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Park, Hyung Wook

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**Biological Aging and Social Characteristics:
Gerontology, the Baltimore City Hospitals, and the National Institutes of Health**

Hyung Wook Park, Ph.D.
Assistant Professor
Division of General Studies
Ulsan National Institute of Science Technology
Ulsan, Republic of Korea
689-798

Email: park0717@gmail.com
Office Phone: 82-52-217-2018
Cellular Phone: 82-10-2808-3549
Fax: 82-52-217-2089

ABSTRACT. The intramural gerontological research program in the National Institutes of Health underwent a substantial growth after its creation within the precincts of the Baltimore City Hospitals in 1940. This paper analyzes its development and the associated problems of its early years. Gerontologists aimed at improving the social and economic life of the elderly through scientific research. With this aim in mind, they conducted various investigations using the indigent aged patients of the Baltimore City Hospitals. Yet the scientists of aging, who hoped to eliminate negative social factors that might bias their research and heighten the confusion between pathology and aging per se, eventually stopped using these patients in the hospital as human subjects. Instead they sought educated affluent subjects in order to eliminate the impact of poverty. By doing so, however, they introduced a new source of social bias to their work, especially within the novel project begun in 1958, the Baltimore Longitudinal Study of Aging. This article thus examines the context of the development of gerontologists' research by analyzing their agenda, institutional environment, and research subjects in the 1940s and the 1950s. **KEYWORDS:** Gerontologists, the elderly, social bias, National Institutes of Health, Baltimore City Hospitals, Baltimore Longitudinal Study of Aging.

The National Institutes of Health (NIH) played a central role in establishing gerontology, the science of aging, as a research field in the United States. The NIH's intramural research program in gerontology, which started as the Unit on Gerontology in 1940, grew considerably in personnel and budget after World War II. As a direct consequence, the National Institute on Aging (NIA) was created within the NIH in 1974, and played a major role in expanding research on senescence. The NIA is currently the world's largest government-sponsored gerontological research institute, supporting a broad range of scientific and medical projects pertaining to the phenomenon of aging.

The making of the gerontology program in the NIH cannot be properly understood without appreciating the role of the Baltimore City Hospitals (BCH), which provided NIH gerontologists with both laboratory space and "clinical material." From the beginning, the Unit on Gerontology was placed within the BCH's buildings rather than on the NIH's main campus in Bethesda. Thereafter, the research program in gerontology continuously expanded while

physically remaining within the BCH's precincts, where NIH scientists gained access to the body of elderly patients for their investigation. Under the sponsorship of the officials of the City of Baltimore and the federal government, gerontologists conducted physiological measurements and experiments on the senile process and chronic illness occurring in aged people staying in the BCH. Such clinical studies continued until the late 1950s when gerontologists began to recruit a different kind of human subject throughout the country who regularly came to the BCH for physical examination.

By tracing the growth of the gerontology program in the NIH and the changes in human subjects used in the BCH from 1940 to 1960, this paper reveals a dilemma in the efforts of NIH gerontologists. I will show that scientists of aging wished to help the elderly adapt to changing industry and society through their scientific expertise. In doing so, they hoped to acquire objective and reliable knowledge on aging devoid of any social influence. But I argue that they, as a consequence of their aim, ultimately produced knowledge that incorporated social factors during the very process of eliminating them. My claim is well illustrated by examining the reason why NIH gerontologists in the BCH changed human subjects in the late 1950s. I will point out that scientists of senescence, in attempting to define "normal" senile processes uncontaminated by social factors, replaced the BCH's indigent elderly patients with more affluent volunteers, who seemed to undergo little abnormal age change caused by non-biological influences such as poverty. Yet this decision introduced another social factor into their work. My article also discusses how gerontologists' social aims guided their biological research on cells, tissues, and organs and how these aims were connected to the making of gerontology as a field during the socio-economic context in the 1950s.

Through this discussion, I explore deeper social implications of the NIH's gerontology program. Several scholars have published historical studies of the science of aging within the NIH and its leading contributor, Nathan W. Shock (1908-1989).¹ Among them, George T. Baker and W. Andrew Achenbaum have emphasized Shock's commitment to scientific rigor and high standards in aging research as key factors in the substantial growth of gerontology in the NIH. Baker and Achenbaum have asserted that Shock tried to control the quality of gerontological research by stressing "six axioms," including "testable hypothesis," "scientifically rigorous protocols," and a clear distinction between aging and disease.² My paper will examine how these axioms were related to the objectives of Shock and his colleagues and the scientific dilemma it presented. To produce reliable gerontological knowledge that could be used to better the life of the elderly in society, these gerontologists had to depend on these axioms that might help them eliminate social factors distorting their work. However, these efforts led Shock and his associates to produce scientific knowledge that was colored by their social perceptions of race, class, and gender.

This interpretation of Shock's work coheres more closely with Tiago Moreira and Paolo Palladino's recent work on the history of biogerontology. They have claimed that the scope of gerontology is much broader than that of biomedicine which is formed according to specific disease categories. In their account, they highlighted "Shock's interest in disentangling 'pure ageing' from 'disease'" which had a wide range of implications in the political as well as clinical arena.³ In a later article, Moreira and Palladino describe an "epistemic culture" in which Shock and his colleagues traced "pure aging" unaffected by disease or economic factors, using a select group of aging people rather than a more representative population.⁴ My paper analyzes the historical development of this "epistemic culture" by focusing on American gerontology's early

period during which Shock's team made a key decision regarding the use of human subjects. In particular, I will examine the institutional, social, and organizational context of this decision that would later invite considerable criticism of the unrepresentative nature of their human subjects.

This paper also contributes to our historical understanding of the use of human subjects in scientific research. By examining the context of NIH gerontologists' change of human subjects in the late 1950s, I provide a historical analysis of how age was implicated in class, race, and gender in research using humans. Indeed, sociologist Steven Epstein has stressed that medical research using human subjects has complex political dimensions which entail ironic consequences.⁵ When the efforts to generalize the findings from dangerous experiments on blacks often led scientists to assume the human body's fundamental equality, the movement to include minorities and women in clinical trials after the 1980s led to controversies on "racial profiling" and biological reductionism in matters of ethnicity and gender. My study deepens the historical appreciation of these problems by highlighting the context of both inclusion and exclusion in gerontological research. Why did gerontologists eventually cease to rely on indigent elderly patients who had been involuntarily included in aging research? Why did the scientists come to use middle-class white men, while excluding women, paupers, and minorities against their will? My article will address these questions by concentrating on the years of NIH gerontology program's most active growth within the grounds of the Baltimore City Hospitals.

The Baltimore City Hospitals, the National Institutes of Health, and the Science of Aging

As a public institution, the Baltimore City Hospitals had a long tradition of caring for the sick and the poor within the town.⁶ It originated from the Baltimore County Almshouse

established in 1773 through the appropriation of £4,000 under the Poor Law of England. Like other almshouses in Britain and colonial America at that time, the institution at Baltimore had two objectives. The first was to help those in need, especially the indigent, the infirm, and the elderly. The second was to correct the socially deviant, such as vagrants, beggars, alcoholics, and the insane, by putting them to work in the institution's precinct. But there was a substantial overlap between the two objectives. In general, its function was to contain and control those who could potentially cause social problems. Poor people could become beggars or vagrants depending on their situation, and sickness and old age could often result in poverty that might encourage social unrest. In this sense, the Baltimore Almshouse was considered an institution created to abate the "public nuisance."⁷

This function continued despite the consistent changes in the institution during the nineteenth and the early twentieth centuries. Whereas some of its residents, especially the insane and those with manifest criminality, were sent to other institutions, the Baltimore Almshouse remained responsible for the city's impoverished and sick people, many of whom were aged and chronically ill. Admittedly, the growth of laboratory medicine along with the name changes—first to the Bayview Asylum in 1866 and then the Baltimore City Hospitals in 1925—gave the institution more medical functions. It hired several prestigious doctors and introduced new medical technologies and sanitary measures based on germ theories of disease. But the BCH was certainly a less desirable institution to both patients and physicians than most private voluntary hospitals, which were rapidly expanding by admitting younger paying patients with acute and more treatable conditions. With the outbreak of the Great Depression in 1929, the BCH's traditional social role was further strengthened due to an increased number of the indigent and the aged who could not obtain assistance elsewhere.⁸ In 1940, according to John T. King, chief

of the medical service of the BCH, the hospital had “350 chronic patients, in addition to a large Alms House where the indigent and ambulatory old people are maintained.”⁹ In other words, borrowing historian Charles Rosenberg’s expression, the BCH was a public hospital where the “intractable burden of age, dependence, and chronic illness”—which persisted despite the success of modern medicine—had to be dealt with.¹⁰

However, as the focus of modern medical science shifted from infectious to chronic diseases, some people began to regard the aged patients in the BCH not as a “burden” but as useful “clinical material” for the biomedical study of chronic diseases and senescence. An initial step in this direction was taken by J. Murray Steele, a young researcher who worked with the renowned cardiologist and gerontologist Alfred Cohn at the Rockefeller Institute Hospital. Since his tenure as an associate member of the Institute was about to be terminated, he had to find another place to continue his clinical research on senescence and chronic disease. For this purpose, he visited Baltimore in February, 1939, and discussed his research plans to use patients in the BCH with Thomas J. S. Waxter, director of Baltimore’s Department of Public Welfare, and Alan Chesney, dean of the Johns Hopkins Medical School.¹¹ Steele also corresponded with John King, who, tempted by Steele’s plan, wrote the following letter to Waxter.

....it stimulates further investigation, and creates an alert progressive atmosphere; another [advantage] is that the best type of men are attracted to the hospital for house staff appointments; and third, an institution that carries out investigative work successfully becomes a real city institution in the best sense. Boston City Hospital, it seems to me, now ranks as one of the cultural centers of Boston, comparable to the Conservatory of Music and the Harvard Medical

School. In other words, research work of the type proposed is one of those things which, if properly handled, reacts to everyone's benefit, including that of the patients.¹²

As historian Rosemary Stevens has mentioned, it was not unusual for public hospitals operated by a city or county government's budget to use their patients as research material.¹³ For King, this could enhance the hospital's prestige and benefit those related to the hospital's functions, including the Baltimore city government officials. Probably due to the lack of funds, however, Steele's plan was not realized, even though Waxter, Chesney, and the Advisory Committee of the BCH were highly impressed by his idea.¹⁴

But Steele was not alone in planning research in the BCH. In March, 1940, Lawrence Frank of the Josiah Macy, Jr. Foundation met with NIH director Lewis Thompson in Washington, D.C. to discuss the issue of starting aging research at the NIH. Two months later, the Foundation awarded the NIH a short-term grant to establish the Unit on Gerontology and hire a renowned medical scientist Edward J. Stieglitz (1899-1958) as its chief.¹⁵ Stieglitz, who specialized in chronic diseases in the urinary system and blood vessels, immediately recognized the potential usefulness of the BCH when he attended a dinner party of the Maryland Branch of the American College of Physicians. There he heard that the BCH's medical staff members were interested in scientific research on their patients. He thus contacted John King about "the potentiality of using certain portions of the vast clinical material....at the City Hospital and the Alms House."¹⁶ King gladly reported this new proposal to all the stakeholders, including Waxter and the Advisory Committee of the BCH. All of them responded very favorably to Stieglitz' proposal.¹⁷ With their approval, Stieglitz was officially appointed a medical staff member of the BCH in October, 1940 and was granted permission to use its aged patients for his clinical investigation of

senescence.¹⁸ (See Figure 1.) The association between the NIH and the BCH began in the fall of 1940.

[Figure 1]

The birth of the Unit was indebted to the on-going change of the research priorities of the NIH. While the precursor of the NIH, the Hygienic Laboratory, focused on short-term bacteriological investigations during the late nineteenth and early twentieth centuries, it gradually expanded the scope of its research, eventually placing more stress on the study of chronic diseases occurring in more aged patients.¹⁹ Surgeon General Thomas Parran made this point clear in his opening remarks for the Conference on Mental Health in Later Maturity in 1941. “Because...the effective control of the communicable and infective diseases of infancy and youth has permitted the survival of many formerly dying young,” he argued, “the disorders of later maturity take on greatly increased significance.”²⁰ In particular, “the prolonged disability from cardiovascular-renal disease, arthritis, diabetes mellitus, cancer, and the mental disorders which not infrequently beset those past the fourth decade represent a gigantic medical and socio-economical problem” that urgently demanded proper treatments by biomedical research.

The NIH’s changing research focus was accompanied by the establishment of a new scientific field, gerontology. As I have discussed elsewhere, gerontology was created as a multidisciplinary field in America amid the Great Depression.²¹ Although the economic conditions of the elderly during the Depression has been a controversial subject, historians agree that many Americans believed the negative effect of the economic disaster upon elderly people’s

livelihood, which came in the form of the disappearance of private pension plans and the drastically reduced job opportunities.²² Of course, loss of job was then a problem for all age groups in the population. Yet the elderly were thought to be more severely inflicted by the widespread unemployment of the time due to the worsened age discrimination that was emerging as a social problem. As Edmund Vincent Cowdry, a major architect of American gerontology, wrote to the Macy Foundation, the elderly were “wrongly [considered] to be past their usefulness” and were less valued in workplaces.²³ In this situation, the Congress passed the Social Security Act in 1935 to provide the elderly with a basic income. However, scientists like Cowdry still believed that they must do something more fundamental than “throwing old people a few dollars.” He wrote, “what we need is a systematic study of the problem of the aged” in order to “profit from the many ways that aged persons can serve and then with proper safeguards to ease their departure.”²⁴ Cowdry also thought that such a study should ask how physical and mental decline occurred with aging and how these changes affected a person’s social and psychological adaptation. Hence, the new science of aging should be multidisciplinary, reflecting the complexity of the problems that included biological, medical, social, and psychological aspects. After corresponding with Cowdry about this issue, Ludwig Kast, president of the Macy Foundation, decided to support the publication of *Problems of Ageing* (1939), the first multiauthored handbook in the science of senescence. Significantly, many of the contributors to this volume became the founding members of the Club for Research on Ageing, the earliest informal group in America for discussing aging as a scientific problem. With the Macy Foundation’s funding, the Club led to the establishment of the Gerontological Society in 1945 and the launching of the *Journal of Gerontology* as its academic periodical.

Gerontology appeared as a scientific field at a crucial moment. The NIH was changing its research directions, and the BCH was interested in creating a clinical research project like other public hospitals. The shared interest of the parties involved led to the creation of the Unit on Gerontology, with an expectation that it would produce scientific knowledge of aging and chronic diseases. Indeed, the people in charge of creating the unit gathered together during the first meeting of the Club for Research on Ageing in 1940, which was supported by the Macy Foundation. Frank attended the meeting as a representative of American gerontology's main sponsor, and Thompson as the head of the federal research institute that had just started a gerontology program.²⁵ Edward Stieglitz also participated as a medical staff member of the BCH and chief of the unit. These three scholars, along with other participants, discussed the future of gerontology and the role of the federal government in conducting research on aging.

Old Age, Poverty, and Clinical Research in the BCH

It is remarkable that the image of old age Vincent Cowdry portrayed partially overlapped with the state of the elderly in the wards of the BCH. According to him, it was often assumed that the elderly "are on the downward path...death is inevitable anyway." People thus turned away "from [a] sad-eyed and driveling old man believing, perhaps honestly, that but little can be done for him."²⁶ But such an association between old age and death had not been taken for granted for a long time in American history. Due to military conflicts, natural disasters, epidemics, or inadequate nutrition, death had been thought to occur at any time even at a fairly early stage of life. As Achenbaum has written, it was only in the late nineteenth century in the United States—when these accidental causes of death began to be controlled—that the

association between death and senescence was more firmly acknowledged.²⁷ Afterwards, amid the industrialization that began to marginalize the elderly in society, the discourse on old age was further intertwined with those on death and its alleged major cause, chronic disease.²⁸ In this light, we can appreciate John King's remark on the BCH where many indigent aged people sought help during the Great Depression. According to King, the BCH's infirmary and chronic wards were filled with "a large proportion of [elderly] patients....disabled from cardiovascular and renal conditions incidental to age."²⁹ An official document on the "clinical material" of the BCH in 1941 also indicated that the following numbers were found for each condition in a chronic medical ward holding 293 patients.³⁰ The average age of the patients was 59.3.

Arteriosclerosis	195
Hypertensive Disease	129
Cardiac Incompetence (all types)	103
Diabetes Mellitus	18
Arthritis	33
Syphilis	49
Senility	6
Renal Decompensation	3
Cancer (all types)	6

In addition, "as complicating disorders," "anemia, cerebral accidents, mental deterioration, and chronic renal disease" were frequently observed. The situation was not considered very different in the almshouse division that offered beds to those who came to the BCH not so much because

they were sick as because they had nowhere else to go. Waxter, in an interview with a journalist, said that the almshouse, which was often called “infirmary,” had about 1,000 “ambulatory patients” demanding “some care,” although they had not yet developed definite medical symptoms.³¹ Indeed, as historians Carole Haber and Brian Gratton have pointed out, American public asylums and almshouses strengthened the relation of old age to illness and poverty in many people’s mind, although the reality of the elderly in general was more complex.³²

Due to the assumed relationships among these factors, Stieglitz had to be careful in his research. It was often difficult to make a clear distinction between the effects of aging and the result of disease. He was sure that the incidence of chronic disease increased with senescence. If so, how could he study age changes without confusing them with pathological alterations?³³ For instance, he tried to use “as many apparently ‘normal’ patients as possible” in his investigation of the uric acid and urea clearance function in the elderly.³⁴ But finding such patients within the wards of the BCH was difficult, because most of its elderly patients were suffering from various illnesses. Conversely, the decline of the renal function with age made it hard to determine the “normal range” based on which a healthy kidney could be differentiated from diseased ones.

How were the elderly in the BCH treated in these studies? The records do not show any evidence that Stieglitz considered them more than mere research material. The following is a typical statement regarding their use.

G.F.T. (Glomerular Function Test). 2nd Day.

At about 8 P.M. the patient is to void and the urine is to be discarded. The patient is to drink one glass (200 c.c.) of water and the Intern is to inject intravenously the contents of 1 ampoule Sodium Ferrocyanide dissolved in 10 c.c. sterile distilled water. It is very important that the

solution be clear before it is injected. Urine specimens are to be obtained 30, 60, and 120 minutes after the injection (same routine as with P.S.P. test) and labelled with the patient's name, Hospital number, date, time of voiding, and marked "G.F.T.", and sent to the Gerontology Laboratory....³⁵

He did not express any concern over informed consent or the problem of nontherapeutic research. Admittedly, there were not many doctors at that time who seriously considered ethical dimensions in research using human subjects. In such works, the subjects were often chosen among the socially unprivileged, such as orphans, prisoners, and people of color. As historian Susan Lederer has shown, however, William Osler and other practitioners began to argue for the necessity of informed consent and ethical guidelines in medical research in the early twentieth century, in response to antivivisectionists' challenges.³⁶ Against this background, an obvious reason for Stieglitz's indifference to the patients can be found in the fact that gerontology, as a new field, was relatively unknown to the critics of human experimentation.³⁷ Yet a more important reason should be related to the distance between him and his subjects in terms of social status and race. Stieglitz and other doctors who used humans in their study did not worry much about the ethics of their work, probably because they were treating those in the margins of society. Almost all the 293 patients designated as "clinical material" in the above document came from the poorest class within the city, and 149 among them were African Americans.

If Stieglitz hardly felt any sympathy or moral conscience toward his "clinical material" due to the matters of race and class, what, then, did he feel about female research subjects? The peculiar absence of women in Stieglitz's investigation reveals another problematic aspect of early gerontology at the NIH. Indeed, there were 121 women among 293 patients in the

aforementioned ward. But none of them were used by Stieglitz or his successor, Nathan Shock, in gerontological investigations. Why were the hospital's elderly women excluded altogether in research? In fact, the male body was traditionally considered the standard type in Western medicine and science, while the female body was deemed its inferior variant or incommensurably distinct opposite.³⁸ In the current case, however, there seems to be a more specific reason, which stemmed from the very conditions that contributed to the birth of gerontology in the 1930s. As I have written, American scientists of aging such as Cowdry decided to create a field for aging research while observing the deep and widespread worries regarding unemployment, job security, and age discrimination,³⁹ which primarily concerned men rather than women at that time.⁴⁰ These problems touched gerontologists themselves as well, who, as breadwinners, could not completely ignore the fear of losing jobs and being disadvantaged because of their age. Hence, it was not strange that Stieglitz and Shock assumed that their investigation should be limited to aged male patients.

At any rate, Stieglitz could use only a small portion of such "clinical material." The Unit during Stieglitz's short tenure was quite limited in its activity due to insufficient funding. The Macy grant was far from adequate for initiating systematic research on aging, and the U.S. Public Health Service could not appropriate adequate budgets for biomedical projects that were not directly related to the most serious incident at that time, World War II.⁴¹ Of course, Stieglitz attempted to justify his research by arguing that scientific data on the work capacity of older laborers would be useful for industrial production when younger people had to serve the military during the war.⁴² Yet research on aging was considered too far from the immediate national needs to warrant substantial government or private funding. In such circumstances, Stieglitz could not carry out his comprehensive research plans that included both clinical and

experimental studies of renal function, hypertension, and blood nitrite concentration.⁴³ The only research whose results Stieglitz was able to publish was the clinical investigation of uric acid clearance rate using BCH patients.⁴⁴ Marvin Yiengst, a lab technician hired with the meager Public Health Service funds, was the sole assistant.

Nathan Shock as New Director: Gerontology within and beyond the BCH

In the summer of 1941, the Macy Foundation grant expired, and the Public Health Service became fully responsible for the Unit. At the same time, Stieglitz, who was hired with the Macy funding, was asked to resign.⁴⁵ The Unit's chief position was then given to Nathan Shock, an assistant professor of physiology at the University of California. (See Figure 2.)

[Figure 2]

Why was Shock chosen? Although the details of his appointment are unclear, it is certain that he was recommended by two members in the Club for Research on Ageing, Lawrence Frank and Baird Hastings, whose opinions were considered important within the NIH.⁴⁶ Frank, as executive secretary of the Macy Foundation, provided a grant for initiating the Unit, and Hastings was a close colleague of NIH director Lewis Thompson. Indeed, Hastings also knew Chemotherapy Division chief William Sebrell, who asked him to recommend an experimental scientist who could fill the position of "physiologist" within the NIH.⁴⁷ Hastings, as a graduate advisor of Shock, recommended him without hesitation.

Shock's previous career and his past interactions with Frank and Hastings provide further clues to how he came to take the directorship of the Unit. Born in Lafayette, Indiana in 1908, Shock earned his Ph.D. in physiology and psychology in 1930 from the University of Chicago under the supervision of Hastings, Anton Carlson, and L. L. Thurstone. It is notable that Hastings and Carlson became active members of the Club after 1940. Upon finishing his dissertation, Shock also began research on how children's physiological parameters changed with *age*. As a research associate at Chicago and an assistant professor of physiology at the University of California, he measured the long-term "age changes" in cardiovascular, respiratory, and nervous functions of boys and girls using a longitudinal method.⁴⁸ Although he did not yet deal with age changes in later life, it is important that he was then funded by the Macy Foundation's "Life Cycle" program initiated by Lawrence Frank, which promoted research on all phases of life, including old age.⁴⁹

Shock's early research in his small laboratory on the fourth floor of the BCH clearly shows how his earlier works formed a starting point of his new investigation in gerontology. First, to measure the physiological changes in the elderly patients, he continued to employ some of the laboratory apparatus that he had used in California for adolescents.⁵⁰ Second, he reused the methods he had adopted in his physiological research with Hastings at Chicago. For instance, as he had done in the early 1930s, he deliberately disturbed the acid-base equilibrium in the blood by chemical means, and examined how long it took for this disturbed blood balance to return to its normal state.⁵¹

Throughout his early investigations, Shock treated his research subjects in a way that was not different from that of Stieglitz. In a personal letter to his friend, he wrote that "the Hospital is practically as good as having a rat colony available, since it is no trouble at all to obtain

subjects—and they are here when you want them.”⁵² Since the patients were like “rats” in the colony, there was “one advantage of the present job.” He said that “there is no objection to taking blood samples for analysis from the subjects” and “it makes blood studies much simpler.” Why, then, didn’t the patients object to having their blood withdrawn? Although it is now difficult to know more about the patients’ response to his research, we may interpret this statement as a case revealing not so much their genuine compliance as the lack of communication between him and them, including that which was necessary for informed consent. It is obvious that he did not ask his patients whether they were willing to participate in the study.

Due to this situation, a particular kind of research was not quite feasible. He wrote to his friend,

For the present, I have no plans for psychological investigations—much as they are needed. For one thing, the population here represents a savage selection on an intellectual and economic basis, so that nothing much is possible on the question of ageing effects on the intellectual side. Most of these fellows started at the absolute zero of intelligence.⁵³

On what basis did Shock think that the intellectual faculty of the elderly patients was so dismal? This passage, I think, indicates the immense gap between him and them with respect to education and social status, rather than their actual psychological state. As I will state later, gerontologists were eager to find the “normal” age change and thought that it should be observed in a population whose education and economic state was similar to theirs. To Shock, as it was to Stieglitz, the mental state of impoverished elderly inmates in a public hospital was too far from this range and, therefore, did not belong to the scope of his scientific concern.

In effect, gerontology was forging the scope of this concern beyond the wards of the BCH. From the beginning, Shock was expected to do what Stieglitz, who relied only on BCH patients for his clinical work, did not do, as could be seen in the following letter from Hastings to Shock.

Larry Frank and I both thought of you as the logical man to take this work over. Stieglitz, who had started the work, approached the problem as a clinician. They know you are not that, but they think that you could contribute other things which would be to my way of thinking of greater importance.⁵⁴

Hastings's "other things" reflected the broad visions as well as the diverse subjects and methodologies of the emerging multidisciplinary field of gerontology in which he was participating. Employing diverse approaches, gerontologists were studying senescence as a complex process involving biomedical, social, and psychological dimensions of humans and other organisms. To have a deeper appreciation of them, Shock participated in as many academic organizations and meetings as he could—including the Club for Research on Ageing, the Gerontological Society, and the Conference on Nutritional Requirements for the Ageing Population. In 1960, he served the Gerontological Society as President.

Through his interaction with his gerontologist colleagues, he began to appreciate their perspectives which were already undergoing a subtle change from those of Cowdry in the 1930s. When Cowdry stressed the misery and plight of the aged during the Depression, it was also obvious that the cause of their distress should be found not so much in their inherent bodily and mental weakness as in the widespread misunderstanding and prejudice against them. In this state,

a major goal of scientific studies of senescence was to enhance the social participation of the aged by highlighting their continuing competence and fitness in industries. As a gerontologist said during the 1942 meeting of the Club for Research on Ageing, the science of aging had to “do something to contribute to an increased efficiency of older people.”⁵⁵

The imperative of this goal was expressed particularly well amid the workforce shortage in World War II. For instance, during the Conference on Nutritional Requirements held in Ithaca, New York in 1941, Shock joined the discussion of the difference between physiological and chronological age as well as the meaning of this difference when applied to aged industrial workers.⁵⁶ Since the two were not always the same, it was necessary to measure the former precisely using various physiological techniques and to use this information as a basis for gainful employment of elderly people.⁵⁷ Shock also thought that these tests might solve the problem of the dwindling civilian workforce, as Stieglitz had already claimed. He even tried to redirect the research orientation of the Unit toward the study of physical fitness of aged and young workers when the Unit was ordered to assist in the war effort.⁵⁸

Although Shock could not implement this study during the national emergency due to the lack of the government’s authorization for the less urgent projects, his research program substantially expanded after the war with considerably increased budget, space, and personnel. In 1946, the Unit on Gerontology was then promoted to a “Section” within the Division of Physiology, and its annual budget of \$38,000 in that year quintupled to \$198,000 in 1947.⁵⁹ The space allotted for Shock’s research in the BCH was also considerably expanded. Whereas his Unit had only 1,500 square feet of laboratory space from 1942 to 1945, it was allowed to use 11,000 in 1947, which included rooms for patient beds and utilities in addition to the laboratory space.⁶⁰ This enlarged space and increased budget was accompanied by the addition of new

personnel. Although Shock had lost his sole staff member, Marvin Yiengst, to military conscription during the war, Yiengst came back to the lab after finishing his service along with three professional staff members and six technical assistants.⁶¹ This expansion was accelerated when the National Heart Institute (NHI) was established in 1948 and the Section was incorporated into it. The budget and personnel of the Gerontology Section kept growing along with that of its host institution.

This postwar growth of gerontology in the NHI was related to a specific way of promoting healthcare which the United States federal government preferred. In fact, the NHI was one of the several new research institutes established within the NIH as a part of the postwar expansion of the federal biomedical programs. According to Stephen Strickland, this expansion was the sole means for the federal government to improve Americans' health when the plans for national health insurance could not be introduced over the vehement opposition by the American Medical Association and other organizations.⁶² Victoria Harden has also written that medical research funded by the federal government was the "principal way by which congressmen could vote to improve their constituents' health" including "the elderly and the indigent," when the creation of the national health insurance and other measures proved impossible.⁶³ In retrospect, this situation partially explains why gerontology fared much better in America than in Britain, as Moreira, Palladino, and I have mentioned.⁶⁴ It is noticeable that Britons made the National Health Service as their comprehensive government-sponsored medical insurance agency when Americans began to build new medical research institutes such as the NHI after World War II. The two countries differed in their response to healthcare—the United States chose research while the United Kingdom chose free medical service—and this difference influenced the two countries' distinct ways of dealing with the issue of aging. Britons decided to construct a better

pension system and NHS-sponsored geriatric care, whereas Americans supported more research on aging through the NIH.⁶⁵ Shock and his fellow gerontologists certainly benefited from their country's distinctive historical development after the war.

The postwar growth of the gerontology program was helped by Shock's consistent efforts and the NIH's institutional changes as well. Above all, his struggles to convince government administrators, particularly those within the U.S. Public Health Service, of the importance of research on aging should not be neglected. He wrote to his mentor Hastings that he "spent so much time trying to educate administrators [on] the importance of fundamental research in aging."⁶⁶ In fact, through several informal meetings, he tried to persuade federal administrators, some of whom later became enthusiastic supporters of gerontology.⁶⁷ In particular, C. J. Van Slyke, the first director of the NHI, became a strong advocate of the science of aging. Van Slyke was well aware of the importance of age in the incidence of heart diseases and even took the position of President of the Gerontological Society in 1950. Champions of gerontology could also be found outside of federal institutions. Many of the administrators of the BCH and the Baltimore Department of Public Welfare, including King and Waxter, were very favorable to Shock's work and tried to provide him with as much hospital space as possible.⁶⁸ The Section's incorporation into the NHI was another important factor for gerontology's survival and growth. According to his later recollection, the Section's "odds were better within the framework of a newly formed institute than in a well-established, ongoing program."⁶⁹ This statement can be supported by the financial state of the Section, which, as of the latter half of 1949, had the largest operating budget among all the sections and branches within the NHI.⁷⁰ It is also notable that most of the Section's research projects did not require justification with regard to heart diseases.⁷¹ This implies that research on aging was granted an independent status within the NHI,

even though the studies of the influence of aging in the occurrence of heart diseases were always welcome.

After becoming a part of the NHI, the Gerontology Section could substantially expand the spectrum of its research programs. Whereas Shock's team primarily conducted clinical research on renal and heart functions using the patients in the BCH in the 1940s, new experimental studies of longevity and metabolic activity using non-human subjects, especially rats and fruit flies, were initiated in the 1950s.⁷² In addition, following the discovery of DNA's structure, molecular biological and biochemical approaches to aging were introduced into the gerontology laboratories within the BCH.⁷³ Another equally important development was the psychological study of aging. As stated above, Shock himself wondered whether he could conduct a meaningful psychological investigation of the elderly patients in the BCH. A paper published in 1949, however, reveals that his team members, especially James Birren and Charlotte Fox, turned this question into a different direction by analyzing the elderly inmates' vocabulary size, education, and the length of hospital stay.⁷⁴ While it might be true that elderly patients in the BCH were not very intelligent, a quantitative study of how age, education, and the days of institutionalization affected their vocabulary size could become a way of retackling the question by focusing on a specific mental capacity. Thereafter, psychological gerontologists at the NIH continued to conduct research on the mental state of the elderly.

During these changes, Shock and his colleagues came to support and corroborate the new biological views on senescence that emerged during the early and mid-twentieth century. As I have discussed elsewhere, gerontologists began to depart from the traditional idea that aging occurred concurrently throughout the whole body due to the "decline" or "decay" of some mysterious entities that controlled every body part, such as "innate heat" or "vital power."⁷⁵ For

many early American gerontologists such as Cowdry, Alfred Cohn, and Clive McCay, senile changes took place at a distinct rate and in a different mode at each location in the body.⁷⁶ Shock, who came to accept this idea during his participation in the Gerontological Society, found several cases supporting it.⁷⁷ For instance, in a book he coauthored with other gerontologists—the third edition of Cowdry’s *Problems of Ageing*—he wrote that each apparatus involved in homeostatic regulations showed a distinct pattern and rate of senescence.⁷⁸ Some homeostasis regulation mechanisms still worked efficiently even in extreme old age, while other devices tended to be disrupted gradually as the organism underwent senescence. Interestingly, this standpoint on aging helped Shock investigate the cause of a particular organ’s impaired function with aging. If one portion of an organ did not show any difference with age while others did, the latter could be suspected as the prime cause of the senile symptoms that manifested in the organ as a whole. In fact, he found considerable evidence supporting this idea, especially through his investigation of the impairment of the kidney in old age. He attributed the reduction of kidney function in the elderly to the decreased activity of the part responsible for its tubular rather than its glomerular function, because only the former became less effective as the organism aged.⁷⁹

Shock and his colleagues found other cases revealing that many constituents of the body underwent little or no change with senescence. For instance, he showed that the water content of the cell did not alter much with age, even though numerous scholars since Aristotle, including some notable physiologists of the early twentieth century, had believed that aging was a process of “drying.”⁸⁰ Likewise, the reaction time and sensitivity to some types of drugs displayed almost no difference between the young and the aged.⁸¹ It was also significant that the ability to maintain acid-base equilibrium in the blood indicated little alteration with senescence. This result,

which came from a study of the BCH's aged patients, led Shock and Yiengst to write that the elderly were able to "adjust to the daily demands for adequate excretion of acid or alkali."⁸²

These works were ultimately related to larger social and industrial issues on older people's employment, when the postwar economic growth considerably increased the number of jobs available to the aged.⁸³ According to Shock, since some body parts' functions were hardly altered with senescence and individual differences in aging were greater than was commonly thought, it was important to devise ways to measure an individual senior laborer's work capacity accurately in order to deploy the person at the right place in industries and to make more realistic retirement policies.⁸⁴ It was also necessary to conduct systematic intelligence testing and to apply its results to actual workplaces, because it was discovered that the mental activity that did not require speed showed little age difference.⁸⁵ Moreover, despite their initial slowness, older laborers were found to maintain their performance for a longer period and with fewer accidents than the young.⁸⁶ With these findings in mind, Shock wrote to Hastings that "ten years of research in our laboratory certainly tended to emphasize one of the questions phrased; namely, that the limitations on the physiological level of older people are more apparent than real."⁸⁷

Such an idea was reflected in an illustration within a report that Shock submitted to the National Heart Institute in 1956. (See Figure 3.) It showed how aging seen from many different points—from cellular physiology to industrial employment—was interrelated in the multidisciplinary field of gerontological research. By studying various physiological topics, scientists of aging could show how the elderly were able to deal with the problems of "income maintenance" and "employment" and how these issues were related to bigger subjects such as "total national productivity."

[Figure 3]

Ironically, such a hopeful outlook for old age was in part based on the use of the BCH's poverty-stricken elderly patients whose prospects of health and wealth did not appear quite bright.⁸⁸ For instance, like the case of the acid-base equilibrium function mentioned above, the pattern of physiological responses to thyroid stimulating hormone revealed little difference between middle-aged and elderly inmates of the BCH.⁸⁹ The variability of beta lipoprotein and cholesterol likewise did not demonstrate a substantial change in accordance with the age of the subjects.⁹⁰ Although many projects of Shock's and his colleagues' using BCH patients produced results that did show an age-related decline, a large number of their papers recorded stability across age groups as well.

This aspect of Shock's research may raise several questions. How can we measure the degree to which the research material itself contributed to Shock's positive view of old age? Was the body of the indigent elderly patients really worn-out and disease-prone? Did Shock intentionally interpret his data obtained from these people in a positive way to make his case coherent with gerontologists' general standpoint? I think that it is difficult to analyze the relationship between the actual state of scientific objects and the social influences upon an investigator's course of work. What seems more important here is to trace how Shock and his colleagues understood the possibilities and limitations of their research subjects. Although Shock's team, using impoverished elderly inmates in the BCH, kept publishing papers that had a positive view of old age, they could not ignore a potential problem in their work, especially a possible "bias" created by the use of these people as research material.

The Baltimore Longitudinal Study of Aging and the New Human Research Subjects

The problem was pointed out as early as 1941 during the Conference on Nutritional Requirements for the Ageing Population. Amid the discussion on the current and prospective clinical projects, Lawrence Frank expressed “general objection to use of institutional population,” because this would introduce a bias in the data toward “inferiority.”⁹¹ To Ephraim Shorr, a medical researcher at Cornell, a better alternative would be to use “certain homes for the aged, such as Andrew Friedman Home for the Aged in New York,” because “this group represents a ‘deluxe’ population of slightly impoverished gentility.” Another option was to choose “retired farmers” who could constitute “an especially valuable group for study.” Shock, who came to this meeting as a young gerontologist, certainly recognized a potential problem in his own work. The elderly patients in the BCH might not show the typical or normal pattern of senescence, because they were too poor and unwell.

Early in his career as a gerontologist, Shock occasionally expressed his concern on this matter. In the 1949 meeting of the Club for Research on Ageing, he stated that his investigation using indigent seniors could incur a problem, because it was difficult to “know how much of the changes observed can be attributed to economic factors that produced the selection of our subjects.”⁹² Here, the “economic factors” were a *contaminant* that exerted an undesirable influence upon his research. In 1957, he also wrote that “most old-age studies on humans have been limited to institutional population of one kind or another, and there are, no doubt, grave sampling errors present in much of our so-called knowledge of aging.”⁹³ These statements show that he was not completely satisfied with his clinical subjects, even though they were the material basis of his strong optimism concerning old age. Perhaps a *more* optimistic view and more

reliable result could be attained if he could employ a different group of people in his investigation.

There was another problem with the studies using older inmates in the BCH. Most of these studies relied upon cross-sectional methodologies. Although the conclusion drawn from a comparison between distinct young and old persons was not insignificant, it still contained possible sources of error caused by individual differences. A better approach would be to trace a person's physiological changes over a long period by asking him or her to be examined by gerontologists regularly throughout the lifespan. Indeed, this was what he had done with children and adolescents at the University of California. Yet asking adults to do the same thing for the rest of their remaining life was a totally different matter.

For two reasons, however, Shock was able to start a project using adults, which was then named the Baltimore Longitudinal Study of Aging (BLSA). First, other longitudinal research projects had already been planned and implemented. These were the Framingham Study initiated in 1947, the Kansas City Study of Adult Life begun in 1952, and the Duke University Longitudinal Study started in 1955.⁹⁴ The studies were the successful precedents for Shock's project. Second, there were many dedicated volunteers willing to offer themselves as research subjects. As Lederer has pointed out, an increasing number of Americans, with their enthusiasm for modern medicine and science, volunteered for research projects after the 1930s.⁹⁵ Some of these people became interested in a long term project on aging at the nation's largest medical research institute.

Among them, William W. Peter (1882-1959), a retired doctor, medical missionary, and public health worker, played a particularly important role in starting the project. Upon finishing his education in Rush Medical School at Chicago in 1910, Peter treated patients, taught students,

and tried to improve public health in various places, such as China, South America, and the Navajo Reservation in the United States. He also taught public health at Yale University and worked in the Health and Sanitary Division within the Institute of Inter-American Affairs at Washington, D.C. After these years, he retired at his home near the Chesapeake Bay, when he was hospitalized in the U.S. Public Health Service Hospital in Baltimore due to an occlusion in an artery.⁹⁶ Expecting to die, he wanted his body to be used for a pathological study. After a chance encounter with Shock in 1957, however, he found that the science of aging is the field in which his body could be used more productively. He thus volunteered to become the first human research subject in Shock's longitudinal study.

From the beginning, Shock's manner of treating Peter was completely different from that of dealing with the nameless aged patients in the BCH. Whereas Shock had barely tried to communicate with BCH patients, he frequently corresponded with Peter in the late 1950s about the longitudinal project and the goals of the science of aging. Shock's letters written at this time revealed his deep respect for Peter's past contributions to medicine and gratitude for his serving the long-term project as the first volunteer. Shock even invited Peter to join the Gerontological Society.⁹⁷

But what was more important for the project was the fact that Shock offered Peter the position of "Special Consultant to the Gerontology Branch" within the NIH. The consultant's main duties were to "aid in extending the community-wide sample of subjects for the longitudinal study of aging" and to "advise the Chief of the Branch on professional matters in dealing with these subjects."⁹⁸ This position officially acknowledged Peter's efforts in recruiting volunteers, whose "quality" was vital for the initiation of the project. Indeed, Peter succeeded in persuading his neighbors, friends, and colleagues to join the study. These people, who were

relatively affluent and engaged in professional occupations, became the starting group of volunteers in the late 1950s. The BLSA continued to recruit volunteers thereafter, primarily through the recommendations of the early participants. The number of volunteers kept increasing, from seventy-four in 1958 to more than nine hundred in 1976.⁹⁹

Shock and Peter explained the rationale of using these people as research subjects. Previous clinical research on aging relied on indigent old people in a public institution, whose physiological condition was thought to be somewhat different from the “great majority of the aged who lived normal lives in their own communities.”¹⁰⁰ An examination of their body might produce results that could not reveal much about the “usual” patterns of aging. Even when the elderly research subjects were chosen from those who did not show manifest symptoms of disease, it was still possible, Shock and others thought, that their aging processes had deviated from the “normal” because their poor socio-economic conditions could negatively influence their health and the results of research. The participants in the BLSA were different, as Peter announced to his colleagues.

There is a reason why people like us should volunteer. We are not receiving custodial care and we are not living institutionalized lives. Nor are we medically indigent. Such research material, if too preponderant, distorts the picture. Many of those being cared for in the Baltimore City Hospitals....have been buffeted by the storms of life for so many penalizing years that they present more than the average number of abnormal findings; both physical and psychological. More persons are, therefore, needed from the outside who live normal lives....¹⁰¹

By encouraging these healthy and well-off people to come to the BCH at regular intervals and to have their physiological and psychological conditions—such as their pulmonary, cardiovascular, and neuromuscular functions, as well as the state of their blood, urine, and intelligence—monitored across their lifetime, it seemed possible to trace aging processes in an individualized manner without worrying about the issues related to the physical and mental problems of the indigent aged.¹⁰²

The inception of the BLSA changed the social characteristics of the human research subjects used in the BCH. Although the physiological examinations still took place at the BCH, the socio-economic position of the human subjects used in research was transformed.¹⁰³ (See Table 1.)

	1949	1954	1959	1964	1969
Human subjects from the BCH	12	3	4	0	0
Community-residing volunteers (BLSA)	0	0	0	6	6
Human subjects from other sources	1	0	2	0	3
Unspecified human subjects	2	7	1	3	1
Animals and biomolecules	0	0	13	27	28
Reviews and others	3	6	7	8	8
Total	18	16	27	44	46

Table 1. *An analysis of the number of publications by the gerontology program within the NIH. The top horizontal column designates the years, while the left end vertical column describes the types of research material referred in the papers.*

The indigent elderly were mostly replaced by middle-class or professional participants, who had worked or were currently working as scientists, educators, government officials, engineers, attorneys, physicians, and clergymen.¹⁰⁴ The racial composition was also altered. While there were a number of people of color among the previous human subjects recruited from the BCH, all the early BLSA volunteers were white. In fact, Peter, in his letter to Shock, briefly mentioned the issue of using “Negro volunteers” whose “unusual characteristics” could be “very much worth studying.”¹⁰⁵ But no people of color were invited to the project during the early periods of the BLSA. Women, who had never been used as subjects in the NIH’s gerontology laboratory regardless of color, were also excluded until 1978, even though some women did express their willingness to participate.¹⁰⁶

If this was the case, how could gerontologists assume that the BLSA studied the “great majority of the aged who lived normal lives”? This assumption may sound flawed to many contemporary readers. It is possible to say that the BLSA, with only white participants, was more racially biased than previous clinical studies in the BCH, which had occasionally relied on African Americans. But the assumption was quite acceptable to Shock and his colleagues in the 1950s.¹⁰⁷ For these scholars, with their social goals during the prosperous postwar period, it was necessary to draw a boundary of normality in which their desired form of old age could be defined. This boundary circumscribed the set of problems that deeply concerned them, such as continued employment, social participation, and industrial productivity. With regard to these problems, the ideal elderly—who were supposed to get older following the “normal” pathway—were designated as those who were well adapted to their work environment and community with their declining yet still sound body and mind. Such people should be found among middle-class white men, especially when class, race, and gender strongly influenced one’s social role and

experience as well as the kind of medical service one could receive. “Normal” aging was thus defined along certain political and cultural lines, which gerontologists did not yet question.

The constitution of the boundary of normal aging process in mid-twentieth century America can also be understood through the shifting ideal of “civilized old age” described by historian Thomas Cole.¹⁰⁸ This ideal, which came from the Victorian middle-class in the nineteenth century, stressed that healthy and active old age as well as economic prosperity could be attained only through hard work, rational scientific planning, and careful maintenance of health across one’s lifespan. According to Cole, this ideal, after a temporary decline, became a dominant vision among well-to-do seniors in the middle of the twentieth century due to the rise of a more optimistic outlook on old age.¹⁰⁹ It is possible to say that the ideal affected gerontologists as well, as can be seen in their search for white middle-class volunteers for the BLSA. The scientists and the affluent lay people who wanted to stay healthy and productive in old age conceptualized what the normal course of aging should be through their participation in the longitudinal project as either scientists or subjects.

Both the success of the BLSA and the ideal of civilized old age had their drawbacks. As Cole noted, the ideal can be just one side of a coin carved out according to the values of industrial society.¹¹⁰ On the other side of that coin, we find the discourse on the inevitable decline and pathogenesis of senile process as well as the maladaptation of the aged to modern society. Civilized old age became an ideal, because the middle class in the industrializing country thought that these negative things had to be avoided by all means. In this light, we can also understand why gerontologists stopped using the indigent elderly in the BCH. They represented all the features affiliated with undesirable forms of old age in modern society—such as dependence, isolation, and ill health.

Conclusion

In an interview with a journalist in 1969, Shock was very pleased to introduce his Gerontology Research Center. The center, which opened in June 1968, hired one hundred twenty-five staff members, including professional scientists, technicians, and secretaries. It had a “building of its own on the grounds of the Baltimore City Hospitals.”¹¹¹ The building had “90,000 square feet of research space, extensive animal facilities and complete supportive services.” The researchers, determined to uncover the nature and characteristics of aging, were maintaining a congenial academic environment within the institute, and were constantly engaged in active communications across disciplinary boundaries. It was the leading research institute in the world for the investigation of the phenomenon of senescence.

Behind this success of gerontology in the NIH, however, a few points of concern were evident. As described, despite the considerable increase in the federal appropriation for research on aging, little was done for the socially and economically unprivileged American seniors, including those in the BCH. Elderly people who could not afford private health insurance or the latest medical technology at a voluntary hospital could still serve the growth of medicine and science by offering themselves for research in public hospitals. But their health and welfare was not yet a subject that interested scientists of aging. The beginning of the BLSA distanced their interest further from the concerns of the indigent aged by using only white middle-class volunteers.

This situation appeared to change after the mid-1960s. In 1965, Medicare and Medicaid were established as the government-sponsored health insurance for the elderly and the indigent,

respectively. Those who had not been treated well in the traditional hospital systems could now experience a changed situation.¹¹² Gerontologists' view of BLSA volunteers also seemed to change slightly. As documented by Moreira and Palladino, Shock said in 1965 that BLSA participants were akin to a special group of standardized "model organisms" rather than random "samples" representing the majority of aged people in American society.¹¹³ From this standpoint, the BLSA was worth pursuing, not so much because it yielded reliable information on the usual aging process of most American seniors, as because it produced a body of knowledge on senescence excluding disturbances from unequal conditions among the subjects.

This change can be observed in a 1976 report by two NIH gerontologists, Clyde Martin and Arthur Norris. In this report, the participants' physical constitution and social standing did not seem to differ substantially from that of the volunteers in the earlier years. While approximately 4% of the participants were African Americans, the majority were still Caucasians. Likewise, most volunteers, who were in professional, managerial, or other white-collar occupations, rated their economic standing as "comfortable." It is also notable that 80% of the participants reported that their health was "good" or "excellent." To the authors, one of the strongest points of this feature of BLSA volunteers was that "the social characteristics of participants [could] be disregarded as important sources of variation in most analyses."¹¹⁴ By recruiting participants among those with common racial and economic features, gerontologists thought that they were able to control social variables and make their study more rigorous. But it was obvious that the absence of women among these volunteers was a continuing problem. Martin and Norris also admitted that some people "raised questions concerning the elite character of the sample." Since the participants represented only a small fraction of the population in America, the data from the BLSA might be biased. It was now manifest that the

category of normal aging that Shock and his colleagues constructed in the late 1950s was social as well as biological, despite, or because of, their efforts to eliminate the social factors in their work.

Yet gerontologists could not abandon the advantages of “homogeneity” of their research subjects, which was definitely a key factor for the maintenance of scientific rigor in their work. Hence, “the feasible alternative...was to continue to follow the same recruiting procedures that had proved effective and to accept the fact that the use of volunteers imposed limitations upon attempts to generalize findings to a wider population.”¹¹⁵ But this “feasible alternative” continued to provoke criticism from scholars, including several younger gerontologists who did not agree with Shock’s original idea.¹¹⁶ It was still difficult to study the “normal” process of aging without touching the complex social dilemmas regarding the use of the human body in scientific research.¹¹⁷

¹ “Nathan W. Shock,” in *Profiles in Gerontology: A Biographical Dictionary*, ed. W. Andrew Achenbaum and Daniel M. Albert (Westport, Conn.: Greenwood, 1995), 321-26; George T. Baker, III and W. Andrew Achenbaum, “A Historical Perspective of Research on the Biology of Aging from Nathan W. Shock,” *Exp. Gerontol.*, 1992, 27, 261-73; W. Andrew Achenbaum, *Crossing Frontiers: Gerontology Emerges as a Science* (Cambridge: Cambridge University Press, 1995), 89-100; Tiago Moreira and Paolo Palladino, “Ageing between Gerontology and Biomedicine,” *BioSocieties*, 2009, 4, 349-65; “‘Population Laboratories’ or ‘Laboratory Populations’? Making Sense of the Baltimore Longitudinal Study of Aging, 1965-1987,” *Studies in History and Philosophy of Biological and Biomedical Sciences*, 2011, doi:10.1016/j.shpsc.2011.05.001. For a more descriptive account by a gerontologist, see James E. Birren, “A Brief History of the Psychology of Aging,” *Gerontologist*, 1961, 1, 127-34.

² Baker and Achenbaum, “A Historical Perspective,” 262; Achenbaum, *Crossing Frontiers*, 95-100.

³ Moreira and Palladino, “Ageing between Gerontology and Biomedicine,” 356.

⁴ Moreira and Palladino, “‘Population Laboratories’ or ‘Laboratory Populations,’” 2. The notion of “epistemic culture” was borrowed from Karin Knorr-Cetina, *Epistemic Cultures: How the Sciences Make Knowledge* (Cambridge, Mass.: Harvard University Press, 1999).

⁵ Steven Epstein, *Inclusion: The Politics of Difference in Medical Research* (Chicago: University of Chicago Press, 2007), 30-52.

⁶ American public hospitals’ role in caring for indigent and sick people has been well documented. See Charles E. Rosenberg, *The Care of Strangers: The Rise of America’s Hospital System* (Baltimore: Johns Hopkins University Press, 1987), 322-27. Also see Morris J. Vogel, *The Invention of the Modern Hospital: Boston, 1870-1930* (Chicago: University of Chicago Press, 1980), 72-75; Rosemary Stevens, *In Sickness and in Wealth: American Hospitals in the Twentieth Century* (New York: Basic Books, 1989), 9-10, 28-29.

⁷ Douglas Carroll, “The First Almshouse: Abating a Public Nuisance (1773-1822),” *Maryland State Med. J.*, 1966, 15:1, 87-90, 87.

⁸ Douglas Carroll, “The Baltimore City Hospitals under the Department of Public Welfare: Social Change (1935-1955),” *Maryland State Med. J.*, 1966, 15:9, 105-8.

⁹ King to Stieglitz, 23 May 1940, folder Administrative files—E. J. Stieglitz 1941 I, Box 11, Nathan W. Shock Papers, Bentley Historical Library, Ann Arbor, Michigan (hereafter NWS).

¹⁰ Rosenberg, *The Care of Strangers*, 326,

¹¹ Steele to King, 17 February 1939, folder Administrative files—E. J. Stieglitz 1941 I, Box 11, NWS.

¹² King to Waxter, 23 February 1939, folder Administrative files—E. J. Stieglitz 1941 I, Box 11, NWS.

¹³ Stevens, *In Sickness and in Wealth*, pp. 28-29.

¹⁴ See King to Steele, 6 March 1939, folder Administrative files—E. J. Stieglitz 1941 I, Box 11, NWS; King to Steele, 7 June 1940, folder Administrative files—E. J. Stieglitz 1941 I, Box 11, NWS.

¹⁵ Frank to Thompson, 11 March 1940; Thompson to Karl Meyer, 1 May 1940, Record Group 443, Records of NIH 1930-1948, Individual Institutes (Org. File) Chemistry—Phys Biology National Heart Institute, folder 0110, Box 135, National Archives and Records Administration, College Park, Maryland.

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- ¹⁶ Stieglitz to King, 21 May 1940, folder Administrative files—E. J. Stieglitz 1941 I, Box 11, NWS.
- ¹⁷ King to Stieglitz, 8 June 1940, folder Administrative files—E. J. Stieglitz 1941 I, Box 11, NWS; King to Stieglitz, 16 September 1940, folder Admin. files E. J. Stieglitz 1939-1941 I, Box 11, NWS.
- ¹⁸ King to Stieglitz, 4 October, 1940, folder Admin. files E. J. Stieglitz 1939-1941 I, Box 11, NWS.
- ¹⁹ Victoria A. Harden, *Inventing the NIH: Federal Biomedical Research Policy, 1887-1937* (Baltimore: Johns Hopkins University Press, 1986), 55; Buhm Soon Park, “The Development of the Intramural Research Program at the National Institutes of Health after World War II,” *Perspect. Biol. Med.*, 2003, 46, 383-402, 386.
- ²⁰ “Opening Remarks of Surgeon General Thomas Parran,” 23 May 1941, p. 2, folder E. J. Stieglitz Conference on Mental Health 1941, Box 11, NWS.
- ²¹ Hyung Wook Park, “Edmund Vincent Cowdry and the Making of Gerontology as a Multidisciplinary Scientific Field in the United States,” *J. Hist. Biol.*, 2008, 41, 529-72, 544-53. The relationship between the Great Depression and the making of gerontology was already briefly mentioned by Gerald Gruman. See Gerald Gruman, “Introduction,” in *Roots of Modern Gerontology and Geriatrics*, ed. Gerald J. Gruman (New York: Arno, 1979), 4-5. On the multidisciplinary of gerontology, see also Stephen Katz, *Disciplining Old Age: The Formation of Gerontological Knowledge* (Charlottesville: University of Virginia Press, 1996), 104-34.
- ²² See W. Andrew Achenbaum, *Old Age in the New Land: The American Experience since 1790* (Baltimore: The Johns Hopkins University Press, 1978), 127-41; *Social Security, Visions and Revisions: A Twentieth Century Fund Study* (Cambridge: Cambridge University Press, 1986), 13-37; William Graebner, *A History of Retirement: The Meaning and Function of an American Institution, 1885-1978* (New Haven: Yale University Press, 1980), 153-214; Carole Haber and Brian Gratton, *Old Age and the Search for Security: An American Social History*, (Bloomington, Indiana University Press, 1994), 172-85.
- ²³ Cowdry to Ludwig Kast, 9 October 1935, folder 9, Box 31, Edmund Vincent Cowdry Papers, Bernard Becker Medical Library, Washington University, St. Louis, Missouri (hereafter EVC).

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- ²⁴ Cowdry, "Citizen Cells: How Cells Manage Their Social Problems," undated but probably written in the 1930s, pp. 56A(84)-57(85), folder 1, Box 142, EVC.
- ²⁵ The Club for Research on Ageing Minutes of Meeting, 11-12 January 1940, folder 2, Box 41, EVC.
- ²⁶ Cowdry to Kast, 28 October 1935, folder 9, Box 31, EVC.
- ²⁷ Achenbaum, *Old Age in the New Land*, 52-53.
- ²⁸ This view has been critically discussed by many scholars. See Brian Gratton, "The New History of the Aged: A Critique," in *Old Age in a Bureaucratic Society: The Elderly, the Experts, and the State in American History*, ed. David Van Tassel and Peter Stearns (Westport, Conn.: Greenwood, 1986), 3-29; Katz, *Disciplining Old Age*, 27-76. On medical science's role in this process, see Thomas R. Cole, *The Journey of Life: A Cultural History of Aging in America* (Cambridge: Cambridge University Press, 1992), 161-211; Carole Haber, *Beyond Sixty-Five: The Dilemmas of Old Age in America's Past* (Cambridge: Cambridge University Press, 1983), 47-81.
- ²⁹ King to Stieglitz, 16 September 1940, folder Admin. Files E. J. Stieglitz 1939-41 I, Box 11, NWS.
- ³⁰ "Clinical Material in Four Chronic Medical Wards at Baltimore City Hospitals as of March 20, 1941," 20 March 1941, folder E. J. Stieglitz Research Proposals, Box 11, NWS.
- ³¹ "U.S. to Launch Old-Age Study in Baltimore," *Baltimore Sunday Morning*, 6 October 1940.
- ³² Haber and Gratton, *Old Age and the Search for Security*, 179.
- ³³ The medical discourse on the distinction between normal age changes and pathological alteration has been documented by several scholars. See Gerald N. Grob, "From Aging to Pathology: The Case of Osteoporosis," *J. Hist. Med. All. Sci.*, 2011, 66, 1-39; Thomas G. Beach, "The History of Alzheimer's Disease: Three Debates," *J. Hist. Med. All. Sci.*, 1987, 42, 327-49; Patrick Fox, "From Senility to Alzheimer's Disease: The Rise of the Alzheimer's Disease Movement," *Milbank Q.*, 1989, 67, 58-102; Laura Davidow Hirshbein, "'Normal' Old Age, Senility, and the American Geriatrics Society in the 1940s," *J. Hist. Med. All. Sci.*, 2000, 55, 337-62.

³⁴ “IV. Clinical Studies in Uric Acid Clearance in Relation to Age, Arteriosclerosis, Gout, and Renal Disease,” undated but probably written in 1940 or 1941, p. 3, folder E. J. Stieglitz Research Proposals, Box 11, NWS.

³⁵ “Diagnosis routine A,” undated but probably written in 1940 or 1941, p. 5, folder E. J. Stieglitz Research Proposals, Box 11, NWS.

³⁶ Susan Lederer, *Subjected to Science: Human Experimentation in America Before the Second World War* (Baltimore: Johns Hopkins University Press, 1995).

³⁷ As far as the archival records show, there is only one instance of antivivisectionists’ attack on gerontology. Even this attack was not directed upon those in the NIH. See James H. Cruikshank to William deB. MacNider, 19 November 1937, folder 414, Box 11, William deB. MacNider Papers, Wilson Library, University of North Carolina, Chapel Hill, North Carolina (hereafter WDM).

³⁸ For example, see Thomas Laqueur, *Making Sex: Body and Gender from the Greeks to Freud* (Cambridge, Mass.: Harvard University Press, 1992).

³⁹ Park, “Edmund Vincent Cowdry,” 544-53.

⁴⁰ In most cases, gerontologists used the term “he” rather than “she” whenever they mentioned an aged person in a singular form. Gerontologists rarely discussed the issue of women’s aging. See Minutes of Meeting of the Club for Research on Ageing, 21-22 March 1941, p. 11, folder 2, Box 41, EVC; Cowdry to Kast, 19 November 1935, folder 9, Box 31, EVC.

⁴¹ Minutes of the First Meeting of the National Advisory Committee on Gerontology, 26 November 1940, pp. 12-13, folder E. J. Stieglitz National Advisory Committee First Meeting, Nov. 25-26, Box 11, NWS.

⁴² Edward Stieglitz, “Geriatrics in National Defense,” 5 June 1941, p. 3, folder E. J. Stieglitz-Speeches, Box 11, NWS.

⁴³ See “Proposed Investigations by Unit on Gerontology,” folder E. J. Stieglitz Research Proposals, Box 11, NWS.

⁴⁴ Edward J. Stieglitz, “Studies in Uric Acid Clearance,” *Public Health Rep.*, 1942, 57, 1306-10.

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- ⁴⁵ It seems that the expiry of the Macy fund was not the only reason of Stieglitz's resignation. Lawrence Frank, in his personal letter, stated that Stieglitz had to leave the NIH "because of a development in his own personal family life which led the Surgeon General to request his resignation." See Frank to Clive McCay, 26 September 1953, folder Macy Foundation Contribution, Box 30, NWS.
- ⁴⁶ Sebrell to Shock, 23 May 1941, folder Career Appointments, Box 1, NWS.
- ⁴⁷ Hastings to Shock, 5 June 1941, folder Career Appointments, Box 1, NWS.
- ⁴⁸ See, for example, "Outline of Course: Physiology #102," folder U of C Physiology of Growth, Box 2, NWS; "Inventory of Procedures in Study of Adolescence," 1 January 1938, folder U of C Adolescent Studies, Box 2, NWS; "The Physiological Changes Taking Place during Adolescence," September 1938, p. 5, folder Research Proposal, Box 2, NWS.
- ⁴⁹ Frank to Robert Underhill, 10 January 1940, folder U of C correspondence K-Z, Box 2, NWS.
- ⁵⁰ Progress Report, October 1943, p. 2, folder Annual Report 1943, Box 12, NWS.
- ⁵¹ Shock to "Tommy," 30 May 1944, folder Correspondence 1934-1974, Box 7, NWS.
- ⁵² Shock to "Bob," 13 January 1942, folder Correspondence 1934-1974, Box 7, NWS.
- ⁵³ Shock to "Herbert," 27 July 1942, folder Correspondence 1934-1974, Box 7, NWS.
- ⁵⁴ Hastings to Shock, 5 June 1941, folder Career Appointments, Box 1, NWS.
- ⁵⁵ Club for Research on Ageing Minutes of Meeting, 28 February 1942, p. 16, folder Club for Aging 1942 March, Box 30, NWS.
- ⁵⁶ "Conference on Nutritional Requirements for the Ageing Population," 1-2 November 1941, pp. 10-15, folder Conference on Nutrition, Box 30, NWS.
- ⁵⁷ Report of Unit on Gerontology: Oct. 1941 to Oct. 1943, p. 1, folder Annual Report 1943, Box 12, NWS; Nathan W. Shock, "Older People and Their Potentialities for Gainful Employment," *J. Gerontol.*, 1947, 2, 93-102.
- ⁵⁸ Report of Unit on Gerontology: Oct. 1941 to Oct. 1943, pp. 4-5, folder Annual Report 1943, Box 12, NWS.
- ⁵⁹ See Sebrell to Shock, 24 July 1946, 6 November 1947, folder 1941-49 (incomplete), Box 13, NWS.

⁶⁰ “Space Used by Section on Gerontology,” 10 December 1947, folder 1941-1949 (incomplete), Box 13, NWS.

⁶¹ Shock to “Roy and Frieda,” 30 May 1944, Box 7, folder Correspondence 1934-1974, NWS; “Budget,” 6 June 1945, p. 6, Box 13, folder 1941-49 (incomplete), NWS.

⁶² Stephen P. Strickland, *Politics, Science, and Dread Disease: A Short History of United States Medical Research Policy* (Cambridge, Mass.: Harvard University Press, 1972), 154-57, 213.

⁶³ Harden, *Inventing the NIH*, 182.

⁶⁴ Moreira and Palladino, “Ageing between Gerontology and Biomedicine,” 357-58; Hyung Wook Park, “Refiguring Old Age: Shaping Scientific Research on Senescence, 1900-1960” (PhD diss., University of Minnesota, 2009), 178-81.

⁶⁵ For a historical explanation on why geriatrics fared better in Britain, see David K. Carboni, *Geriatric Medicine in the United States and Great Britain* (Westport, Connecticut: Greenwood, 1982). On how old age was considered a social rather than a medical problem in Britain, see Moira Martin, “Medical Knowledge and Medical Practice: Geriatric Medicine in the 1950s,” *Soc. Hist. Med.*, 1995, 8, 443-61.

⁶⁶ Shock to Hastings, 11 March 1953, folder Shock 1942-71, Box 25, Albert Baird Hastings Papers, National Library of Medicine, Bethesda, Maryland (hereafter ABH). He also said in an interview that he had a particularly hard time in persuading James Shannon, who was then associate director of the NHI, and Robert Berliner, one of Shannon’s colleagues. See “NIA Interview Transcript,” pp. 27-29, folder Biography, Box 1, NWS.

⁶⁷ For example, see Minutes of the Second Meeting on Gerontology, undated, folder USPHS Conference on Aging, Box 5, NWS.

⁶⁸ See “NIA Interview Transcript,” pp. 25-26, folder Biography, Box 1, NWS. The city government’s budget for the BCH also covered the cost of electricity, water, gas, and nursing services for the human subjects. See Nathan W. Shock, *Trends in Gerontology*, 1st ed. (Stanford: Stanford University Press, 1951), 98.

⁶⁹ “NIA Interview Transcript,” p. 24, folder Biography, Box 1, NWS.

⁷⁰ “National Heart Institute Operating Budget,” July-December 1949, folder Budget & Operating Plan Jul-Dec 1949, Box 13, NWS.

⁷¹ Most research proposals of gerontologists did not specify how they were related to heart diseases even though the official project description form had an item on “Significance of Heart Research.” See, for example, N. W. Shock, S. P. Baker, G. W. Gaffney, F. A. Silverstone, “Analysis of NIH Program Activities,” undated, folder Annual Report 1955, Box 12, NWS.

⁷² “Adaptive Enzymes and Age,” folder Annual Report 1952-56, Box 12, NWS; N. W. Shock, Gerontology Branch Annual Report—1957, folder Annual Reports 1957, Box 12, NWS.

⁷³ See, for example, Charles H. Barrows, “Individual Project Report: Age Changes in Cellular and Tissue Biochemistry,” 1956, folder Annual Report 1956, Box 12, NWS.

⁷⁴ C. Fox and J. E. Birren, “Some Factors Affecting Vocabulary Size in Later Maturity, Age, Education, and Length of Institutionalization,” *J. Gerontol.*, 1949, 4, 19-26.

⁷⁵ Park, “Edmund Vincent Cowdry,” 546; “Longevity, Aging, and Caloric Restriction: Clive Maine McCay and the Construction of a Multidisciplinary Research Program,” *Hist. Stud. Nat. Sci.*, 2010, 40, 79-124, 108. For traditional standpoint, see, for example, Hippocrates, “Aphorisms,” in *The Genuine Works of Hippocrates*, tr. Francis Adams (Baltimore: Williams and Wilkins, 1939), 294; Galen, “The Nature and Sources of Growth and of Disease,” in *A Translation of Galen’s Hygiene*, tr. Robert Montraville Green (Springfield, Illinois: Charles C. Thomas, 1951), 6-8; Roger Bacon, *The Cure of Old Age and Preservation of Youth* (London: Tho. Flesher and Edward Evets, 1683), 2; Francis Bacon, *History Natural and Experimental of Life and Death or of the Prolongation of Life* (London: William Lee and Humphrey Moseley, 1658); Christopher William Hufeland, *The Art of Prolonging Life* (London: J. Bell, 1797), 35, 63-64; Marie François Xavier Bichat, *Physiological Researches upon Life and Death*, tr. Tobias Watkins (Philadelphia: Smith and Maxwell, 1809), 1-2; Homer Bostwick, *An Inquiry into the Cause of Natural Death or Death from Old Age* (New York: Stringer and Townsend, 1851), 7.

⁷⁶ Charles S. Minot, *The Problem of Age, Growth, and Death: A Study of Cytomorphosis* (New York: Putnam, 1908), 214-16; Alfred E. Cohn and Henry A. Murray, Jr., “Physiological Ontogeny I. The

Present Status of the Problem,” *Q. Rev. Biol.*, 1927, 2, 469-90, 482, 490; Raymond Pearl, *The Biology of Death* (Philadelphia: Lippincott, 1922), 138-49, 225; A. J. Carlson to Cowdry, 28 Jun 1937, folder 397 Box 10, WDM. Reading Alexis Carrel’s papers along with Cowdry’s also reveals this point clearly. See Alexis Carrel, “Tissue Culture and Cell Physiology,” *Physiol. Rev.*, 1924, 4, 1-20; Edmund Vincent Cowdry, “Ageing of Tissue Fluids,” in *Problems of Ageing: Biological and Medical Aspects*, ed. E. V. Cowdry (Baltimore: Williams and Wilkins, 1939), 642-94, 643, 685, 689.

⁷⁷ Indeed, it was one of Shock’s six “axioms” illustrated in Baker and Achenbaum’s paper. Baker and Achenbaum, “A Historical Perspective,” 265-66.

⁷⁸ Nathan W. Shock, “Ageing of Homeostatic Mechanism,” in *Cowdry’s Problems of Ageing*, 3rd edition, ed. Albert I. Lansing (Baltimore: Williams and Wilkins, 1952), 415-46, 421, 430, 436.

Nathan W. Shock, “Kidney Function Tests in Aged Males,” *Geriatrics*, 1946, 1, 232-39.

⁸⁰ Nathan W. Shock, “Physiological Aspects of Mental Disorders in Later Life,” in *Mental Disorders in Later Life*, ed. Oscar J. Kaplan (Stanford: Stanford University Press, 1945), 33. Also see, J. A. Murray, “The Chemical Composition of Animal Bodies,” *J. Agr. Sci.*, 1922, 12, 103-10; H. H. Donaldson and S. Hatai, “On the Weight of the Parts of the Brain and on the Percentage of Water in Them according to Brain Weight and to Age, in Albino and in Wild Norway Rats,” *J. Comp. Neurol.*, 1931, 53, 263-307.

⁸¹ Shock, “Physiological Aspects,” 44, 48.

⁸² Nathan W. Shock and Marvin J. Yiengst, “Age Changes in the Acid-Base Equilibrium of the Blood of Males,” *J. Gerontol.*, 1950, 5, 1-4, 4.

⁸³ The postwar economic recovery brought forth more positive views on aging. See Richard B. Calhoun, *In Search of the New Old: Redefining Old Age in America, 1945-1970* (New York: Elsevier, 1978), 1-12.

⁸⁴ Shock, “Older People,” 101; National Heart Institute Annual Report, Calendar Year 1952, p. 65, folder Annual Report, 1952, Box 12, NWS; Summary Statement of Research Accomplished—1955, folder Annual Report 1955, Box 12, NWS.

⁸⁵ Shock, “Older People,” 96.

⁸⁶ National Heart Institute Annual Report, Calendar Year 1952, p. 66, folder Annual Report, 1952, Box 12, NWS; Shock, "Older People," 98-99.

⁸⁷ Shock to Hastings, 11 March 1953, folder Shock 1942-71, Box 25, ABH.

⁸⁸ As Epstein, Londa Schiebinger, Robert Blakely and Judith Harrington scholars have noted, the result of research using unprivileged people was often considered to have an implication for the humanity in general, including those in higher social status. See Epstein, *Inclusion*, 39-41; Londa Schiebinger, "Human Experimentation in the Eighteenth Century: Natural Boundaries and Valid Testing," in *The Moral Authority of Nature*, ed. Lorraine Daston and Fernando Vidal (Chicago: University of Chicago Press, 2004), 384-408; Robert Blakely and Judith Harrington, "Grave Consequences: The Opportunistic Procurement of Cadavers at the Medical College of Georgia," in *Bones in the Basement: Postmortem Racism in Nineteenth-Century Medical Training* (Washington, D.C.: Smithsonian Institution Press, 1997), 162-83.

⁸⁹ Saul Baker, George Gaffney, Nathan Shock, and Milton Landowne, "Physiological Responses of Five Middle-Aged and Elderly Men to Repeated Administration of Thyroid Stimulating Hormone (Thyrotropin; TSH)," *J. Gerontol.*, 1959, 14, 37-47, 46.

⁹⁰ Donald Watkin, Eleanor Lawry, George Mann, and Max Halperin, "A Study of Serum Beta Lipoprotein and Total Cholesterol Variability and Its Relation to Age and Serum Level in Adult Human Subjects," *J. Clin. Invest.*, 1954, 33, 874-83, 880.

⁹¹ "Conference on Nutritional Requirements for the Ageing Population," 1-2 November 1941, p. 10, folder Conference on Nutrition, Box 30, NWS.

⁹² Memorandum, 30 August 1949, p. 4, folder Club for Aging, Box 30, NWS.

⁹³ Nathan W. Shock, *Trends in Gerontology*, 2nd ed. (Stanford: Stanford University Press, 1957), 123.

⁹⁴ Gerald M. Oppenheimer, "Becoming the Framingham Study, 1947-1950," *Am. J. Public Health*, 2005, 95, 602-10; Katz, *Disciplining Old Age*, 115-16.

⁹⁵ Lederer, *Subjected to Science*, 128.

⁹⁶ A. H. Norris to Shock, 6 November 1957, folder Longitudinal Studies W. W. Peter July-Dec. 1958, Box 21, NWS.

⁹⁷ Shock to Peter, 29 October 1958, folder Longitudinal Studies W. W. Peter July-Dec 1958, Box 21, NWS.

⁹⁸ Shock to Barbara C. King, 8 August 1958, folder Longitudinal Studies W. W. Peter July-Dec 1958, Box 21, NWS.

⁹⁹ Norris to Shock, 16 September 1958, folder Longitudinal Study Questionnaire, Box 22, NWS; Clyde E. Martin and Arthur H. Norris, "The Baltimore Longitudinal Study of Aging: Characteristics of the Sample," 11 November 1976, p. 14, folder Longitudinal Studies Program Conference on Women's Aging, Box 24, NWS. In 2011, more than fourteen hundred volunteers are participating in this longest-running research project on aging. See <http://www.grc.nia.nih.gov/branches/blsa/blsanew.htm>

¹⁰⁰ "The Aging Program of the National Institutes of Health," 30 July 1959, p. 2, folder Longitudinal Study Administrative Record 1956-1962, Box 22, NWS.

¹⁰¹ Peter to "Neighbor," 8 April 1958, folder Longitudinal Study W. W. Peter 1957-1958 June, Box 21, NWS.

¹⁰² "Clinical Examinations of Outpatients," and "Longitudinal Studies: THIRD SERIES Testing Schedule," folder Longitudinal Study Administrative Record 1956-1962, Box 22, NWS.

¹⁰³ This table is based on The National Heart Institute, "Publications of the Gerontology Branch, National Heart Institute, 1940-1962" (Bethesda: U.S. Department of Health, Education, and Welfare, 1962). A copy in box 5 of the Nathan Shock Papers includes the articles published after 1962. The papers with "unspecified human subjects" are mostly abstracts or short articles published in conference proceedings without details on the identity of human subjects.

¹⁰⁴ Norris to Shock, 16 September 1958, folder Longitudinal Study Questionnaire, Box 22, NWS.

¹⁰⁵ Peter to Shock, 3 September 1958, folder Longitudinal Studies W. W. Peter July-Dec 1958, Box 21, NWS.

¹⁰⁶ According to gerontologist Arthur Norris, women's applications were rejected because the "facilities are geared to house only men." See Norris to S. F. Ashelman, 16 January 1958, folder Longitudinal Studies W. W. Peter Correspondence 1957-1958 June, Box 21, NWS.

¹⁰⁷ In fact, many clinical trials in America after the mid-twentieth century relied only on Caucasian men. Yet it is also known that the reasons for determining the typical human subjects varied according to each research group's priorities in their historical context. See Epstein, *Inclusion*, 31-33. On how white male students in prestigious universities were considered to have the "normal" body, see Heather Munro Prescott, "Using the Student Body: College and University Students as Research Subjects in the United States during the Twentieth Century," *J. Hist. Med. All. Sci.*, 2002, 57, 3-38.

¹⁰⁸ Cole, *Journey of Life*, 139-58.

¹⁰⁹ But I do not agree with Cole's claim that it was only in the 1960s that the ideal returned to the American public. *Ibid.*, 232-33.

¹¹⁰ Cole, *Journey of Life*, 227-33.

¹¹¹ "Managing the Creative Scientist," *Lab. Manage.*, September 1969, 36.

¹¹² As many people pointed out, however, Medicare and Medicaid have had significant limitations. For example, see Laurie Kaye Abraham, *Mama Might Be Better Off Dead: The Failure of Health Care in Urban America* (Chicago: University of Chicago Press, 1993).

¹¹³ Moreira and Palladino, "'Population Laboratories' or 'Laboratory Populations,'" 9. On model organisms, see Robert Kohler, *Lords of the Fly: Drosophila Genetics and the Experimental Life* (Chicago: University of Chicago Press, 1994); Karen Rader, *Making Mice: Standardizing Animals for American Biomedical Research, 1900-1955* (Princeton, Princeton University Press, 2004).

¹¹⁴ Clyde E. Martin and Arthur H. Norris, "The Baltimore Longitudinal Study of Aging: Characteristics of the Sample," 11 November 1976, p. 12, folder Longitudinal Studies Program Conference on Women's Aging, Box 24, NWS.

¹¹⁵ *Ibid.*, 5.

¹¹⁶ Moreira and Palladino, "'Population Laboratories' or 'Laboratory Populations,'" 7-9.

¹¹⁷ For a thorough sociological discussion of these complex problems, see Epstein, *Inclusion*, 203-32.