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EPISODES AND PERSONALITIES IN THE DEVELOPMENT OF BIOLOGY AT BROWN[1]

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IN the diamond jubilee number of the *Atlantic Monthly,* issued in November, 1932, seventeen articles selected from the 900 monthly issues of the *Atlantic* were reprinted. One of them was Dallas Lore Sharp's famous paper on "Turtle Eggs for Agassiz" (1910), which already had been reprinted many times and which, incidentally, has been read by Dr. Walter to his class in comparative anatomy in Brown every year for a quarter of a century. Now this touches my subject at several points: The hero of the episode was J. W. P. Jenks, the first teacher of zoology at Brown. Jenks was a lifelong disciple of Agassiz and widely disseminated his doctrines at Brown and elsewhere. Sharp was a student at Brown (1895) and a special protégé of Professor Jenks, from whom, while at Brown, he got the tale about the turtle eggs. Again, Sharp's own colorful career at Brown, if as adequately written up, would win a place in literature. And finally, his introduction to the turtle egg paper provides the theme, which is at least implied, of this post-prandial talk, namely, that the progress of a science in a period of years, like a game of golf in an afternoon, is not completely recorded in the mere enumeration of the end results and the scores, but that personalities and minor dramatic incidents are a vital and substantial part of the story.

Sharp found the clue to his story in Agassiz's four volumes of "Contributions to the Natural History of the United States." "The volumes," he said, were "massive, heavy, weathered as if dug from the rocks,"

[1] Address at the dinner of the National Academy of Sciences, Brown University, October 24, 1939.

a "laminated pile . . . a kind of printed coral reef." One volume contained a monumental work on turtles and their embryology. "I turned away from the weary learning to read the preface," says Sharp. There he found the brief acknowledgment of Jenks's assistance in furnishing turtles and eggs in early stages, and "all there is to show for it, so far as I could discover, is a sectional drawing of a bit of the mesoblastic layer of one of the eggs!"

"Of course Agassiz wanted to make that mesoblastic drawing and had to have a fresh turtle egg. I'm glad he got it. But what makes me so sad and impatient is that he did not think it worth while to tell about the getting of it and so made only a learned turtle book about what might have been an exceedingly interesting human book." Then follows the thrilling tale of getting those fresh eggs which the turtle laid for Jenks—as though upon special order at four o'clock one Sunday morning—from a pond near Middleboro to the great man at Cambridge forty miles away; a tale which, for dramatic and exciting incident, puts Sheridan's ride completely in the shade. What Agassiz, in Sharp's view, neglected, Sharp did superlatively well. He proved his point. And mine too!

However, in justice to Agassiz, it must be said that, if he did miss a human story, Sharp missed an even greater story in the same dull volumes from whose "weary learning" he "turned away with a sigh," for there was Agassiz's *Opus Magnum,* his mature interpretation of living nature, the famous "Essay on Classification." And as to the despised bit of mesoblastic layer of one of the eggs, it had not, after all, been buried in this laminated coral reef, as Sharp calls the heavy old volumes, but it had been rescued long before and formally presented by Agassiz himself to the élite of Boston at one of the Lowell Lectures, and then gallantly escorted into the *Atlantic Monthly,*[2] a veritable Cinderella, to live happily in the palace among the little princes of literature ever after.

Professor Jenks[3] came to Brown in 1871, at the invitation of President Alexis Caswell, one of the founders of this National Academy, commissioned to establish immediately a museum through which to teach Agassiz's bio-theological doctrines. Evidently the ground was well prepared for him, for the student magazine, *The Brunonian,* of April, 1870, had said: "A cabinet of comparative anatomy is essential to any college. . . . Every plant and animal is an expressed thought of God and can not be presented through the medium of a professor!" As the Brown historian, Professor Bronson, observes, "those thoughts of God for whom professors are no substitute were soon to be supplied." Within a year several thousands of specimens of notable variety were acquired through Jenks's initiative.

In 1876, by invitation, Jenks prepared the well-known text-book "Fourteen Weeks in Zoology" in Steele's Scientific Series of text-books on the natural sciences. In this he found occasion to promulgate widely the views of his mentor, Louis Agassiz, relative to the theory of design, the subservience of all creation to man, and the explanation of morphological resemblances. In one of the revisions of this book Jenks employed an assistant who had become tainted with evolutionary ideas by Professor Packard, then at Brown. He particularly cautioned the assistant to retain the statement of what the hippopotamus was designed for: "It is exactly fitted to dredge the rivers and keep open the channels, so apt to become filled with the luxuriant growth of that tropical region"—Africa. Whereupon the reluctant and impertinent Bumpus countered the injunction with the query, "Shall I then say the beaver was exactly fitted to dam up the rivers of North America?" Of the position of man and of morphological resemblances the text said: "Man—the lord of the Animal Kingdom—is constructed after the same type as the cat which purrs at his feet, the ox which he eats, the horse which bears his burden, the bird which sings in his gilded cage, the snake which crawls hissing across his pathway, the toad which hides in his garden, and the fish which swims in his aquarium. All are modifications of one creative thought, showing how the Almighty Worker delights in repeating the same chord, with infinite variations."

It is, I think, significant of the long-continuing hold of Agassiz's doctrines upon the laity that, as late as 1889, the Chautauqua Assembly adopted this text-book by Jenks and took over for distribution 30,000 copies of it. The paragraph about the hippopotamus, alas, was emasculated, but the one about "Man—the lord of the Animal Kingdom" passed through the ordeal unscathed.

Because Jenks was here, the ontogeny of biological work at Brown the better epitomizes the progress of biological thought in the country generally. Agassiz made an epoch. Jenks represented this epoch at Brown.

Alpheus Spring Packard, a student of Louis Agassiz, came to Brown in 1878. He was to the academic manner born, his father, a distinguished professor of Latin and Greek at Bowdoin, his mother, the daughter of the president of the college.

He was a typical boy naturalist, that lovable combination of grave maturity of purpose and natural boyishness. In his diary at the age of sixteen he records his decent pleasure in discovering for himself

[2] 1862.

[3] John Whipple Potter Jenks, Curator of the Museum of Natural History from 1871, professor of agricultural zoology from 1875 to 1894.

and reading the lives of Cuvier and Lamarck and, in almost the next entry, really lets himself go: "February 5, 1855. I have read a good deal to-day in my Naturalists' Library. Oh, that I could wander around the earth to collect specimens of Natural History! It seems to me that if I could know all about botany, mineralogy, geology and conchology, and knew how to stuff animals and birds, and to preserve insects and keep shells, that nothing could be more pleasant, provided that I had the *finances*." In good time, as we know, his heart's desire was to be satisfied. He traveled widely, was a prolific writer, was honored at home and abroad, was elected to this academy at the age of thirty-three on nomination of Louis Agassiz, and was elected as foreign member of the Entomological and Linnean Societies of London—and, he had "the finances." He was, however, at heart a boy naturalist to the end of his days.

As junior colleague, I was privileged to know Packard at Brown for nearly ten years. In my recollection he spent little time on the campus and in the laboratory except at lecture periods. He evidently prepared some 300 of his 579 printed works mostly at his home on Angell Street. Visits to his home were a continual revelation. Book shelves in every room groaning under the weight of scientific books and journals, sideboards, cabinets and bureau drawers all over the house, hospitably entertaining thousands of his precious insects, all testified to the admiring, affectionate and long-suffering devotion of his wife and daughters.

The Packard régime overlapped that of Jenks, but there was no genetic relation between them. They were distinctly different in their conceptions of what biology was all about and in their ideas of scholarship and of teaching. Packard and Jenks were on friendly terms and took long trips together, but in academic matters each went his separate way.

What I might call the Recent or Cenozoic Era in the history of biology at Brown had, likewise, little if any genetic relation to the régime of either Jenks or Packard, although it overlapped them both—one by four years, the other by fourteen. The new era dawned suddenly in 1890 and at once took on a clearly defined character which has not changed essentially in these forty-nine years. This character was determined by a curious combination or concatenation of events which would seem in the recital of them to have no connection, but which, altogether, conduced to this one end. I refer to the founding, in 1888, of Clark University, the founding of the Marine Biological Laboratory at Woods Hole in 1888, and to the advent of E. Benjamin Andrews as president of Brown in 1889.

To be more explicit, as the first president of Clark University, Dr. G. Stanley Hall had, of course, brought to Clark from the Johns Hopkins the ideals of scientific scholarship for which that institution was so well known, and he had assembled at Clark a notable group of leading scholars in biology as well as in the other sciences—Whitman, Donaldson, Mall, Baur,[4] Watase, McMurrich, Wheeler, Jordan, Lillie and others. The Marine Biological Laboratory, as you know, was the spiritual descendant and legatee of the laboratories at Penikese and at Annisquam and, from its start, was the Mecca of American biologists. At Clark and at the Marine Biological Laboratory, there was represented the best scholarship of America and Europe in the field of biology and, at both, the informal and close association of professors and students, young and old, in the laboratories day in and day out, was a feature of vast importance. President Andrews, in his first annual address to the corporation in June, 1890, had already declared his aggressive educational policy and had begun to put it into effect, namely, the positive encouragement of learning by what later the ritual of Sigma Xi was to call "companionship in zealous research," and the definite and formal establishment of graduate work at Brown for its favorable effect upon the undergraduate teaching and upon the intellectual atmosphere of the campus. He said: "Nothing in the world would so inspire our undergraduates . . . as the presence upon these grounds of a few score of graduate students pursuing and discussing their advanced studies and conducting special researches in our library and laboratories, and nothing else could so spur our faculty to that enterprise which is imperative, as to have to direct and examine investigations in these higher fields."

In the autumn of 1890, Dr. H. C. Bumpus, a Brown graduate, was summoned from Clark and the Marine Biological Laboratory where he had been since these two institutions opened their doors. He was specifically commissioned by Andrews to put these declared policies into effect as far as biology was concerned. By virtue of his baptism by immersion (orthodox at Brown) in the atmosphere of Clark and the Marine Biological Laboratory, Bumpus was "exactly fitted" to carry out this commission.

When he arrived, at the beginning of the college year, he brought with him from Woods Hole one graduate student, a green youth from the Green Mountain State—a sort of nest egg, whose presence was a faintly perceptible adumbration of coming events in graduate work. As capital to work with he had inexhaustible energy, unsinkable optimism and the hearty endorsement of the president. He needed to have laboratory space, equipment and apparatus, books, current and back issues of biological periodicals and financial support to help hold together, temporarily, the bodies and souls of a few prospective graduate students. These things the university, through its president, would fain have provided, but could not.

[4] Paleontology.

However, it never occurred to Bumpus to be sorry for himself. He had in Necessity, the fertile mother of Invention, a strong ally. She fairly spawned inventions and devices for overcoming the difficulties and making good the deficiencies. In a short few years a department of biological work, such as Andrews had envisioned, was realized and was functioning.

What this triumvirate—Andrews, Bumpus and Necessity—was able to get done in the first ten years, the episodes, escapades and personalities involved, would strain the capacity of a semester course to relate. I call them a triumvirate, aware of the abundant evidence that "necessity" is feminine. They needed space in a building already crowded. Some was acquired by the dubious right of eminent domain; much of it was created. If creation of space seems incredible, your physicist colleague, Dr. Frederick Keyes, will substantiate the claim, for, some years later, in a part of this "created" space in Rhode Island Hall, Keyes, having temporarily turned biologist for diplomatic reasons, set up his anastomosing labyrinth of glass tubing and began some initial experiments. And it is because, elsewhere, he followed up the matter so carefully that now he's a member of the academy.

A very creditable library of biological books and journals was soon assembled which, each summer, was taken to Woods Hole, along with the whole department staff and graduate students, and there for several years constituted practically the library of the Marine Biological Laboratory. In the quest for moral and financial support a visiting committee consisting of physicians and friends was invented—long before it was imitated elsewhere—which, through the years, contributed several hundred thousands of dollars to the support of biological work.

The scope of the department was extended as general physiology, bio-chemistry and bacteriology pressed for recognition. Tower and Gorham, the young instructors who had built the elementary "cat course," were picked for these purposes. Ralph Tower was sent abroad to study modern physiology and, returning, to establish it in the department. Frederick P. Gorham, after submitting a thesis on the development of the egg of the shrimp—perhaps not because of it—was metamorphosed into the bacteriologist of the family. This was not so irregular as might appear, for at practically the same time, E. O. Jordan, afterward the veteran chief of bacteriology at the University of Chicago and a member of your academy, was submitting his doctor's thesis on the development of the egg of a salamander. Bacteriology was only in about the "two-cell stage" of development in those days. It developed here rapidly and soon the cooperation between the university and the city through Gorham and the Superintendent of Health, Dr. Charles V. Chapin, was perfected. Each supplemented the other and their accomplishments are of immeasurable value not only to the city and the state but to the science and the art of public health everywhere. Dr. Chapin, for many years professor of physiology at Brown, is, happily, a prophet not without honor *even* in his own country, the hospital which bears the imprint of his genius also bears his name, the Charles V. Chapin Hospital. This recalls a brilliant suggestion by a student which is recorded in Dr. Walter's "Anthology of Student Responses," "The City hospital treats contagious and genealogical diseases"—a suggestion of singular appropriateness in this old and aristocratic community.

The establishment by the "Triumvirate" of the houseboat floating laboratory on Narragansett Bay in cooperation with the state, the establishment of the pathological laboratory at the Rhode Island Hospital, the restitution of scientific work, which Baird had first established, at the United States Fish Commission at Woods Hole, the setting up in the biological laboratory at Brown of the first x-ray machine in the state, and its pioneer employment in morphological research, and the subsequent installation of the first x-ray equipment at the Rhode Island Hospital, we must pass over. Many other enterprises, full of incident and personality, can not even be read by title.

Andrews and Bumpus came in with the decade and went out with the decade, the one to Chicago, the other to New York. Necessity stayed. The biological establishment continued and still continues to develop and grow and mature, although the personnel and the biological fashions change.

As I have been thinking on these things I have wondered how far the story of biological work at Brown is typical of that in other American colleges. I have wondered also whether, in these days of sophistication and relatively luxurious equipment, episodes and personalities do, or will ever again, play anything like the role which they played in the pioneer period from 1870 to 1900. The biologists in your academy, of course, could answer both these questions far better than I can. I suppose that the experience at Brown is fairly typical of that in such colleges of the eastern section of the country as were going concerns seventy years ago.

Be that as it may, Brown early felt the full impact of Agassiz's powerful personality and teachings. In Packard, Brown fortunately had a member of that extraordinary group of men, including Morse, Hyatt, Putnam and Verrill, who, having studied with Agassiz, broke away from him and became acknowledged leaders in evolutionary interpretation of biology. In retrospect it is clear also that, in the coming of Bumpus, Brown was involved immediately in that network of

circumstances, or perhaps coincidences, that seemed to just happen in 1888–89 and centered in the opening of Clark University and the Marine Biological Laboratory at Woods Hole. Through the personnel of these institutions directly, and through the Johns Hopkins University indirectly, Brown was in close touch with European biological ideas, especially German. Ideals of the German scholarship of that time were then grafted upon those of an old American college of English descent and this new thing was grown in an atmosphere of academic democracy engendered by the great emphasis upon life in the laboratory.

I have mentioned only those persons who have gone from us forever, or who, like myself, are academically extinct. I have talked only of the biological work at Brown in its formative stages; the post-larval development is another chapter. In its personnel and its increasingly effective work under the unwritten constitution of 1889–90, we old-timers all take parental satisfaction.

FUNCTIONS OF THE PRECLINICAL SCIENCES IN MEDICAL EDUCATION[1]

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WITH war raging in Europe, there is a tendency for all of us to feel an oppressive sense of futility in taking up our academic duties. College presidents and deans the country over have in their addresses before faculties and students been trying to counteract this tendency. But events that represented a potential threat to our existence can not easily be banished from our minds. Whether or not we become directly involved in the conflict, there is, as Park Commissioner Robert Moses[2] recently stated in an address before Union College students, "a mental and spiritual cost of war, as irremediable as other costs." Further, that "Unless we strongly will it otherwise, an oppressive cloud blacks out every non-military usefulness" of our minds. With such distractions, it is all the more important to do what we should always do, namely, pause now and again to clarify our aims and try to find out if our efforts are directed effectively in achieving the ends we desire. This morning it is my privilege to discuss some of the functions of the preclinical sciences in medical education.

The general purpose of a medical school is to train physicians and surgeons. Because this training is constantly undergoing changes resulting from advances made in experimental medicine and its allied sciences, the student must realize at the start that his task is to obtain a foundation which will not crumble under these advances. He must develop the capacity to alter his concepts according to new facts, and establish the habit of assimilating these facts in such a way that they will increase his confidence in his own resources even as he finds some of his earlier training misconceived. Much of what he will learn rests upon insecure experimental evidence—is indeed empirical. Other phases of his work will be well founded. He must learn to distinguish between the two. This he can do only by drawing his own conclusions from what he regards, after careful consideration, to be well-established facts. Such a scientific attitude, acquired early and practiced throughout his course, is the student's most valuable weapon for his medical training.

A large part of the medical course is devoted to scientific studies in which the student has no direct contact with the patient. These studies are designed to give a thorough understanding of the normal structure and function of the human body. For this purpose medical schools support large faculties and expensive laboratories, both for teaching and for research. It is apparent that such establishments would not be required if their services to the schools consisted only in imparting to students a measure of factual information. This could be accomplished by lectures, supplemented by text-books and demonstrations—a method generally employed not so many years ago.

The emphasis on research in preclinical departments is often a subject of speculation if not outright criticism by those who do not fully understand the relation of these sciences to experimental medicine and to the intent of medical faculties in training students. I must remind you that the ultimate goal of medicine is to gain mastery over living processes, in order that these processes may be directed to the welfare of the patient. If therapy is to emerge completely from the realm of the empirical to that of rational scientific procedure, it will do so only when all the factors that govern the normal structure and function of the body are understood. Such understanding is, of course, the ultimate goal of investigators in the preclinical sciences. It is hardly surprising, therefore, that they should be supported and encouraged with as much vigor as those who study abnormal structure and function.

[1] Delivered at the opening exercises, College of Physicians and Surgeons, Columbia University, September 27, 1939.

[2] Quoted from an editorial in *The New York Times*, Sunday, September 24, 1939.