human
knowledge and the search for basic scientific truth.” (Grass
Instrument Co., 1967). They took great care to ensure that
equipment was being properly used for the benefit of the
patient. Ricardo Miledi recalls, “When I was in Mexico, I
remember on more than one occasion, seeing a letter [from
the Grasses] inquiring about doctors that intended to pur-
chase their most advanced EEGs and other equipment.
Albert and Ellen were very concerned that their equipment

The Development of Electroencephalography at the
HMS Department of Physiology and the Formation
of the Grass Instrument Company

The report of voltage changes recorded through the cra-
nium of humans by Hans Berger (electroencephalogram,
EEG; Berger, 1929) and his observations of EEG variations
in patients with epilepsy (Berger, 1932; Gibbs et al., 1936)
were the basis for continued EEG studies of epilepsy in the
United States.

At the time, Stanley Cobb (1887–1968) and William G.
Lennox (1884–1960) were experts on epilepsy (e.g., Cobb,
1922; Lennox and Cobb, 1928; Lennox, 1936; see White,
1984, for Cobb’s complete bibliography) carrying out their
investigations at Harvard Medical School (Hughes and
Stone, 1990). In 1929, Cobb offered Frederic A. Gibbs
(1903–1992), who had just received his M.D. from Johns
Hopkins, a fellowship in neuropathology to work on epi-
lepsy. Gibbs worked in the Lennox lab where he met Erna
Leonhardt; the couple were married in 1930 and were
collaborators thereafter (Hughes and Stone, 1990).

The Gibbses wanted to record EEGs from epileptic pa-
tients, and Hallowell Davis’ engineer, E. Lovett Garceau
(1906–1966), had built amplifiers and a portable EEG that
could be used for such recordings (Garceau and Davis,
1934, 1935; Garceau and Forbes, 1934). Encouraged by

Cobb, the Gibbses approached Davis to be a collaborator,
and Davis enthusiastically endorsed their plan (White,
1984). With the departure of the engineer, Garceau, and the
need for EEG machines with more than one channel,
Frederic Gibbs sought out advice at the Massachusetts In-
stitute of Technology. There he met Albert Grass (Marshall,
1980; Grass, 1984). With funding from the Macy Founda-
tion, he contracted with Albert Grass in May of 1935 to
build three channels of EEG amplifiers to drive the West-
ern Union Morse Code inkwriting undulator” (Grass, 1984;
Hughes and Stone, 1990).

The Gibbses met in the fall of 1935 and were married on
June 28, 1936. Ellen continued as a Ph.D. candidate in the
Department of Biology at Harvard University, recording from
the auditory cortex of rabbit in the laboratory of the noted physiological psychologist Karl
Spencer Lashley (1890–1958). Soon, however, she decided
to devote herself “to motherhood and doing whatever I
could to help Albert provide equipment to a growing num-
ber of scientists” (Marshall, 1995).

The report of voltage changes recorded through the cra-
nium of humans by Hans Berger (electroencephalogram,
EEG; Berger, 1929) and his observations of EEG variations
in patients with epilepsy (Berger, 1932; Gibbs et al., 1936)
were the basis for continued EEG studies of epilepsy in the
United States.
be used wisely for the benefit of the patients and for research, and not merely to extract money from the patients.”

Department of Physiology at Harvard Medical School

Albert and Ellen Grass’s success was clearly due, in part, to the support they received from established researchers in the Department of Physiology at Harvard Medical School. Walter B. Cannon and Alexander Forbes were especially critical in this regard.

“Speaking personally now,” Ellen once said, “Dr. Cannon made very many things possible for Albert and for me. He invested in us at a time when biomedical engineering was indeed in its infancy, and the role for women in science practically negligible” (Grass, 1970).

Walter B. Cannon (1871–1945) served as the George Higginson Professor of Physiology at Harvard Medical School for 36 years (1906–1942). For this entire period, he was chairman of the Department of Physiology and an Emeritus for his last three years. He made many important contributions to our understanding of how the human body functions: the use of Roentgen rays to investigate gastrointestinal motility (Cannon, 1898; Cannon, 1911; Brooks et al., 1975; Barger, 1981), the effects of emotions on the functional state of the body (Cannon, 1915; Davenport, 1981), the basis of surgical shock (Cannon, 1923), the constancy of the internal environment or homeostasis (Cannon, 1939), autonomic neuro-effector systems (Cannon and Rosenblueth, 1937), and the effects of denervation on various tissues (Cannon and Rosenblueth, 1949).

Walter Cannon spent his undergraduate years at Harvard University and continued on at Harvard Medical School, where the faculty held that interested medical students should be encouraged to conduct original research. Thus, in the first semester of his medical training Cannon and fellow student Albert Moser were encouraged by Henry P. Bodditch (1840–1911) to conduct a study on deglutition (Benison et al., 1987). Later, as a third-year medical student, Walter Cannon was approached by William Norton Bullard (1853–1931), a neurologist at Boston City Hospital, who offered to fund further research (Taylor, 1931).

These early research experiences clearly had a profound influence on the development of Cannon’s scientific philosophies.

Every man active in investigation has more problems in mind that he can work at himself. A part of his service to the world consists in training others by giving to others these problems to work at under his direction. These “others” are ordinarily his students,—young men who have been stimulated by his example. They are not yet established in life, they require remuneration until they have done enough work to warrant their being taken into independent positions. They should receive during these years of training (which are very likely to be productive of good results in research) sufficient compensation to afford comfortable support (Benison et al., 1987).

Cannon is generally considered to have been exemplary in his scientific conduct and his concern for human welfare (Cannon, 1945; Forbes, 1945; Morison, 1945; Davis, 1975). He “saw that the freedom and beneficence of science could be guaranteed only within the framework of a just society, national and international” (Grass, 1970), and was committed to providing promising young scientists, independent of nationality, the opportunity to participate and contribute to the advancement of science (Morison, 1945).

One such scientist was Arturo Rosenblueth (1900–1970) who came to Harvard from Mexico as a Guggenheim Fellow from 1930 to 1932 to work with Cannon. He quickly became Cannon’s “favorite son” and secured a position in the Department of Physiology. Their collaborations continued for the next 14 years (e.g., Cannon and Rosenblueth, 1937, 1949).

Cannon and Rosenblueth mentored several scientists who would ultimately become founding and early trustees of The

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1 The names of the founding and early trustees of the Grass Foundation are printed in bold type in this section of the paper. E-mail: Steven.J.Zottoli@Williams.edu.
Grass Foundation (Table 1). Alexander Forbes (1882–1965) as a fourth-year medical student was encouraged by Cannon to become involved in research. After receiving his M.D. degree in 1910 from Harvard Medical School, Forbes studied with C. S. Sherrington (1857–1952) for two years, and briefly with Lucas in 1912; afterwards, he returned to Harvard and the Department of Physiology (Fenn, 1969, Davis, 1970; Eccles, 1970). Forbes added a strong engineering background to the department and was continuously at the forefront of technological advances that he applied to neurophysiological investigations. These included the use of the vacuum tube amplifier in conjunction with a string galvanometer to record action currents in nerve and muscle (Forbes and Thacher, 1920, see also Gasser and Newcomer, 1921; Forbes et al., 1931; Grass, 1984; Frank, 1986; Seyfarth, 1996), the study of reflex activity (Forbes, 1922; Davis, 1970; Eccles, 1970), some of his studies at Harvard include the all-or-none nature of the nerve impulse (Davis et al., 1926), the use of the EEG in the study of epilepsy (Gibbs et al., 1935), recordings from single units in the “auditory nerve” of cats (Galambos and Davis, 1943; the recordings turned out to be from cell bodies of the cochlear nucleus, Davis, 1975), and the tolerance of the human ear to loud sounds (Davis et al., 1950). Hallowell Davis would become the sponsor of Ellen Grass’ research and an exponent of EEG recording at Harvard.

Donald B. Lindsley (currently Trustee Emeritus) had come to Harvard Medical School with a National Research Council Fellowship to work with Forbes and Davis in 1933. During this period, Lindsley recorded motor unit responses (Lindsley, 1934, 1935a) and pioneered the use of the electromyogram in neuromuscular disorders (e.g., Lindsley, 1935b, 1936; see Lindsley, 1995, for a review).

Arturo Rosenblueth had encouraged George H. Acheson (1912–2000), a first-year medical student, and Fiorindo A. Simeone (1908–1990), a third-year medical student, to consider conducting original research. Both contributed to the scientific productivity in the department (e.g., Rosenblueth and Simeone, 1934, 1938a, b; Acheson, 1938; Acheson et al., 1936, 1942; Simeone et al., 1938) and went on to distinguished medical careers.

Robert Morison (1906–1986) received an undergraduate degree from Harvard in 1930 and the M.D. in 1935. He was encouraged to pursue research by his mentor, Rosenblueth, during his medical school years. “He [Morison] was a man of great and thoughtful learning but one who, above all, wanted to understand the meaning of life and the significance of science for that fundamental issue. He understood what it was to make a moral vocation of one’s intellectual work, an effort that requires not only reading, writing, and thinking, but also something else: the living out, in daily life, of the values and virtues that animate that work.” (Callahan, 1987). Morison collaborated with many of those present in the Department of Physiology in the 1930s (e.g., Rosenblueth and Morison, 1934; Rosenblueth et al., 1936) and went on to Rockefeller University and then Cornell (Eisner et al., 1986–1987).

The Formation of The Grass Foundation

As the number of requests for financial support of neuroscience endeavors grew, Albert and Ellen recognized that a mechanism must be found to evaluate proposals and make decisions (Morison, 1979). The Grass Charity Trust was formed on December 31, 1948, and charitable disbursements were made after June 27, 1951. This Trust donated most of its assets to The Grass Foundation (The Grass Foundation minutes, 1958), which was formed in 1955 “to assist in advancing knowledge principally in the field of

Table 1

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<th>Founding trustees</th>
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<td>Alexander Forbes</td>
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<td>Albert M. Grass</td>
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<td>Ellen R. Grass</td>
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<td>Frederic A. Gibbs</td>
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<td>William G. Lennox*</td>
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<td>Robert S. Morison</td>
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<td>Arturo Rosenblueth*</td>
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<td>Robert A. Zottoli</td>
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<th>Early trustees</th>
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<td>Fiorindo A. Simeone</td>
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* Although Lennox and Rosenblueth are not listed as original members of the Corporation in the Constitution and Bylaws of The Grass Foundation, they are recognized as founding members in the minutes of The Grass Foundation.
neurophysiology, and including allied fields of medicine and science” (Article 2 Section 1 of The Grass Foundation Constitution and Bylaws).

As we have seen, most of the founding and early trustees of the Foundation were, at some time in the 1930s, members of the Department of Physiology at Harvard Medical School (Fig. 2; Table 1). This is only fitting, because their commitment to the support of young scientists, their own exemplary performance at the bench, and their concern for human welfare (Morison, 1979) reflect the basic principles that have molded The Grass Foundation. The Foundation currently supports programs within the Society for Neuroscience, at the MBL, and at other institutions. The Grass Fellowship Program at the MBL was one of the first and most important projects of The Grass Foundation, and it continues to flourish.

The Association of Albert and Ellen Grass and The Grass Foundation With the Marine Biological Laboratory at Woods Hole

Albert and Ellen Grass’s affinity for the MBL developed over many years and is based on several associations. For example, Alexander Forbes had a natural affection for the Woods Hole area. He spent summers on Naushon Island, which is still owned by the Forbes family, and he was a distinguished investigator at the MBL, publishing research done there with Catharine Thacher (Forbes and Thacher, 1925; Forbes, 1933). Albert Grass was undoubtedly attracted to the MBL because, as a center of neurophysiology, it was regularly visited in the summers by scientists who were actively involved in the development of new equipment. With this common interest, Albert developed lasting friendships with several MBL scientists, including Harry Grundfest (1904–1983) and Stephen Kuffler (1913–1980). Finally, Ellen was drawn to the MBL by her passion for the marine environment and the animals that live there. This passion was particularly evident in her Grass Instrument Company Calendars and the “live displays” presented at the annual meetings of the Society for Neuroscience.

Of the initiatives in support of basic science at the MBL, the Grass Fellowship Program most closely embodies the philosophy of the founding trustees who had “a love for the adventure of new ideas, a priority for assisting young investigators, and a program focus to direct its resources to the growth of neurophysiology” (Grass, 1987). Beginning with two fellows in 1951 under the auspices of the Grass Charity Trust, more than 400 young neuroscientists have spent summers at the MBL conducting independent research.

Established in 1959, the Forbes Lectureship is an integral part of the Grass Fellowship Program. Each summer, the Trustees of The Grass Foundation bring one of the world’s outstanding neuroscientists to the MBL “to honor the outstanding achievements of Dr. Alexander Forbes as a pioneer and major contributor to the field of neurophysiology, who has always been an inspired teacher of young students.” (The Grass Foundation minutes, December 11, 1958). The

**Figure 2.** Four of the original Trustees of The Grass Foundation. From left to right: Albert Grass, Frederic Gibbs, Ellen Grass, Robert Morison, and Erna Gibbs (not a Trustee) at the III International Congress of Electroencephalography and Clinical Neurophysiology held in Boston from August 17–21, 1953.
The philanthropic largess of Albert and Ellen goes well beyond the MBL and has benefited the neuroscience community in many other ways. For example, “individuals known to be sound investigators, working under budgetary or foreign exchange difficulties, often found themselves the recipients of indefinite loans” of neurophysiological equipment through the auspices of the Grass Instrument Company (Morison, 1979). Ricardo Miledi remembers, “Joaquin Remolina and I were once asked to make a list of Grass equipment to be bought for the Department of Physiology at the Institute of Cardiology in Mexico. We made a big list that was sent to the Grass Instrument Company and we were looking forward, with great excitement, to the day when the equipment would arrive. Then, to our great consternation, there was a big devaluation of the peso and we were asked to send a new order with a good number of items deleted. Later, when the shipment arrived we were all extremely pleased to see that all the items in our original list had arrived and a few extra ones had been included, as if to compensate for our transient worries. I wonder if any other community exists that would do that?”

Albert Grass died in Quincy, Massachusetts, on May 29, 1992, and Ellen died 9 years later on June 14, 2001, also in Quincy. The Grass Foundation that embodies their ideals continues to be committed to providing general support for

### Table 2

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<th>Year</th>
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<td>1951</td>
<td>Hal C. Becker</td>
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<td>1952</td>
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<td>1957</td>
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<td>Ricardo Miledi</td>
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<td>1960</td>
<td>Joaquin Remolina</td>
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<td>1961</td>
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<td>1958</td>
<td>Clarence Hardiman</td>
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<td>1960</td>
<td>Joan Taylor*</td>
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<td>1959</td>
<td>John P. Reuben</td>
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<td>1959</td>
<td>William H. Rickles, Jr.</td>
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<td>1959</td>
<td>Shirley H. Bryant</td>
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<td>Raymond J. Lipicky</td>
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<td>Walter Herzog</td>
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<td>Robert H. Wurtz</td>
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*Her fellowship was carried out at UCLA.*
“excellent science.” The tireless efforts of Albert and Ellen to monitor the pulse and flow of neuroscience have led to initiatives in support of the field, especially in helping those in need or just starting out. The greatest achievements of the Foundation’s initiatives, such as the Grass Fellowship Program at the MBL, have resulted from the ability of the Trustees to listen, hear and respond to needs of scientists in a rapidly changing discipline.

Acknowledgments

I would like to thank Ernst-August Seyfarth for his help and support during this project. George Acheson, Ellen Grass, Hank Grass, Ron Hoy, Don Lindsley, Ricardo Miledi, John Reuben, and Richmond Woodward provided important suggestions for the improvement of an earlier version of this manuscript. I also thank Helena Warburg for her efforts in providing biographical information. Mrs. Elin L. Wolfe at the Countway Library of Medicine deserves special mention for the research she did on Catherine Thacher. Finally, I would like to acknowledge the help, enthusiasm, and patience of Mike Greenberg.

Literature Cited


