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ROSS GRANVILLE HARRISON

1870—1959

A Biographical Memoir by
J. S. NICHOLAS

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Biographical Memoir

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BY J. S. NICHOLAS

PROFESSOR ROSS GRANVILLE HARRISON was born in Germantown, Pennsylvania, as were George H. Parker and E. Newton Harvey. Harvey referred whimsically to them as the Germantown trio. It is possible that Harrison was attracted to natural history and living things rather early, for he attended Mrs. Head's School in which the teaching of the children included real trips to study nature and animals in their natural surroundings. Shortly after his several years in Mrs. Head's School, the Harrison family moved to Baltimore where Ross Harrison's education was continued in the public schools (No. 6 Grammar School and Baltimore City College). He also did some work at Marston's University School, probably tutoring in advanced subjects in preparation for the Johns Hopkins which he entered in 1886. He had applied for matriculation as an undergraduate in June of 1885 but did not begin his studies until 1886.¹ I suspect that it was in this period that he took special tutorial work at the Marston School. Whether this delay was due to his age (he was but fifteen at the time he applied for matriculation) or to the invalidism and death of his mother, we do not know. At this time he declared his intent to study medicine.

He completed his work and received his A.B. degree in three years, graduating in 1889 at the age of nineteen. His major work was

¹ The information concerning his Johns Hopkins career was furnished by the Registrar, Irene M. Davis, through the request of Professor B. H. Willier. I wish to express my thanks to them for this assistance.

in biology and mathematics and the related premedical subjects in chemistry and physics. In his background he had a good foundation for languages, for he was thoroughly schooled in Latin and in Greek. During his undergraduate days he spent much time browsing in the University library and stated that some of his greatest intellectual pleasure was in getting acquainted with the classics both in ancient and modern form. He must have been a prodigious and retentive reader during this period.

In his biological training he became an excellent naturalist. His knowledge of the outdoors and the animal and plant populations was not the limited scope so often a characteristic of a laboratory man. Nor was the material analyzed only in the classroom and laboratory, for he loved to take bicycle trips on weekends and vacations either by himself or with friends and classmates. He cycled through most of Maryland, Virginia, and the entire eastern half of Pennsylvania. Wherever he cycled or walked he planned his movements with preliminary reading and map study. Usually he used the United States topographic maps both in preparation and review, and it was fascinating to make some of these trips with him in retrospect for his mental associations and recollections were so very vivid. As his son (R. E. H.) says of a later period after the family went to New Haven, his father took the children on walks around New Haven where he explained to them the plants and animals of the region. His interests were those of a natural historian and comprehended everything in detail except birds, to which Harrison felt too much amateur attention had been attracted. While he did not decry bird-watching, he always felt that it was an effort similar to stamp-collecting, of which he was quite fond but which he never regarded as a serious pursuit.

His interest in nature apparently started at Mrs. Head's School and always was pursued with serious interest and enjoyment. This interest was imparted to his friends and classmates as they made their cycle trips on weekends during the school year. It was on one of these that Harrison rescued Mr. Emilio Parlato from drowning.

Harrison, in spite of his youth, had secured as an undergraduate an awareness of nature in a mature sense, the knowledge of what it encompassed, an intellectual curiosity which gave him the broad and yet detached perspective which characterized his thinking during his entire career.

In 1889, Harrison entered the Graduate School at the Johns Hopkins and continued both his biology and his mathematics. He took courses in determinants, calculus, solid analytical geometry and general astronomy, in addition to physiology with H. Newell Martin and morphological readings and seminar with William K. Brooks. This was quite a schedule for a nineteen-year-old. Some of the texts used at that time were in the revolving bookcase in Dr. Harrison's laboratory at the time of his death. They had been studied and re-studied throughout the years.

In 1890 Harrison spent the summer at the laboratory of the United States Fish Commission at Woods Hole. He was an assistant working on the embryology of the oyster. Associated with him were H. V. Wilson and E. G. Conklin. Conklin had come to the Johns Hopkins in 1889 and Brooks had suggested that he work on siphonophores as his thesis material; but when Conklin got to Woods Hole and found the dearth of siphonophores in that region, he was encouraged by both Wilson and Harrison to study the embryology of *Crepidula*. Harrison and Conklin both told this story; Brooks had taken it for granted that any marine laboratory would have plenty of siphonophores.² The friendship formed between these two men was a lasting one. There was an aspect of Harrison's life which glowed when he was with Conklin and the fellowship which existed between them was unmatched by that of any of their contemporaries.

The return to the Hopkins marked a big change in schedule of subject material for Harrison. His entire time was spent with H. Newell Martin and W. K. Brooks. Martin stimulated Harrison as he had T. H. Morgan but in a far different way. Morgan was classified

² See E. N. Harvey, "Edwin Grant Conklin," National Academy of Sciences, *Biographical Memoirs*, Vol. XXXII (Columbia University Press, 1958).

by Harrison as one of Ostwald's romantics whose ideas came thick and fast and demanded immediate expression. To Morgan, the physiological approach was the quickest way to test an idea, but to Harrison, it was contributory to the cross-checking of the morphological details which had been altered by experiment. Harrison had Brooks' reverence for the morphological approach. This was, and still is, basic.

Brooks' philosophy found Harrison an appreciative listener not so influenced by it as was Conklin. It may have been Brooks who indirectly slanted Harrison's attention to Goethe's writings, which were a big part of Harrison's reading in later years. Harrison, however, never wrote along philosophical lines nor did he mix philosophy with the interpretation of his experimental work. He was a firm believer in the logical approach without drawing philosophic implications.

Conklin, who took his Ph.D. degree in 1891, Morgan in 1890, and Harrison in 1894 were all starred in the first edition of *American Men of Science*, which appeared in 1906. Conklin and Harrison appropriated Morgan's copy before he saw it and erased his star. Conklin's rendition of Morgan's reaction was priceless. Morgan was more than annoyed and was so incensed that he requested Professor Brooks to write to McKeen Cattell (the editor) in protest. For several days there was a period of *Sturm und Drang* until Professor Brooks showed Morgan his own copy in which Morgan was starred along with the rest. Whether Conklin or Harrison initiated this prank is not known but it certainly resulted in a wholehearted collaboration between the mischievous pair.

At that time, Professor Brooks was working on the embryology of *Salpa*, and Harrison often typified Brooks' attitude with regard to scientific priority which, then as now, was regarded by some investigators as extremely important. A foreign scientist was visiting the Johns Hopkins laboratory and, when Professor Brooks told him he was working on *Salpa*, commented that he had better hurry since a very competent French zoologist was working on identical

material. Professor Brooks ruminated over this statement and replied that he would not possibly hasten publication for, in the first place, his fellow-investigator might do a much better job in which case he (Brooks) would not need to publish and in the second place he might omit many things which he (Brooks) had observed. These then could be added in Brooks' publication, thus complementing the published findings and giving a better developmental picture of this form. Harrison's attitude was identical and he refused to be hurried either in his planning or his publication. This thought he passed on to his students with varying degrees of effect, and he always chuckled when Swett and I joked with Detwiler about publication of results before the slides were dry.

Harrison did not return to Woods Hole for summer work until 1896 after which there is a longer gap of thirteen years. He spent the summers of 1909 and 1910 there, became a Trustee of the laboratory in 1908, and was active until 1940, when he was made Emeritus Trustee which he remained until his death. To him the trusteeship was a serious matter and nothing was allowed to interfere with his attendance at the annual meetings. He usually visited the Conklins and when Dr. Conklin was not there he would be with Dr. Frank R. Lillie. His admiration for Dr. Lillie as an intellectual leader in biology was an unusual one. He felt that he had organized his biological thought at an oriented and orderly philosophical level. He had great respect for Lillie's analyses of biological material upon which his sound philosophical implications were founded. He was chairman of the committee which nominated Lillie for the presidency of the National Academy of Sciences, a position which Lillie filled with outstanding dignity and foresight.

Harrison was a member of the marine expedition to Jamaica in 1891. This added considerably to his naturalistic experience and also made him acquainted with many more organisms. He made the remark frequently that every experimental embryologist should know the animal kingdom thoroughly since these organisms made up the tools of enquiry for the experimentalist. During this summer

he raised a complete set of whiskers. It was the last time he went through either experience. Morgan retained both his beard and his fondness for marine organisms.

In 1892 and 1893, Harrison studied at the University of Bonn. This year was destined to become an important part of Harrison's career and future outlook. He had gone to Germany to study, but he had not committed himself either to the man under whom he would work or the places that he would visit. Bonn was one of the places early scheduled in his itinerary and it was here that he met Moritz Nussbaum, with whom he discussed possible men and laboratories for the type of work he wished to do. He had begun his study of the development of the fins of Teleosts and wished to continue them. Nussbaum, with characteristic modesty, convinced Harrison that Bonn was the place to work and that he would be the most stimulating teacher of this young investigator. Harrison was never sorry that he decided to stay in Bonn, and he returned there for rather long periods of study in 1895, 1898, and 1899 when he was granted his M.D. He returned to the Hopkins for the year 1893-1894 and completed his Ph.D. work during that year. The degree was granted in June, 1894. He also was granted the Adam T. Bruce Fellowship for further work but resigned this to take up his duties as Lecturer in Morphology at Bryn Mawr. He returned to Hopkins, however, to give two lectures on the limbs of vertebrates.

T. H. Morgan had succeeded E. B. Wilson at Bryn Mawr in 1891 and Harrison was thrown into even closer association with one whom he had gotten to know as a graduate student. Harrison's year at Bryn Mawr was one which he always recalled vividly and he esteemed President M. Carey Thomas as one of the finest presidents with whom he had come in contact.

He remained at Bryn Mawr for one year only and returned to Bonn in 1895 for the medical work which he wished to complete and then returned to the Hopkins as Instructor in Anatomy in the Medical School. He was made Associate in Anatomy in 1897 and Associate Professor in 1899. During this period his teaching was in

histology and embryology and was so arranged that he could get back to Bonn for more medical work. He held his Associate Professorship until 1907 when he was called to head the Department of Zoology at Yale as Bronson Professor of Comparative Anatomy. The Department of Anatomy at the Johns Hopkins was headed by Professor Franklin P. Mall and Harrison was associated during his stay there with Florence Sabin, Lewellys Barker, Warren Lewis, and many others in the Medical School. Welch, Osler, Kelly, and Halsted, known as the big four of the early Medical School, were more than simply acquainted with Harrison and his association with them was maintained during their lifetimes. Harrison's reminiscences of these men, his sketches of their work and character revealed his human insight into the men themselves. His interests and contacts with the clinical side of the Medical School were strengthened by his position as a Bonn M.D. He was more than an acquaintance of Harvey Cushing, George Blumer, and Joseph Flint during his days as a teacher at the Hopkins. His tales of the early days of the Medical School would form a classic study of the ways by which it rose to the eminence it had in setting new standards of medical training for the world.

During his study and teaching at the Johns Hopkins and Bonn, the study for the Ph.D. and M.D. degrees, Harrison had published more than twenty papers in the little more than a decade. In addition to this he had become a friend of the front-rank men in medical training and education as well as a battery of scientific colleagues both at home and abroad who were attracted to him as a person and esteemed him for his thought and works. He had likewise acquired a wife, Ida Lange, whom he married in Altona, Germany, January 9th, 1896, and a family of four children before he left Baltimore. He was prevailed upon by Morgan, Wilson, and Conklin and Parker to take on the responsibility for a new journal, the *Journal of Experimental Zoology*. It is small wonder that his son (R.E.H.) states, "My Father left home early during the Baltimore days and came home late in the evening, he had little time for family life." Harri-

son's own account of the founding of the Journal is given in Vol. 100 of the *Journal of Experimental Zoology*, 1945. He continued as Managing Editor of this journal until 1946, editing 104 successive volumes and voluntarily editing a special volume in 1955, making a total of 105 volumes.

The fears expressed by Wilson and Morgan that the editorial duties would take too much time from Harrison's scientific work were not justified. He maintained his scientific output with a new significance that made his contributions outstanding. He never permitted administration of any sort to dominate his thought at the expense of his research. This was true even in the war years when he was Chairman of the National Research Council, for on innumerable train trips the conversation was not on Council business which had been so pressing with him but on new things in the field of science. Harrison always felt that his editorial responsibilities were an asset since they kept him in close contact with developments in the field. He was still making valuable editorial comments up to the year before his death.

When Harrison moved his family to New Haven they lived at 306 York Street, just a short distance from the laboratory at 2 Hillhouse Avenue. The house has since become known to thousands of Yale men as the home of Mory's Association, a most popular undergraduate club. Here his son, Ross G. Harrison, Jr., was born and it was from this house that the explorations of the countryside were conducted, taking the three older children for a real view of the natural wonders of the countryside in the New Haven environs.

Harrison was called to Yale to revitalize a department which up to this time had been largely naturalistic. His immediate predecessors had been James K. Thacher, Sidney Smith, and A. E. Verril. Of these Thacher intrigued him because of his relationship to the Balfour-Mivart-Thacher finfold theory of the origin of paired fins. President Hadley had promised that a new laboratory would be built and Harrison secured the assurance that zoology would be a University department and not the divided science and arts faculties

then characteristic in Yale. Even with this specification the appointments of faculty were governed by the Sheffield Scientific School and Yale College but, since Harrison insisted on a single University laboratory, the appointment differences amounted to very little. Harrison held a University appointment with membership in Yale College, Sheffield Scientific School and the Graduate School. He later was invited to join the Medical School faculty which was a very rewarding experience and one which was of tremendous value in the reorganization of the Yale Medical School under Deans George Blumer and M. C. Winternitz.

The facilities of the Sheffield buildings were somewhat cramped. Professor Lafayette B. Mendel and Franklin P. Underhill were doing pioneer work in physiological chemistry and much of Mendel's research was being conducted at the Connecticut Agricultural Experiment Station in association with Thomas B. Osborne and A. J. Wakeman. Russell Chittenden, then Director of the Sheffield Scientific School, was also in the tower building which was connected with the old Sheffield mansion by a second floor hallway. Professors W. R. Coe and A. W. Evans lived in quarters in the Sheffield mansion.

In 1907, Harrison, Coe, B. W. Kunkel, and Leon J. Cole were the working zoology staff. Harrison taught the elementary course which was prerequisite to all the other biology courses and at that time was required for admission to medicine. Bayne-Jones, later Dean of the Yale Medical School, and Lewis Weed, later Dean of the Johns Hopkins Medical School, were in Harrison's classes. The transition from Medical School teaching to the elementary level was too great a gap and Harrison was exceedingly unhappy in this work. He never relished lecturing and he once said that he panicked most violently in the early elementary lectures. Later L. L. Woodruff was brought from Williams where he had already proved himself as a stimulating and inspiring undergraduate teacher, a reputation which he sustained at Yale. Alexander Petrunkevitch was secured from Indiana. These

men with Harrison and Coe formed a group with diverse interests and very different points of view. They were to make full use of the opportunities presented to them and supported Harrison in the building of a first-rate department. Harrison appreciated particularly the help given him by Coe in the planning of the Osborn Laboratory and he commented frequently on Petrunkevitch's planning of the photographic equipment and the darkrooms for animal studies which are in use today. With the occupancy of the new building in 1913 the stage was set for a very active and experimentally slanted department.

In 1914, Professor Harrison was offered the chairmanship of anatomy at the Johns Hopkins and this led Dean Blumer to attempt the consolidation of anatomy and zoology under Harrison. By this device it was also calculated rather shrewdly to raise Harrison's salary to meet the Johns Hopkins offer. Harrison's charming home had just been completed and although strongly tempted by the offer to succeed F. P. Mall he decided to stay in New Haven. From 1914 until his retirement in 1938, Harrison served the Medical School as their chief advisor on staff replacements.

In the meantime many younger men held instructorships or other positions within the department: Beverly W. Kunkel, T. S. Painter, Davenport Hooker, Reynald Spaeth, W. C. Buchanon, G. A. Baitzell and others, the most socially minded of whom was Henry Laurens. Laurens was the first of the younger group to break through a genuine diffidence, labelled by the students as "the Harrison reserve." Little did any of us realize that Harrison's approach to younger men was difficult and that he was most anxious to make contact. When he sat on the corner of your work table and suggested that a course in the Art School would help in your embryological illustration he did not mean to hurt your feelings. He was expressing his own wish for better comprehension of the material and better delineation of it. He himself was a master draftsman and the illustrations for all his earlier work were done by himself. A brief glance at his drawings,

the detail in his study of fins, shows that in Harrison you had an artist as well as a scientist. He started making sketches during his undergraduate days at Hopkins and many of his cycle trips showed sketches of terrain or dwellings. He had both the hand and the eye for beauty.

Laurens had a room nearby Harrison's laboratory and Harrison did not hesitate to come to Laurens' room to talk shop or other things. Laurens had worked at Harvard with George Parker, who was a close friend of Harrison's; it was through Laurens that Detwiler was made acquainted with Harrison as a person and they sometimes had lunch in Harrison's office and laboratory. We of the graduate group felt that Laurens and Detwiler had attained something that we badly missed. Some of us were to realize later that this was just an initial step in friendly companionship which no students before had had and that Harrison was warmly interested in us and what we were trying to do. At that time he had not found a way of conveying this feeling except to people he knew well and he was cautious about adding to the small circle with whom he felt at home. To Henry Laurens the succeeding generations of graduate students at the Osborn Laboratory are grateful for making possible the wonderful relationship which we all had with Harrison. It was he who dubbed him "the Chief," a name by which he was known to the laboratory over all the years.

Harrison's interest in the environs of New Haven was a dual one. He first wished to locate the breeding pools of the amphibia and secondarily he enjoyed hiking. With two of his friends, Yandell Henderson and George Hendrickson, there was little of the terrain surrounding New Haven that was not covered. They referred to themselves as the 3H Walking Club. Harrison's zest for walking embarrassed many younger men and a short jaunt would convince them that here was a man who could walk both fast and long. After the Pacific Science Congress, of which he was president, in 1939 he went on a jaunt which took him to various peaks in California. His name

is proudly registered in the summit cairns as Ross G. Harrison—in his seventieth year. The walks with Henderson and Hendrickson continued up to the time of Henderson's resignation as Professor of Physiology in the Yale School of Medicine. Henderson had made some demands in the Executive Committee which were not received with pleasure, and because he regarded the action as a vote of no-confidence he peremptorily offered his resignation. Much to his discomfiture the Dean immediately accepted the resignation in such terms that Henderson felt it was final. Due to the efforts of Harrison, the University instituted the Department of Applied Physiology of which Yandell Henderson became its first professor, with Howard Haggard and later Leon Greenburg as his assistants. Harrison had been very frank with Henderson and had tried to calm the troubled waters, but Henderson never spoke to him after that. So the 3H Club was decreased by one.

During the First World War Dr. Harrison was placed in a most peculiar situation. He saw the drift which was to carry us into the maelstrom and, with his background of German studies and a German wife, had great sympathy with the German people. He misjudged the capacity for fair play and good sense of the populace in general and some members of the Yale faculty in particular. The war hysteria was mounting and anything German was anathema. These were the days when we stopped teaching German, renamed towns which were unfortunate enough to have German counterparts, and even stopped singing "Bright College Years." Harrison was never pro-German after our entrance into the war; as a matter of fact it was due to his recruitment that several of the graduate students were inducted into service and trained at Colonel Russell's Army Medical School in Washington, D. C. He was of the strong opinion that war was noncivilized and useless, an opinion which antagonized the burning and nonthinking patriots so rampant at the time.

In the Osborn Laboratory at that time were Professor Richard

Goldschmidt of the Kaiser Wilhelm Institute, who had been studying Lymantria in Japan, and Dr. Rhoda Erdmann. Goldschmidt had a commission as Colonel in the German artillery and Dr. Erdmann was a parasitologist. Both had the run of the laboratory and were working away with little thought of the *Weltpolitik*. One night the three graduate students who slept in the Osborn tower were awakened by an officer in Military Intelligence demanding to know why certain lights were burning. The lights were in Dr. Goldschmidt's laboratory and gave rise to the rumor that he was signaling ships in the New Haven harbor. This was months after a German submarine had surfaced off New London with a cargo of Neosalvarsan. Since Dr. Goldschmidt's laboratory was on the rear of the Osborn, from which the lights could not possibly have been visible, it was evident that the report was false. Nevertheless many accepted the rumor which was continued after our entrance into the war and until Professor Goldschmidt was interned at Fort Oglethorpe. The case of Dr. Erdmann was more unfortunate for she had brought with her, for her studies, some chicken cholera. There is a law forbidding such importation but, before we were in the war, strains of this sort were brought in as scientific materials and there was much laxity. After the declaration of war nothing was more natural than to give credence to rumors that a German scientist had introduced chicken cholera and that this had been spread to American broods. This rumor was so effective that the officials arrested Dr. Erdmann and took her incommunicado to Hartford where she was placed ignominiously in jail. Harrison's efforts to liberate her, or at least give her the comforts due a prisoner of war, were severely criticized. For him, this was not a happy period.

Yet it was during this period when upsetting conditions were all around that he pursued his studies on asymmetry that led to the rules which are followed in the leftness and rightness of body parts. It is a tribute to his disciplined serenity that in such insecure times he was able to produce work of such far-reaching significance. He showed that the axes of limb polarity appear at different times and

different stages of embryonic development. He showed that under suitable experimental conditions the axes can be reversed and an area of tissue, which unmolested would give rise to a right limb, could be converted to a left. Later he established the same sort of rules for the gills and the ear.

Ten years had now elapsed since Harrison was called to succeed F. P. Mall at Johns Hopkins. The anatomy headship at Columbia was now open because of the retirement of Professor Huntington. The position was an important one and involved the planning of a new department in the new Medical Center. After consultation with President James Rowland Angell, Harrison decided to stay at Yale. He was granted a year's leave of absence and on his return from abroad was named Sterling Professor of Biology. When he notified the authorities at Columbia that he would not accept their offer he strongly recommended for the post a former student, then at Harvard, who was approached and who accepted. This was how Columbia secured the head of an outstanding Department of Anatomy, S. R. Detwiler. (See page 85.)

Harrison never regretted this decision even when irked by happenings at Yale with which he did not agree. He watched Detwiler's development of his department with interest and constant advice. Since Yale at that time was the headquarters for training in human anatomy, most of Harrison's students took the course in human anatomy with Professor Harry B. Ferris. He was a master of anatomy, both human and comparative, and gave special consideration to the students from the Osborn Laboratory. He would sit with us at the dissecting table and point out comparative anatomical homologies as the dissection went along. This, plus Harrison's course in vertebrate morphology, fitted his students both in specific detailed knowledge and in the presentation of morphology. The vertebrate morphology course was given over two years, one devoted to classification and systematics, the other to systemics. Each student was assigned a subject for presentation with complete bibliography.

During Dr. Harrison's entire lifetime he maintained the interest

which he expressed on matriculation as an undergraduate at the Johns Hopkins. His studies at Bonn which qualified him for the M.D. were added to the morphological training which he had with Brooks and the physiological slant which he had with Martin. All formed a background for an active interest in medicine which he considered not as a discontinuous element but as a continuum of the biological discipline. He sometimes whimsically referred to medicine as applied biology. It was natural, therefore, that he should bridge the gap between the undergraduate biology and medical school anatomy both in his teaching and research.

Harrison had no official relation with the Medical School during his first years at Yale. Probably the duties of building the Osborn Laboratory occupied all of his spare time for he was conscientious in its planning and inspected the construction each day. However, his contacts with the Medical School Faculty were numerous. George Blumer and Joseph Flint were Hopkins acquaintances and both H. B. Ferris and Yandell Henderson were friends. As given in the minutes of the Board of Permanent Officers, Harrison was sitting on the Board on October 20th, 1914, at which time the preclinical work was given in the York Street building. A committee of the Medical Faculty was set up to consider moving anatomy to the Osborn Laboratory, thus releasing sorely needed space for physiology and pharmacology. Anatomy did not move but the medical students came to the Osborn for the course in embryology taught by Harrison. In 1920, a separate embryology course was offered by Dr. L. S. Stone, now Bronson Professor of Comparative Anatomy in the Yale Medical School.

By this time two of his Ph.D. students were instructing in the Department of Anatomy: Davenport Hooker, later Professor of Anatomy at the University of Pittsburgh, and H. Saxton Burr, now E. K. Hunt Professor of Anatomy, Emeritus. S. R. Detwiler (former Professor of Anatomy at the College of Physicians and Surgeons) and L. S. Stone also have served the school. Harrison always felt that his

students should know vertebrate morphology and that taking human anatomy was the best way to acquire it.

Dr. Harrison had a large share of medical committee work and served at one time or another on sixteen of these. He usually was on committees dealing with appointments, among these Milton C. Winternitz's to the chair in pathology and later to the Deanship. He remained a member of the Board of the Jane Coffin Childs Fund after his retirement, and was also a Trustee of the Rockefeller Institute.

His relationship to medicine was maintained on a national scale. He was in constant touch with Abraham Flexner during the crusade to better medical training and education and to a lesser degree with Simon Flexner, then Director of the Rockefeller Institute. He became acquainted with them at the Hopkins and his ability to think things through to a logical end was greatly appreciated by both Flexners and many others during his lifetime. Professor William W. Welch always came to see him during his frequent trips to New Haven.

Many controversial points have evolved about Harrison's relation to the Nobel prize and why it was not formally awarded to him for what has rightly been judged as an outstanding biological discovery—the outgrowth of the neurone. The record which clearly resolves any controversy was published in 1950.³ I quote,

“For the study of growth during embryonic development the method of cultivating animal tissues outside of the body that was introduced in 1907 by R. G. Harrison has been of great value. From frog embryos Harrison took fragments of the tissue of different parts of the body and placed them in a drop of clotted frog's lymph. The tissue remained alive and even continued to grow. Harrison found that shoots grew from the edge of pieces from the medullary tube and that, in certain cases, they were outgrowths of nerve cells. They grew rapidly, branched out, and ended up with the typical growth cones. Harrison has also made a number of valuable observations on

³ Nobel, *The Man and His Prizes* (University of Oklahoma Press, 1950), p. 245.

other tissues. His method has since been improved and has been widely used by experimental biologists. In 1917, a majority of the Nobel Committee recommended that the prize should be given to him '*for his discovery of the development of the nerve fibers by independent growth from cells outside the organism.*' The Institute, however, decided not to award the prize for that year. When Harrison's work was again submitted to a special investigation in 1933, opinions diverged, and *in view of the rather limited value of the method and the age of the discovery*, an award could not be recommended." (Italics mine.)

The foresight of the Committee could not be too reliable since in 1956 one of the sharers in the Nobel prize was given the award for the cultivation of kidney cells in tissue culture (the Harrison method) which made the large scale production of Salk polio vaccine possible. At present, the method which obtained the answer to the problem of nerve outgrowth is more universally used in the experimental field than ever before. Its application in the field of medicine is becoming more and more apparent. Cancer, pathological cell reaction, and preventive medicine are all involved as well as are the problems of growth, cellular organization, cellular aggregation after dissociation, organ culture and physiology. Never has *a method of so limited value* (v.supra) been used so much.

This sets forth the record. Now let us look into some of the misunderstandings which have arisen about Harrison and Nobel prize-winning contestants. The first of these has been stated to be Carrel, whose award was made for his contribution to the suture of blood vessels and the transplantation of blood vessels and of organs. The award was made in 1912. Harrison's first announcement of the tissue culture method was in 1907;⁴ his big paper on nerve outgrowth was three years later.⁵ During the intervening years Carrel wrote Harrison and asked that Montrose Burrows come to work with Harrison. This request was granted and Burrows contributed markedly

⁴ *Proceedings of the Society for Experimental Biology and Medicine*, 4 (1907):140-144.

⁵ *Journal of Experimental Zoology*, 9 (1910):787-848.

to the tissue culture method. He found that chick plasma was a much better medium for supporting the growth of mammalian and avian tissues than frog lymph. Davenport Hooker,⁶ under Harrison's direction, was the first to show the myogenic origin of the heartbeat; Burrows was the first to confirm this in tissue culture.⁷ Dr. Burrows then returned to the Rockefeller Institute to work with Carrel and Murphy. Harrison never met Carrel until Friday, December 15th, 1933. The Harvey Society Lecture at the New York Academy of Medicine was given by Harrison on the previous evening. His subject was Heteroplastic Grafting in Embryology and the occasion was his second appearance before this body to which he had presented a similar subject in 1908.

Carrel's Nobel award was in no way connected with Harrison's problem and the method which gave rise to its solution. Harrison himself did everything he could to correct the invidious rumors which accused Carrel of capitalizing on his work. C. C. Guthrie, with whom Carrel was associated in the blood vessel suture problem, could have had much more cause for complaint. He was awarded the prize of the College of Physicians and Surgeons in 1911, while the Nobel prize went to Carrel. In 1960, the gold medal and the citation of the American Association of Plastic Surgeons were awarded to Guthrie since the importance of his work is even greater in the present period of blood vessel surgery than in 1911.

In 1933, the Nobel Committee had the difficult choice between Harrison's work on asymmetry, which was being pressed vigorously at the time, and the brilliant studies of T. H. Morgan. This was the period when the gene studies were undoubtedly in the ascendancy and when Harrison was working upon the problem in which the optimal method of approach was transplantation.

In 1935, Spemann was chosen for the Nobel prize. In this award Harrison thoroughly concurred. He endorsed Spemann for the Silli-

⁶ *Proceedings of the Society for Experimental Biology and Medicine*, 7 (1910):154; *Journal of Experimental Zoology*, 11 (1911):159-186.

⁷ *Journal of Experimental Zoology*, 10 (1911): 63-83.

man Lectures in 1938 at Yale and recognized the tremendous import of the organizer concept to the analysis of development. In the light of the action of the Nobel Committee in 1933 it was not to be expected that they would reconsider Harrison in 1935. The situation, however, in 1941 was entirely different, for disregarding altogether the tremendous impact of the nerve outgrowth solution upon biology, anatomy, and neurology, Harrison should have been considered on the basis of his outstanding work on asymmetry and his part in establishing the thinking for present-day molecular biology. Again we were in a war period and the award went to a less theoretical but much more practical line of investigation. "For the invention of devices for tissue grafting and tissue culture" Harrison was awarded the John Scott Medal and Premium of the City of Philadelphia in 1925, and later, 1947, the John J. Carty Medal of the National Academy of Sciences.

After retiring from Yale, Harrison became Chairman of the National Research Council, serving from 1938 to 1946. It was fortunate for the Research Council and also for the national good that Yale automatically retired Harrison at sixty-eight for his value during this critical period was of the highest importance to the Research Council's new role in relation to the governmental and national needs. During this period the function of that body changed from being a peripheral advisor on request to government agencies, to an operating agency which sought to make the agencies aware of what scientists could do for government agencies' problems. Since science was doing most unusual things in connection with World War II, the entire focus of the importance of scientists as a group was intensified to a large extent through the efforts of Dr. Harrison and of Dr. F. B. Jewett, then President of the National Academy of Sciences. This pair of minds cooperated in some of our major national policy decisions.

It was due to Harrison's thinking that the armed services' demands for penicillin were curtailed and that Dr. Keefer was appointed to ration this antibiotic to take care of critical areas, both military and

civilian. The supply, while limited, was utilized as completely as possible. He had also picked Robert D. Coghill as the man who could overcome the difficulties of mass production of penicillin. Harrison worked also in assisting the office of Medical Procurement by supporting their contention that medical personnel, which was in short supply, be utilized in the regions of greatest need where they could serve to greatest advantage. Wherever Harrison touched medicine, whether by advice, teaching, training anatomists, or the administration of problems directly related to medicine, his contact made for professional betterment.

It is, however, through his research that he made his greatest contribution to medicine, for the method which he evolved in solving the problem of nerve outgrowth was proved and is proving of the greatest value. The demonstration of the nerve origin changed the whole line of thought in neurology. The physiological integrity of the neurone rests upon the embryological facts which he so critically demonstrated. It formed the basis for Sherrington's integrative action and the whole present functional treatment of neurology. The method itself, tissue culture, is being used successfully at present for the study of disease, cancer, and in the preventive field.

His later work is just as remarkable although not yet ready for medical exploitation. It is the result of the same sort of critical planning; it led to the discovery of the rules which govern asymmetry. The presentation of the facts governing polarization has sharpened the focus of our thought and has made us think of structure and function at molecular levels. His paper with W. T. Astbury shows that this approach to the asymmetry problem was very much in his thinking and, while the condition of preparation of his material did not present critical x-ray diffraction patterns, it was a step toward the current manner of investigation showing that this is a possible method of attack upon the changes in molecular structure.

In 1913, Harrison was elected to the National Academy of Sciences and to the American Philosophical Society as well. These were the early recognitions of his proved scientific accomplishment and future

promise. He was a working member of the Academy. He served on the Council of the Academy and the Executive Committee of this body from 1932 to 1946. He also served his turn as Chairman of the Section of Anatomy and Zoology and on numerous committees in association with specific points, such as the commission for the study of highways and resources.

He became a member of the Science Committee of the National Resources Planning Board in 1938 and served as chairman of President Roosevelt's Committee on Civil Service Improvement in 1939. In these capacities he created a liaison between governmental agencies which he was not hesitant about advising on the use of scientists in areas where they could do the greatest service. He was alert to the necessity for change in the Divisions of the Research Council and carried these forward in a quiet and deliberative way.

When Harrison assumed the chairmanship of the National Research Council, the Academy, when consulted by governmental agencies, would either appoint a committee of its members or pass the recommendation on to the Research Council. This practice continued through Dr. Lillie's presidency, but with the changes imminent to our entrance into war which both he and Dr. Harrison feared was approaching, they set up the first plans for initiating Research Council actions which then could be approved by the Academy but were not subject to the delays then prevalent. This was the first realization of the Academy-Research Council integration of function and it led under Harrison and Frank B. Jewett to the activation of the Research Council as the real operating and operational partner to the Academy which it was originally supposed to be. This policy move has been followed by the succeeding presidents of the Academy, A. N. Richards and Detlev W. Bronk, with increasing emphasis on advancing possible and profitable scientific participation in government activities. The whole policy of making scientific advice available by formulating the problem and suggesting qualified personnel began with Harrison.

This is the main and lasting thing which he contributed to the utilization of scientists in the age of science. An enumeration of the individual problems attacked under this policy would more than exhaust the available space. The resolution of the Executive Board of the Academy-Research Council expressed their tribute to Dr. Harrison upon his retirement from the chairmanship in 1946 as follows:

"Dr. Ross G. Harrison . . . has served the Council through a long and turbulent period during which problems of far-reaching import and complexity have had to be met. He has supported, stimulated and guided the divisional chairmen in their efforts to advance human welfare through the various Natural Sciences; he has brought this Council into amicable working relationship with the Council of Learned Societies and the Social Science Research Council; he has been responsive to calls from civilian agencies and to the many requests and needs from military and other divisions of the Government. These numerous, wisely rendered services form a notable contribution to Science and the Nation."

In reply, Dr. Harrison responded in characteristic fashion:

"It is easy to work effectively when one finds such cordial response and such willingness to sink minor differences of opinion for the common end."⁸

His period of administration was at an end and he returned to his laboratory. He was prevailed upon to undertake the delivery of the Silliman Lectures, so the years from 1946-1949 were spent in preparation for this event.⁹ It was a delightful opportunity for many of his students and friends to return to New Haven to hear this youthful man of seventy-nine deliver these famous Lectures. He dreaded the ordeal but carried it through with that same perfectionism that characterized all his thought and action. After their presentation he could not bring himself to finish the manuscript. This had to be left to other hands. His interests were his studies on the limb and the ear

⁸ News Report of the National Academy of Sciences—National Research Council, IX, No. 6 (1959), 90-91.

⁹ In Press.

which he feared he would not finish if he devoted himself to the refinement of the lectures.

By one of those queer circumstances of fate, he suffered a fall in the spring of 1955 on the evening of the dinner given in honor of the Silliman Lecturer of that year. He never completely recovered from the fall and, although for many months he was able for short periods to discuss advances in science, he never recovered his strength to the point where he could return to work in the laboratory. He died September 30th, 1959.

His accomplishments in all the fields in which he worked were truly phenomenal: departmental, administrative, research, teaching, counseling and finally administration at the national level—

“Whatever he doeth shall prosper” (Psalms 1:3).

KEY TO ABBREVIATIONS

- Amer. Assoc. Adv. of Sci.=American Association for the Advancement of Science
- Amer. Journ. Anat.=American Journal of Anatomy
- Amer. Nat.=The American Naturalist
- Amer. Phil. Soc. Year Book=American Philosophical Society Year Book
- Anat. Anz.=Anatomischer Anzeiger
- Anat. Rec.=The Anatomical Record
- Arch. f. Entw.-Mech. d. Org.=Archiv für Entwicklungsmechanik der Organismen
- Arch. f. mikr. Anat.=Archiv für mikroskopische Anatomie
- Arch. f. Zellforsch.=Archiv für Zellforschung
- Biol. Bull.=Biological Bulletin
- Brit. Med. Journ.=British Medical Journal
- Bull. VI. Internat. Zool.-Kongr., Bern=Bulletin des VI. Internationalen Zoologen-Kongresses, Bern
- Carnegie Inst. Wash. Year Book=Carnegie Institution of Washington Year Book
- Johns Hopkins Hospital Bull.=Johns Hopkins Hospital Bulletin
- Johns Hopkins Univ. Circ.=Johns Hopkins University Circulars
- J. Comp. Neur.=Journal of Comparative Neurology
- J. Exp. Zool.=Journal of Experimental Zoology
- Proc. Amer. Assoc. Anatomists=Proceedings American Association of Anatomists
- Proc. Mid-Year Meeting Amer. Pharm. Manuf. Assoc.=Proceedings of the Mid-Year Meeting American Pharmaceutical Manufacturers' Association
- Proc. Nat. Acad. Sci.=Proceedings of the National Academy of Sciences
- Proc. Roy. Soc., London., Ser. B=Proceedings of the Royal Society, London, Series B
- Proc. Sixth Pacific Sci. Congr.=Proceedings of the Sixth Pacific Science Congress
- Proc. Soc. Exp. Biol. and Med.=Proceedings of the Society for Experimental Biology and Medicine
- Rendiconti R. Accad. Naz. d. Lincei=Rendiconti della R. Accademia Nazionale dei Lincei
- Sitzungsberichte Niederrhein. Gesellsch. f. Natur. u. Heilkunde, Bonn=Sitzungsberichte Niederrhein. Gesellschaft für Natur und Heilkunde
- Trans. Congr. Amer. Physicians and Surgeons=Transactions of the Congress of American Physicians and Surgeons
- Trans. Conn. Acad. Arts and Sciences=Transactions of the Connecticut Academy of Arts and Sciences
- Verhandl. d. Anat. Gesellsch., 80. Versamml., Jena=Verhandlungen der Anatomischen Gesellschaft, 80. Versammlung in Jena
- X. Congr. Internat. Zool.=X. Congrès International de Zoologie

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