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ABSTRACT

Little attention has been paid to the topic of science education in liberal arts colleges and seminaries during the 3 decades following the Civil War. This paper argues that Mount Holyoke College (Massachusetts) made a place for itself in the scientific community in the last decades of the nineteenth century by developing a curriculum which accommodated the school's commitment to science education with the opportunities opening for women in newly professionalized jobs, such as teaching, medicine, and research. The first section of this paper describes the changes in the structure and content of the science curriculum of the seminary from about 1868. The second part presents a brief intellectual biography of Cornelia Clapp to suggest something of the changes in the attitudes and consciousness of faculty engaged in the transformation of the curriculum. A final section provides information about the careers of graduates and suggests some further inquiries. (YP)

# The Transformation of Science Education at Mount Holyoke in the Gilded Age



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Paper presented at the Joint Meetings of the American Historical Association and the History of Science Society (December 28, 1988).

# THE TRANSFORMATION OF SCIENCE EDUCATION AT MOUNT HOLYOKE IN THE GILDED AGE

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## INTRODUCTION

Until recently, studies of the history of science education in the United States during the three decades following the Civil War have focused on the development of research universities and of graduate education in science.(1) They provide much insight into the impetus that fostered specialization and professionalization of scientific endeavors, including the important role which exposure to german research methods and new monies from industrialists and state and federal governments played in the growth of these institutions. Large-scale institutional commitment to research activity at newly founded private universities such as The Johns Hopkins University, the University of Chicago, and Stanford; reorganized and expanded colleges such as Yale, Columbia, and Harvard; and public institutions such as the University of Michigan and landgrant colleges, benefited from and encouraged a belief in the value of science as central to national well-being and prestige, and a special means of access to truth unhindered by the religious sectarianism which marked the older evangelical colleges and seminaries.(2) These universities were to be training grounds for the technical personnel needed to staff growing industry in this country, and the private and public research institutes and the university system itself. (3) Women were peripheral figures in their development. however, and in the post-war decades, a period when the purpose of higher education for women and the place of women within the scientific community were being defined, women often came to hold subordinate positions, often doing tedious work at lower pay. Their only opportunities for teaching positions, particularly for single women, lay in the women's colleges.

The research universities did not, however, replace the liberal arts colleges and seminaries, many of which were founded well before the Civil War, and came to serve the emerging scientific community in a variety of ways. (4) Yet, surprisingly little attention has been paid to the topic of science education in liberal arts colleges

and seminaries during this period.(5) They had been the primary institutions of higher education for men and women before the Civil War, and it was in them that many American scientists and science teachers, both men and women, have received their primary education in science. By including science courses as part of their general curriculum, they helped to popularize science and create an educated audience of supporters for it. Faculty also introduced laboratory work into their courses, and often did research. In the twentieth century the colleges have stood in the academic hierarchy between the highschool and the university as a major recruiter of talented youth and source of graduate students for university science programs, and ultimately of American scientists and science teachers. Women's colleges and the seminaries which preceded them, in fact, often gave more emphasis to science than many male and co-educational colleges, and have been as successful and in some cases even more so than their counterparts in training individuals who went on to receive graduate degrees in science. (6)

The transformation in the status and function of the colleges within the American scientific community required structural changes within these institutions as well as radical shifts in the curriculum and even in the way faculty and administration thought about science and taught it. The history of these institutions during this transitional period in higher education is especially important for it provides a missing link as it were in the evolution of these American institutions.

Mount Holyoke College is a particularly good institution to study during this transitional period in order to understand how the liberal arts colleges made a place for themselves and for women within the emerging scientific community. It is exemplary for several reasons: Unlike the other women's colleges--which were founded after the Civil War, Mount Holyoke was established in 1837 as a seminary with a strong commitment, often stronger than the classically oriented male colleges, to science and science education as an integral part of a curriculum designed to educate women to be teachers and missionaries, to complement the role of men within the context of a Christian life of service. Moreover, there was always, even after it was chartered as a college in 1887, a commitment to the idea that women were the intellectual equals of men. The college, therefore, has much that it shares and that differentiates it from male colleges of the period.(7)

Mount Holyoke is also significant because it successfully made the transition to the status of a college that trained women for specialized teaching or for professional schools, within the context of a liberal, Christian education. In the twentieth century Mount Holyoke produced more students who went on to get

advanced degrees in science than any other college or university, a figure which suggests that the school provides a good model for characterizing and tracing the development of the liberal arts college science education and establishing how these institutions came to serve as intermediaries between the high schools and the universities and professional schools.(8) As a woman's college, Mount Holyoke also offers the opportunity to raise the question: to what degree did the relative success of the school in training scientists who practiced their profession in positions other than university research professor suggest that the college itself helped to define roles for women in the scientific community that complemented those of male scientists.

THE DEVELOPMENT OF SCIENCE CURRICULUM AT MOUNT HOLYOKE

This paper will argue that Mount Holyoke made a place for itself in the scientific community in the last decades of the nineteenth century by developing a curriculum which accommodated the school's longstanding commitment to science education with the opportunities opening for women in newly professionalized jobs such as teaching, medicine and research. This accommodation between the old and the new was in part due to faculty and administrators' participation in new scientific organizations and research institutes after the war, as well as exposure to ideas about evolution, and the pressure of difficult economic circumstances and competition from the new women's colleges. These circumstances seem to have stirred enormous enthusiasm for science, a new self-consciousness about the significance of being educated women, at the same time that habits of depending on male scientists for advice and guidance and a tradition of educating women for socially useful lives after college, particularly as teachers, set different criteria and goals for science education at the undergraduate level.

The record to support this argument lies in the papers which document the activity of the science teachers. They include Trustee's and President's Reports, college catalogues, some alumnae files containing letters, class notes and some class exercises, and faculty and department files, as well as journal letters written by teachers at the school and sent out to graduates as a means of keeping them in contact with their alma mater and classmates. Other materials were gathered from the Woods Hole Marine Biology Laboratory archives, and from Amherst College. It is unfortunate that virtually none of the surviving official reports record the content of discussions that went on about policy. Moreover, as correspondents, the graduates and faculty were remarkably reticent. In so far as they expressed opinions about events at the school or feelings about one another, their comments are quite

cryptic. They also were not given to writing memoirs and keeping diaries as a general habit of writing. Cornelia Clapp (1849-1933), a professor of biology at the seminary and college during these years, and one of the more outspoken figures in its history, explained her classmates reticence in an interview by her former student, Ann Haven Morgan in 1921, when Morgan was on the Zoology Department faculty. (9) Clapp also appreciated the difficulties of trying to gain direct access to Mount Holyoke's past through the reflective writings of the participants: "'Nowadays we can have no idea what those teachers did.' Their very personalities made it impossible that they should every be known. 'They were willing to do to the last degree but not to talk.'" (sic) (10)

Such reticence not only makes it challenging to study the character of the transformation which occurred in science education at Mount Holyoke, but it also provides an insight into and partial explanation for the small number of publications produced by faculty and graduates. The school's emphasis on an active life of service marked the direction of their careers and working lives within and outside academe in ways that made for a different sort of contribution to the development of the scientific community, a point which will be discussed at the end of the paper.

The first part of this paper sketches in changes in the structure and content of the science curriculum of the seminary from about 1868, when the natural history collection was started. The second part of this paper presents a brief intellectual biography of Cornelia Clapp to suggest something of changes in the attitudes and even consciousness of faculty who were actively engaged in the transformation of the curriculum. A short final section, provides some information about the careers of graduates and points to some further lines of inquiry which our finding suggest it would be fruitful to pursue.

In 1868 the curriculum at Mount Holyoke seminary was much as it had been before the civil war, and science was an integral part of a curriculum shaped and defined by evangelical religious beliefs. It was as Mary Lyon had written in her prospectus, "The grand features of this institution are to be an elevated standard of science, literature, and refinement---all to be guided and modified by the spirit of the gospel." (11)

The four year course of study at the seminary, which was followed by all the students, included three science and math courses each year, save the last, which was primarily devoted to the course of moral philosophy, intended to provide an overarching theological framework for the previous year's studies. The science courses included botany, physiology, the philosophy of natural history, physics,

astronomy, and geology. Save for botany and chemistry, students were taught in classrooms, where they answered set questions drawn from a single text and posed by the teacher. There were a number of courses whose titles suggest the way in which science was understood as rooted in theistic principles, serving to establish and make vivid certain analogies between the order of the world seen and the realm of the divinity. These texts included Butler's Analogy of Religion, Natural and Revealed to the Constitution and Course of Nature; Chadborne's Natural Theology. Science was also conceived as a methodical and reasoned system for ordering and disciplining all facets of human life, including moral action and practical tasks such as analyzing chemical substances and collecting and arranging plant specimens gather on walks near the school grounds. (14) Save for botanizing and the making of herbaria, science education emphasized memorization, cataloging, rather than theorizing or writing on scientific subjects. The educational program of the seminary in 1868 was fixed into a four year course which all students followed. It was as unified and fixed in content and purpose as the natural world which students were taught to accept as a reflection of the divine order.

In the decades following the Civil War Mount Holyoke science education changed in ways that parallel developments in the universities, where distinctions were being drawn in the formulation of undergraduate and graduate curricula. It was a time marked by rapid growth in the science program, which took place in three stages. The first, from 1865-1873 was marked by introduction of electives and changes in textbooks. The second, from 1873 to 1887 spans the years from the introduction of laboratory work conducted by faculty in special departments to the certification of Mount Holyoke as a college with the power to award the B.A. and the B.S. degree. The third period from 1887 to 1900 saw the establishment of general requirements for all students, with provisions for concentrating in special areas of science and for preparation for science teaching, and at the very end of the period for research and graduate education. Over the course of thirty-odd years, efforts to accommodate to a more secularly-oriented society, altered the relationship between science and religion in the curriculum and helped gain acceptance for new theories of evolution. To some degree these three shifts in the course content and curriculum are significant simply because they provide new details about which explanations for change were adopted at the introductory level, and how explanations for changes in natural record were integrated into the course of study and accommodated in a school which remained an evangelical seminary, at least in name, until 1887.(12)

The status and salary of science faculty rose in these years primarily in recognition of the advanced degrees they had earned at the University of Chicago and in German universities. (13) In addition, faculty developed new associations with male and female scientists at other colleges, including Princeton, Dartmouth, Williams, Harvard, and M.I.T., Wellesley, and Bryn Mawr; and at research institutes, especially the Marine Biological Laboratory at Woods Hole and the Naples Zoological Station in Italy. Individuals from these institutions, among them James Dwight Dana and E. O. Wilson, lectured on a variety of scientific topics, including Darwinian evolution, at Mount Holyoke and advised the science faculty and trustees about the science program. Mount Holyoke faculty visited the labs of their colleagues in these schools, and took advanced work during semester leaves absence and summer vacations. In addition, outside specialists presented evening lectures and annual courses of lectures. These male scientists included the geologist Charles Hitchcock, whose father had been instrumental in founding Mount Holyoke, and the astronomer Charles Young, both of whom would became trustees and taught at the school for almost thirty years.

New buildings were erected, designed with special facilities and equipment for each department. The seminary even had a small-scale industrialist as one of its major benefactors: A. Lyman Williston of East Hampton, a manufacturers whose largess helped finance the Arts and Science s building and the new observatory. The growth of the campus and improvements in the physical plant during the Gilded age testified to the extent of Mount Holyoke's commitment to science education as part of its desire to embrace the industrial age and appear modern. In 1868, the seminary had one main building with a wing housing the entire library. By 1900, it was a campus with nine buildings, four of them devoted solely or primarily to science. There was electricity, running water, steam heat and an elevator. Each science department had its own library with collections of books and scientific periodicals for each special field. The beginnings of a departmental structure appeared in which faculty were distinguished by their scientific disciplines in the catalogue. Special areas of study included botany, zoology, geology, chemistry, astronomy, and physics, and a number of courses were offered within each category. (14)

The design and content of science courses changed in these years, however, in ways that differed from graduate programs in science, but proved to compliment them. Emphasis was placed on the acquisition of basic information and training in laboratory techniques in each of the basic fields of study. In 1868 there was little or

no lab work; but by 1900 just the opposite was true. Lab work sat at the heart of most courses, and its predominance was made possible in part through the installation of an aquarium and a botanical garden, and gifts to the natural history collections from alumnae and their husbands, often at foreign missions. These gifts included 1000 minerals donated in 1870; collections of ferns from India and China, shells, and stuffed birds. Faculty, including Cornlelia Clapp identified and arranged these objects in special cabinets built for the purpose, and displayed in Williston Hall where students had access to them for class assignments. Clapp in fact used the collections at Harvard's museum as a resource.

The school purchased new equipment for use in the science courses, including thirty-six microscopes, twelve of them Zeiss according to the catalogue, and a new telescope for the observatory. From the detailed description of this equipment and the number of illustrations devoted to the laboratories and to the new science buildings in college and seminary catalogues during these years, this material wealth was intended to signify that the school was modern, up to date, progressive, and serious. Prof. Young made these points in an article he wrote on new observatories in the United States for the Smithsonian Reports in 1881.

The shift in science education was much more dramatic and far reaching than simply adding equipment and architectural structures, and changing course content. In these first years after the war, although evangelical Christianity maintained its place at the head of the curriculum and in the daily activities of the school, the character of that divine order, and that of the divinity, began to be open to some interpretation. As of 1865, for example, Asa Gray's botany text was used instead of Wood's. This text offered students a system for identifying and arranging specimens based on Darwinian ideas about the evolution of species, patterns of development, and the inheritance of certain physical characteristics. In moral theology, a new text introduced in the early 1880's presented an accommodation between evolution and theology, marking a shift in the focus of moral education towards accepting patterns of change as part of the order of things.

1868 also marked the beginning of shifts in the goals of the school from that of educating women to be teachers and missionaries on the American frontier and in foreign lands to a curriculum by 1889 aimed at providing a "solid and balanced education in fundamental principles, while encouraging and providing facilities for further study," explicitly defined as a balance between a course of general knowledge and specialized study in preparation for work as teachers in city schools or for medical school entrance requirements. (15) There were further reforms about

this time in keeping with the restructuring of the seminary and curriculum reforms that attended the transformation of the seminary into a college. By 1900 Mount Holyoke catalogues listed two lines of professional development from which women majoring in science could choose: teaching or preparation for advanced research.

The personal engagement once expected of students in their religious devotion, now in the early 1870's began to find its way in a different form into the science courses. Major changes in the curriculum also included an increasing amount of personal and immediate engagement of students with the natural world, extending the tradition of botanizing into the other sciences. Students in the vertebrate biology class dissected a cat and used chickens and fertilized eggs for embryology experiments. In Geology, students also studied casts of dinosaur bones and footprints, some of them taken from the surrounding mountains.

To a great extent, science teaching made new use of the world the students' knew. The cat which Cornelia Clapp dissected in 1873 was simply caught near the house and chloroformed on the porch of the main building. The chickens used in the embryology experiment came from a broody hen rented from a local farmer. Geology courses included the study of fossil remains in nearby mountains. At the same time, the natural history collections which included the familiar and the exotic, provided a sense of the variety and complexity of the natural world. Even more important, students were engaged in doing experiments themselves, as well as in observing demonstrations performed by teachers. They thus gained a knowledge of basic scientific techniques and experimental procedures, along with an understanding of the physical properties and internal structures of organisms.

The manner in which the information was organized and presented also changed, so that emphasis was placed on learning to order facts in accordance with patterns of change, either in terms of stages of development--as was the case with the chickens, or in terms of geological time, or chemical processes. We have some detailed idea of what students studied in some of these courses from the notes of Eliza Miner, class of 1873, who later became a trustee. Eliza's class notes from 1873 are quite rich in detail. In chemistry she noted that the sun was a source of chemical activity; she learned how to measure the specific gravity of water. Her notes include a list of topics covered or information to be learned. They read: " describe process of chrystalization, state properties of ice, method of ascertaining the composition of water, disinfecting and decolorizing power of charcoal." In Botany she studied "how to distinguish animals from plants, the structure of vegetable embryos, the eight directions in which parts increase." In Geology, she identified minerals, studied the

structure of the earth, the development of rocks, and considered briefly the possibility of external causes for changes in the fossil record. She studied "the trilobites and modern creatures which resemble it." It is not clear from her notes whether the theory of natural selection was even mentioned in any of her courses at this time. The only reference to theories of creation or mechanisms of change was a brief one citing the catastrophe theory as an explanation for discontinuities in the fossil record.(16)

It is surprising, and equally important in terms of training students in science to find that relatively little attention was paid to theory or methodology, and much more to the systematic gathering, description, and organization of empirical information in all the courses save for the biological sciences. Rather than speculative questioning and testing of hypothesis, it seems that students may have used modified theories of evolution as a source of a new vision of natural ordering. A student essay written in 1872 titled "The Chemistry of a Sunbeam," suggests that it was possible for students to conceive of natural processes, like fixed patterns, in terms of analogies with the actions of a divine power. The essayist is more intrigued with the metaphorical possibilities offered by this relationship than with questions of analysis or physical mechanisms--or perhaps they were encouraged to be so in their rhetoric classes. After speculating on what would happen if the sun were withdrawn--"man would be bereft of his most valuable servants, and the magnetic telegraph would no longer be a possibility,", she finds a synthesis in the image of flowers that look upward to the sun of the world, so all our hearts may expand to the influence of the "sun of righteousness." While it is not clear whether such assignments were common practice at the school, this essay provides some idea of the manner in which many students were taught to conceive of natural processes. (17)

Only in Zoology courses after 1888, does it seem that students received serious instruction in Darwinian ideas and scientific methodology. We have no papers or lab reports, however, to provide more substantive information here, and are relying on fairly detailed descriptions of course content published in the catalogues, as well as descriptions of the activities of the Biology Club. Yet the prominence of Zoology in the science curriculum and the open way in which the texts of Huxley and Darwin are cited as core readings, as well as the activities of the Journal Club established for students to discuss current scientific research, suggest that this subject with its radical approach to the material world came to hold an important and accepted place within the curriculum by the turn of the century. There was a Biology Club

where students and faculty read scientific journals and discussed their work. Moreover, beginning in the mid-1890's the zoology program offered possibilities for a select number of students to do additional work in the summer at the MBL. By century's end, faculty and students could apply to pursue research opportunities at the post graduate level at the Naples Zoological Station in Italy. (18) They could prepare for one of three career paths: teaching in primary or secondary schools, medicine, or graduate training leading to college teaching and/or research.

The shape and content of the zoology curriculum seem to have been the product of Cornelia Clapp's efforts and interests, and I would suggest that she provides a good example of how the curriculum itself is the text that best documents the activities and values of Mount Holyoke teachers, their conflicts and beliefs about science and religion. The manner in which she taught and the courses she developed reflect her experiences at the Penekese Island school in the summer of 1874 where she first did collecting and laboratory work under the guidance of experienced zoologists. While evangelical religion set a pattern into which the individual fit experience, the great intellectual awakening which she experienced then seems to have opened her mind to a host of new possibilities and stimulated new interests and more speculative approaches to the study of the natural world. "I didn't know how to teach before Penekese," "I hadn't heard any one talk theory before then," she told Morgan. "I was like a young boy, trying first this thing and then that." (20) When the Marine Biological Laboratory opened at Woods Hole in 1888, she was one of the first instructors. There she worked with major American biologists and also with secondary school teachers and naturalists in an organization that was engaged in sorting out distinctions between professional researchers, college teachers, and amateurs. (21)

Clapp brought back from the MBL teaching and research methods she learned there and at the University of Chicago--where she received her doctorate in 1897, to her Mount Holyoke classroom, developing a course in cell biology, for example. Her own work focused on mechanisms of development and morphological studies. At the same time, she drew on her training and convictions about the necessity of good libraries for scientists to insist that the MBL establish and maintain its own library and subscriptions to the important scientific journals. (22)

CONCLUSION

Frederick Rudolph describes the curriculum as a reflection of society and its values. In the case of Mount Holyoke, the curriculum with its increasingly fragmented character might signify the changing community on the campus itself as

students and faculty separated into different departments and lived in smaller groupings, and took differing views on the way the world worked. (23) It can stand as well for the increasingly specialized character of the scientific world in which scientists moved within the spheres of their own particular disciplines. What they had in common at century's end was the conviction that change was a integral part of the natural world as well as their own. If there were an overarching idea presented to students in the Zoology course, providing them with a coherent view akin in some ways to that once offered in the traditional course in moral theology, it was the view that an analogy existed between the natural, the social, and the professional worlds in which Clapp and other scientists worked. It was a view which Clapp had imbibed at the MBL: Specialization is the rule of the natural, as well as the scientific and the social world. (24)

This view of the world as a congeries of complementary sub-worlds, of interdependent communities of plants, animals and human beings is in some ways appropriate for describing the place which Mount Holyoke came to hold within the scientific community at the turn of the century. Its curriculum provided the knowledge and training necessary for students to qualify for entrance into the professional or graduate schools that had emerged, or to enter directly into public life as teachers. The results of our survey of alumnae files confirm that the college was successful in producing almost seventy graduate from these years who followed one of these career paths. There is not time to recount the variety of jobs the graduates held; but by and large they were those professions that came to be designated as appropriate work for women in science--science teachers, nurses, public health officials, doctors, professors and administrators in women's colleges. Given that these positions were often modest if not subordinate ones, from the perspective of Mount Holyoke's mission, these women were successful, and moreover they were able, as were their teachers at the college, to make a contribution to the scientific community in ways that are difficult to measure.

It is hoped that we will be able to gather some comparative material on the graduates of other single-sex colleges, male and co-educational, in order to see what type and level of position they held after graduation and whether they followed the model established by Mount Holyoke. In this way, we may be able to assess to what degree the expectations and traditions of Mount Holyoke set feasible but short-sighted and ultimately frustrating goals for women in science.

NOTES FOR "THE TRANSFORMATION OF SCIENCE EDUCATION AT MOUNT HOLYOKE IN THE GILDED AGE"

1. Hugh Hawkins, "Introduction," The Emerging University and Industrial America (Lexington: 1970). Lawrence Veysey, The Emergence of the American University (Chicago:U. of Chicago, 1965). Frederick Rudolph,, The American College and University, A History (New York: 1962). Konrad Jarush, ed., The Transformation of Higher Learning: 1860-1930 (Chicago:U. of Chicago, 1979). Also see Salley Gregory Kohlstedt, "Curiosities and Cabinets," Isis, Sept.1988: 405-426.

2.Veysey, The Emergence, 4-6. Hugh Hawkins, Pioneer, A History of the Johns Hopkins University, 1874-1889 (Ithaca:Cornell U. Press, 1960). Roger L. Geiger, To Advance Knowledge: The Growth of American Research Universities, 1900-1940 (New York: 1986).

3. Jane Maienschein, "Agassiz, Hyatt, Whitman, and the Birth of the Marine Biological Laboratory,"Symposium Supplement to The Biological Bulletin, 1985:168(suppl.), 29-30.

4. For the ante-bellum period, see Stanley Guralnick, Science and the Antebellum American College (Philadelphia: 1975).

5. On the women's colleges, see Helen Lefkowitz Horowitz, Alma Mater (New York: 1984). Margaret Rossiter, Women Scientists in America (Baltimore and London: 1984), chpt. 1. Kohlstedt, "Curiosities", 405-426.

6. Hall, Alfred F., "Baccalaureate Origins of Doctorate Recipients," Journal of Chemical Education," May 1985: 406-07. Mary Oates and Susan Williamson, "Women's Colleges and Women Achievers," Signs 3(1978):806. Elizabeth Tidball and Vera Kistiakowsky, "Baccalaureate Origins of American Scientists and Scholars," Science, 1976:646-52.

7. Arthur C. Cole, A Hundred Years of Mouunt Holyoke College: The Evolutin of an Educational Ideal (New Haven: 1940).

8. Tidball, "Baccalaureat Origins."

9. Folder 4, Box 1, Clapp file, Mount Holyoke College Archives.

10. Contemporary Biography," p. 6, Folder 4, Clapp file.

11. Mount Holyoke Female Seminary, 1835, p.3.

12. For a study of the long and painful transition period, see Charlotte King Shea, Mount Holyoke College: The Passing of the Old Order (Ph.D. Thesis, Cornell University, 1983). The question of the role of the science faculty or of controversies over science and religion in the transition is not discussed here.

13. See "List of Teachers with Their Salaries for 1889-90," Mount Holyoke Seminary and College Trustees Report, 1889-90, p. 265, Mount Holyoke College Archives.

14. Catalogue of Mount Holyoke Seminary, 1868-69, pp. 20-21. Also see catalogues for the Mount Holyoke Seminary and College beginning in 1888.

15. Catalogue of Mount Holyoke Seminary and College, 1889-1890, p. 25.

16. notebook of Eliza Miner.

17. Alumnae files, Mount Holyoke College Archives.

18. Catalogue of Mount Holyoke College, 1892-93, p.13. "Mount Holyoke subscribes to a private room at the Marine Biological Laboratory at Woods Hol [sic] Mass." The Catalogue of 1899-1900 amounces "Graduate Study in other Institutions," "Mount Holyoke College is a subscriber to the Woman's Table at Naples."

19. -skip

20. Folder 4, Box 1, Clapp file, College Archives.

21. Maienschein, "Symposium". Frank R. Lillie, The Woods Hold Marine Biological Laboratory (Chicago, Univ. of Chicago Press, 19 ), pp. 85-88, and also 42-49, for discussions of organizational reforms. Pamela Clapp, "Cornelia Clapp," Spiritsail, Summer 1988, pp. 8-14.

22. Cornelia Clapp, "report on the library," Marine Biological Laboratory Reports, no. 9, 1896, pp. 78-94.

23. Frederick Rudolph, Curriculum, A History of the American Undergraduate Course of Study Since 1636, (San Francisco-London, Jossey-Bass, 1981), Chapt. 1.

24. Notes on lecture by C. O. Whitman, 1888. Notebook with lecture and lab notes from Woodshole, Clapp files, Box 1, Mount Holyoke College Archives.