WARREN E. BOW
President

DAVID D. HENRY
Executive Vice-President

Tel: Randolph 8717

WAYNE UNIVERSITY
BOARD OF EDUCATION
DETROIT 1, MICHIGAN

COLLEGE OF MEDICINE

June 14, 1945

Air mail - Special ERE phoned 6/15/45

	ERE	15	ERE	0
✓	CBJ		CBJ	0
✓	WWA		WWA	0

Mr. Edwin R. Embree
Julius Rosenwald Fund
Chicago, Illinois

My dear Mr. Embree:

I should like to admit at the outset that I am behaving like an individual who is entirely confused and frustrated. This is especially true in view of the letter I wrote you a few days ago. And for fear that I will give you an even worse opinion of my ability to judge what course to take I will not enter into a lenghty discussion.

I have reached the point where I need the opinion of some one who occupies a vantage position such as you do, and for this reason I am respectfully asking if you will favor me with your candid opinion on the matter I will presently relate. I wish to assure you that I have the highest regard for your opinion and am turning to you as a source of help. I hope this reliance on your opinion will not prevent you from writing me frankly, for I sincerely believe that there comes a time in everyone's life when sound counsel or the opinion of others is needed.

I haven't found three persons in Detroit who agree with me that I am doing the wisest thing by returning to Dillard. They all point to the very wholesome influence my presence at Wayne has had on race relations and say that they fear a step backwards will be taken if I leave. I have definite reasons for believing that many years will pass before the medical school considers another Negro for a teaching post, if I should leave. This belief is strenghtened because my leaving will bring to a halt the present researches in surgical bacteriology and will severely handicap our teaching staff. On the other hand, if I should remain the field would be open for additional appointments. A case in point was the appointment of Mrs. Bertrice Stewart of Chicago to the post of research technician in the department of surgery. As for my own advancement, I have been told that I can go as far as my ability and industry will carry me.

My request to you is this: Will you be so kind as to tell me in which of the two situitions you think I have the larger opportunity for making an outstanding contribution to the culture and development of my people? Your opinion is earnestly requested, and it is with a great deal of anxiety that I await your reply.

Very sincerely yours,

C. W. Buggs

C. W. Buggs

WARREN E. BOW
President

DAVID D. HENRY
Executive Vice-President

FELLOWSHIPS

WAYNE UNIVERSITY

BOARD OF EDUCATION
DETROIT 1, MICHIGAN

May 25, 1945.

Buggs, CW

COLLEGE OF MEDICINE

	ERE	28	ERE	29
	VH		VH	0
✓	WWA		WWA	0
	CSG		CSG	0

Mr. Edwin R. Embree
Julius Rosenwald Fund
Chicago, Illinois

Dear Mr. Embree:

Without making a long story too long, I will begin my reply to your letter of May 15th by stating that when I indicated to my superior colleagues here the possibility of my returning to Dillard (I had already been appointed) a number of overtures were made in attempts to have me remain. With pardonable pride, I knew that I had injected new life into the bacteriology department, had set a pace for good teaching, and was doing the major portion of research for my department as well as all of the bacteriological research for the department of surgery. (Surgery has been conducting extensive researches on contaminated wounds and burns under contracts from the Committee on Chemotherapeutic and Other Agents of the Office of Scientific Research and Development, and I have been an active member of the staff from the very first week of my arrival.) I was sure that I would be pressed to remain, both by my own department and the department of surgery, and for this reason I urged Mr. Dent to have me appointed at Dillard as quickly as possible so that I would not be tempted to accept increased offers on this end. I arrived at the decision to accept Mr. Dent's very kind invitation to return to Dillard without consulting anyone, not even Mrs. Buggs.

I was quite unprepared, however, for the extent to which my colleagues were willing to go in order to have me remain here. I had always thought that I wished to study medicine, and when it was arranged for me to enter the freshman class in July and continue the research in surgical bacteriology at a salary almost equivalent to my teaching salary, I thought it well to consider once and for all time my desires, both from the standpoint of what I wanted to do in life and what personal satisfactions and joys I wished to have - this irrespective of my contract to return to Dillard. It was necessary for me to obtain admission to the freshman class at once, if I had any intention of entering this year, and for this reason I presented my application before I had decided what I was going to do. I was granted admission to the freshman class on the 10th of this month, the requests for recommendations, as sent to you, being necessary formalities.

WARREN E. BOW
President

DAVID D. HENRY
Executive Vice-President

WAYNE UNIVERSITY
BOARD OF EDUCATION
DETROIT 1, MICHIGAN

COLLEGE OF MEDICINE

Up until about ten days ago it was impossible for me to reason for myself as so many persons, both within and without the university system, were influencing me to remain. All of the arguements for my return to Dillard that I had formulated in the solitude of my own chamber were torn apart, and nice pictures were painted for me of the opportunities I have here for personal growth, the added prestige a medical degree would give me, and the "pots of money" I would make, especially because of my connection with the college of medicine. Three of my friends in the city offered to loan me money each year until I finished, and one of them had written a check for $500 before I knew definitely that I could enter the July class.

However, I knew within my soul that I was not doing the thing I wanted to do. I knew that I was being influenced against my own judgment to remain here and study medicine, just as I had been influenced to remain at Dillard. At Dillard I had had the courage of my conviction and had broken my ties to come to Wayne. I saw no reason why I should not continue to trust my own judgment. So, I cast off all outside influence and talked over with Maggie the things I wanted to do in life that would contribute most to my own personal satisfaction and happiness. I indicated to her that the things I wished to do did not involve medicine or Wayne University, but Dillard. I have known this all along, even before I left Dillard for Wayne, but had I remained at Dillard there would have lingered the uncertainty of just what I wished to do. Coming to Wayne has definitely fixed my goal in life. I know that it is not medicine; I know that it is not achieving so-called prestige as a Negro professor in a white institution; I know it is not achieving recognition as an investigator primarily. I have confirmed my belief that the contribution I wish most to make is the development of a pre-medical curriculum at Dillard second to none, while at the same time contributing to the development of Dillard as an outstanding institution in all of its Divisions. I have also confirmed my belief that I am at heart a pure scientist and will find greater satisfaction and expression for whatever scientific abilities I have in following up the researches I began at Woods Hole. I have confirmed my belief that for me the everyday happinesses and joys derived from work and of being alive are to be found with our friends in New Orleans.

For these reasons I talked with Mr. Dent a fortnight ago and informed him that I had no intention of remaining here, either as a member of the faculty or as a medical student. My application for admission to the freshman class has already been withdrawn.

WARREN E. BOW
President

DAVID D. HENRY
Executive Vice-President

WAYNE UNIVERSITY
BOARD OF EDUCATION
DETROIT 1, MICHIGAN

COLLEGE OF MEDICINE

Mr. Edwin R. Embree, page 3:

I have related these things, Mr. Embree, for two reasons. First, as an individual and as President of the Julius Rosenwald Fund you have for more than a decade shown an interest in my development. I shall never forget the talk we had with Mr. Dent prior to my selection as a Rosenwald Fellow. Every time I have been tempted to break my promise or contract I have thought of you. As an individual interested in me I wanted you to know my story.

Second, as the Julius Rosenwald Fund is interested in the development of Dillard, I wanted you to know that I am returning to Dillard without regrets, without any fears that I am "throwing away an opportunity to achieve". I did not ask Mr. Dent for any commitments, for I know that he is interested in building a strong college, and if the college grows I am sure that I will gain in stature with it.

My work here has been stimulating and profitable, and has been done under the most pleasant of conditions. All of my clllcagues have been most cordial. The students have been exceptionally fine, and if there has been one who objected to being taught by a Negro he has not evidenced his objection.

With the kindest of regards, I am

Very truly yours,

C. W. Buggs

C. W. Buggs

FELLOWSHIPS

May 15, 1945

Dear Doctor Buggs: The enclosed application form has come to me from the Wayne University College of Medicine and I am not sure that I understand the present situation. Are you planning to enter the College of Medicine yourself, or is the questionnaire for some relative? I should be glad to assist you in this matter as soon as I am enlightened in regard to present plans.

Very truly yours,

EDWIN R. EMBREE

ERE*SO
Enc.

Dr. Charles W. Buggs
Wayne University
Detroit, Michigan

FELLOWSHIPS

Buggs, John W

January 11, 1944

Dear President Bow: I congratulate you on the appointment of Dr. Charles W. Buggs. I have known of his work for many years and regard him as one of the most creative of the younger bacteriologists. He has capacity for original research and a gift for teaching. The appointment is brilliant on its merits. It takes on special significance in showing that Wayne University is able to rise above prejudice and appoint members of its staff regardless of race, creed or color. You have done a fine thing both for science and for democracy.

Very truly yours,

EDWIN R. EMBREE

ERE:SO

President Warren E. Bow
Wayne University
Detroit 1, Michigan

(15)

November 2, 1943

Dear Doctor Buggs: Thank you for your letter of October 26. In behalf of Dillard University, I am very sorry that you are leaving there, but I congratulate you on the opportunities offered at Wayne University. As you request, we are cancelling the remainder of your Fellowship. We are proud to have had your name on our lists.

Done D.E. Bal was $825.00

Very truly yours,

EDWIN R. EMBREE

ERE:30

Dr. C. W. Buggs
Dillard University
Division of the Sciences
New Orleans, Louisiana

DILLARD UNIVERSITY
NEW ORLEANS

DIVISION OF THE SCIENCES

October 26, 1943

	ERE	28	ERE	11/2
	VH	11/3	VH	0
	DE		DE	0

Mr. Edwin R. Embree
Fulius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

My dear Mr. Embree:

I feel it necessary to write this letter for two reasons: first, to express my appreciation for the recommendation you sent Dean Edgar H. Norris in support of my candidacy for a position at Wayne University, and second, to relinquish my Fellowship with the Julius Rosenwald Fund.

Having been honored by the Rosenwald Fund with Scholarships and a Fellowship, I am certain that your recommendation was given great weight in considering my candidacy. And I am happy to report to you that I was offered, and have accepted, an instructorship in the Department of Bacteriology.

It was most difficult for me to come to the decision to leave Dillard. As a matter of fact, I originally declined the nomination for the position, but reconsidered it because of Dean Norris' apparent desire for me to come to Wayne and my feeling that I was being unfair to myself in rejecting the offer on sentimental grounds. My greatest concern was the verbal pledge I made to you and Mr. Dent - namely, that I would remain at Dillard at least for one year after finishing up the Fellowship. I have a great regard for one's pledge, and it was most difficult for me to break mine. But after thinking through the matter I came to the conclusion that your advice to me, if I had asked, would have been to give careful consideration to what I was best prepared to do and my own desires. As I had spent four years preparing myself for the field of medical bacteriology, and as it was my fondest desire to actively enter that field, I decided to accept Wayne's offer. I hope that you will understand my action and know that I took this course only after long deliberation.

I wish to express my appreciation to you personally, and to the Rosenwald Fund for the continued interest shown in my advancement throughout the years since 1931. I shall make every effort, in my new position, to prove worthy of the trust and confidence placed in me.

With kindest regards, I am

Very sincerely yours,

C. W. Buggs

(C. W. Buggs)

Comm. Folder

DILLARD UNIVERSITY
NEW ORLEANS, LA.

FELLOWSHIPS

OFFICE OF THE PRESIDENT

March 18, 1942

	WCH	3/20	WCH	2 b

Dear Mr. Haygood: I enclose a letter which I have just received from Dr. Charles W. Buggs who is our Professor of Biology and Head of the Division of the Sciences. Dr. Buggs is one of the most valuable members of our faculty. He has been here since the very beginning of the University, and apparently is well pleased to settle upon building a good department of biology at Dillard. At one time he was invited to come to the Howard University School of Medicine, and at another time to head the biology department at Morehouse. His refusal of those offers and the zeal with which he has gone about developing the science curriculum at Dillard leads us to want to do all we can to better prepare him for his teaching.

I know that the deadline is already passed for you to receive fellowship applications, but if under the peculiar circumstances involved you can consider Dr. Buggs as an applicant for a Rosenwald fellowship this year, Dillard University would be very grateful for your so doing.

Dr. Buggs has had three Rosenwald fellowships for study toward the M.S.and Ph.D. degrees at the University of Minnesota. There is probably a good deal of information about him in the Fund files. If it is possible to consider Dr. Buggs' application, he and I will be glad to furnish any additional information you need now.

Sincerely yours,

A. W. Dent

AWD:C
Enclosure

A. W. Dent
President

Mr. William C. Haygood
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

Air mail special delivery

DILLARD UNIVERSITY
NEW ORLEANS

March 16, 1942

President A. W. Dent
Dillard University
New Orleans, La

My dear Mr. Dent:

It has been my desire, since first coming to Dillard in 1935, to pursue courses in the field of zoology at the University of Chicago, and it was my plan to make a formal request for sabbatical leave in 1943. A very careful consideration of the whole problem of future study however has led me to bring the matter to your attention this year. And I have chosen this particular time to present my request for sabbatical leave in order that trustee action might be taken at the spring trustee meeting if you deem my request worthy of consideration.

A review of my graduate record of courses pursued in partial fulfilment of the requirements for the M.S. and Ph.D. degrees at the University of Minnesota will reveal the fact that my graduate training has been that of a bacteriologist and biochemist and not that of a zoologist. This has not worked a serious hardship in my teaching duties, for the techniques of learning and the over-all scientific maturity incident to the winning of the doctorate degree, together with the awareness of my own needs in this particular sphere of learning, have made it possible for me to handle my courses without difficulty. It is true however that the greater portion of my time has been devoted to the organization of courses within my department, the writing of syllabi, and the organization of the Division of the Sciences as a whole, of which I am chairman.

With the department and the Division on fairly solid foundations, I need now to give attention to more academic problems, and in order to achieve any degree of success in this sphere it is necessary that I study for at least one year. I am very reluctant to teach in one field and do research in another, for this can only result in a weaking of the department, inferior teaching, and alienation of student interests. I feel that it is to the interest of the University, the Division, and my department that I become identified as a zoologist and not as a bacteriologist or biochemist by training. My previous training does, I think, put me in a unique position for acquiring the information, tools and techniques of the zoologist, for the basic needs of the zoologist are the disciplines of chemistry and physics, and these I have already acquired, to some extent, from my previous training.

DILLARD UNIVERSITY
NEW ORLEANS

My purposes in requesting sabbatical leave may be set down as follows:

1. To obtain orientation in the field of zoology through formal courses, seminars, and conferences so that I might be better prepared

    a. for conducting zoological research,
    b. for directing student problems in zoology, and
    c. for stimulating and fostering interest in zoology in my students;

2. To obtain orientation in more advanced courses in zoology as an aid to the teaching of the courses presently taught here;

3. To gain first-hand information on the organization and implementation of the biological and physical sciences at the University of Chicago in furtherance of our Divisional curriculum; and

4. To continue investigations on the biochemistry and physiology of medusae which were begun several years ago under a Sigma Xi grant-in-aid but which were discontinued because of lack of facilities, lack of time, and lack of material with which to work.

The program of study contemplated is:

1. A formal course in embryology and research on medusae at Woods Hole during the summer of 1942;

2. Formal courses in embryology, physiology, and zoology and a study of the Chicago Plan for the biological and physical sciences during the fall, winter and springs quarters of 1942-1943; and

3. Study and research at Woods Hole during the summer of 1943.

A review of our regulations concerning sabbatical leaves makes it expedient that I say a word about finances. It will not be possible for me to finance this study without outright fellowships for the summer work at Woods Hole and a sustaining fellowship for the work at the University of Chicago. As it is rather late in the year for placing applications, I am wondering if it is advisable to seek aid from the Julius Rosenwald Fund. If it is your feeling that it is too late in the year to place an application for a fellowship I will withdraw my request for sabbatical leave, for, as indicated above, I could not finance a year of graduate study on less than my present salary.

I have refrained from referring to any accomplishments I may have made during the six and a half years that I have served as Chairman of the Division of the Sciences and as head of the department of biology, for if any have been made I am sure that you and the Dean are cognizant of them. It is my hope,

DILLARD UNIVERSITY
NEW ORLEANS

however, that you concur with my belief that the University, the Division and the department will be better served by me after a year of study and that you will present this request to the trustees with a recommendation that it be granted. Also, I would appreciate any suggestion you might have with reference to making application for a fellowship.

Very sincerely yours,

C. W. Buggs

C. W. Buggs
Professor of Biology and
Chairman, Division of the Sciences

Chicago, Ill.
Defender 11/6/43

Appointed

DR. CHARLES W. BUGGS

Former Dillard university professor of biology, who was appointed Nov. 1 to the College of Medicine, Wayne university, Detroit, the first Negro full-time faculty member. Dr. Buggs received his Ph.D. from the University of Minnesota in 1934. In addition to his teaching duties the new appointee will conduct research in war wound infections.

Defender 11/6

Afro American
12/4/44

White College Hires Colored Bacteriologist

Afro-American 12/9/44

DETROIT. — Dr. Charles W. Buggs, 37-year-old bacteriologist, recently became the first colored person to hold a full-time position at Wayne University here.

Already he has distinguished himself as a key figure in research on treatments for burns and wound infections, having aided in developing one cure from the inside out.

Work Called Important

The importance of Dr. Buggs's work was cited by Dr. John W. Hirschfield, director of laboratory study, who said: "Most advances in infection treatment depend on identification of infecting micro-organisms and drugs which can cure them."

"When treating infections in fleshy wounds or compound fractures," said Dr. Buggs, "we isolate the micro-organisms, test their sensitivity to sulfa drugs and penicillin, and check the patients to note effects of dosage."

Lung Treatment Sought

The bacteriologist is also interested in treatment of lung abscesses in which anaerobic organisms (those independent of free oxygen) are recovered. "These have not even been classified yet," he says.

Dr. Buggs, who came here from Dillard University, New Orleans, completed undergraduate study at Morehouse College, Altanta. He too a master's degree at Minnesota University, where In 1934 he received his doctorate in bacteriology.

SCHOLARSHIP

Buggs, Charles

January 20, 1937

Dear Dr. Buggs: I have read with much interest your letter of January 10 written from the heights of Pisgah. I think I understand your position and I certainly appreciate your impatience. I do not, however, see any way by which this Fund can properly help. A foundation cannot wisely begin to help individuals in their regular work. We can give fellowships for preparatory studies to a wide number of promising individuals and we can make general appropriations to institutions and movements, but if we should begin to select individual members of a faculty for special assistance we would be, in effect, interfering with the administration and policies of the institution. So far as Dillard University is concerned, we have from the beginning made substantial contributions both to the buildings and to current expense. I hope we can continue these, but I am sure they must continue to be made to the general budget of the University and that the constituted authorities of that University must decide on the proper division of the funds to the various departments and faculty members.

JAN 22 1937

I recognize the difficulties of a research scientist in a small institution which has limited finances. I think it proper for such an institution to make unusual provisions for exceptionally qualified members of the faculty even if this seems to violate the principle of standardized democracy. The officers of the university rather than outside agencies must make the decisions as to which departments and which professors they will give special facilities. And then, of course, there is the problem of finding financial support for these special provisions as well as for the regular budget.

All I can suggest is that you place your problems as vigorously as possible before President Nelson. I have no doubt that he will sympathize with them. Whether or not he can find special financing is another question.

I realize that this must be a disappointing reply to you, but I believe you will understand and agree with our position.

Very truly yours,

EDWIN R. EMBREE

ERE:JW

Dr. C. W. Buggs
Department of Biology
Dillard University
New Orleans, Louisiana

SCHOLARSHIP

DILLARD UNIVERSITY
NEW ORLEANS

January 10, 1937 Beggs, Charles W

	RRP	18	9th	20

Mr. Edwin R. Embree
Julius Rosenwald Fund
5901 Ellis Avenue
Chicago, Illinois

My dear Mr. Embree:

In February of last year I sent you a set of inscribed reprints which represented the published results of the work I executed at the University of Minnesota as a student, sustained for two years and a summer as a Rosenwald Fellow. It is with regard to a continuation of this work which I wish to direct your attention to.

Since leaving the University of Minnesota I have been virtually isolated from the scientific world. First, because it is just about impossible for me to follow advancements in the several fields since I do not have access to libraries, and second, becaude it has been impossible for me to cintinue my researches. I feel that the work I did at Minnesota is indicative of greater accomplishemnts, if I am given the opportunity. But so far the opportunity has not presented itself, not-withstanding the fact that I have sought after such opportunities. In a word, I feel at the present moment that the four years I spent at Minnesota have brought me only unto the mountain of Nebo. I have been premitted to look out into the promised land, but so far, I have been denied the privilege of entering. The question I put to myself is will I too die and be buried in the land of Moab, without even visiting the promised land. It seems as if I will.

JAN 22 1937

I need not go into the matter of what preparation I have had for doing independent research, for I believe you to be fully aware of the type of work I did as a student at Minnesota. I should, however, like to mention that while at Minnesota I outlined quite a number of projects which I sincerely believed I would be given the opportunity to execute just as soon as I located in one of our schools. TIME has brought me only an exexution of the work by other men in my field; work which I had partially completed, but for which I receive no credit.

In September of last year I received a grant of $250.00 from The Society of the Sigma Xi for work on jelly-fishes. I accepted this grant fully confident that I would be able to make a substantial addition to it from other sources. I believed the recognition of my ability and the importance of the project by Sigma Xi would act as a wedge in opening up other avenues of funds. But so far I have been disappointed. I am therefore appealing to the Rosenwald Fund to give financial aid for the completion of the work on jelly-fishes, and for

continuing the work which was started at the University of Minnesota.

I should like to request a grant of $5000.00 with which to purchase equipment, supplies, and books for continuing my investigations into the physiology and biochemistry of medusae and the electrophoretic phenomena of biological units. The work on medusae (jelly-fishes) will be conducted in part at Waveland, Mississippi. I should wish to construct a more or less temporary marine biological laboratory at Waveland where this work would be pursued. The laboratory at Waveland would serve for spring and summer investigations, and it is entirely probable that this venture could lead to a justifiable desire and need for the permanent establishment of a marine biological laboratory for teachers in this section of the country.

Five thousand dollars would equip me for permanent work, not only in the field of electrophoresis, but for quite a number of physiological, biochemical, bacteriological, and zoological problems. Indeed, the bulk of this equipment is indicated in courses in general physiology and bacteriology, courses which we do not as yet offer. Once the equipment is purchased, the investigations may be sustained by sums amounting to from $100 to $300 annually.

In a word, Mr. Embree, I am asking the Rosenwald Fund to equip my department so that it might offer courses in general physiology and bacteriology, which at the same time will permit me to continue my investigations.

I am inclosing a tentative outline of proposed researches. I trust this will serve to indicate something of the nature and scope of the work I contemplate, and that you will be disposed to act favorably toward this request.

With sincere wishes for the New Year, I am

Very sincerely yours,

C. W. Buggs

C. W. Buggs
Assistant Professor of Biology

DILLARD UNIVERSITY
NEW ORLEANS

January 10, 1937

A TENTATIVE OUTLINE COVERING (I) AN INVESTIGATION INTO THE BIOCHEMISTRY AND PHYSIOLOGY OF MEDUSAE, AND (II) THE ELECTROPHORETIC PHENOMENA OF BACTERIA.

Investigation to be conducted by : C. W. Buggs, Ph. D. (Minnesota)
Assistant Professor of Biology
Dillard University, New Orleans, La.

Location of Investigator : Dillard University, New Orleans, La.

Purpose and Importance of the Investigation into the Biochemistry and Physiology of Medusae.

The Purpose of this investigation is to attempt to fill a definate gap in the knowledge of the physiology of digestion and the chemistry of medusae. With regard to digestion, very few accurate observations have been made, and there seems to be no literature dating beyond the 19th century. A few of the early biologists, Müller, Haller, the Hertwigs, and Fredericq, Krukenberg, and Moebius, during the last decade of the 19th century, have reported on this problem, but no extensive physicochemical investigation seems to have been made. Gortner and Bateman have both reported on the water content of medusae, but we know of no work covering the chemistry of the group.

Studies contemplated by the applicant should add materially to our knowledge of the chemistry and digestion of the Coelenterata. Further, such studies may throw new light on the general problem of digestion, and the physiological role of water in organisms. The chemistry of the group would be a definite contribution to the field of biochemistry.

Plan of Investigation

(1) A redetermination of the water content of several species, representing different genera of medusae.

(2) A study of the osmotic properties of medusae.

(3) A complete biochemical analysis, with especial attention to:

a. Analysis of the bell
b. Analysis of the digestive tract
c. Analysis of the tentacles

(4) The enzymes of medusae, with a study of optimum reactions for digestion.

Purpose and Importance of Investigations into the Electrophoretic Phenomena of Bacteria.

Bacteriology is a young science; and in its infancy, it was crippled by being developed from the practical point of view. It was developed by men who were primarily interested, not in the nature of bacteria, but in what ways bacteria were responsible for some of the ills of man, and in what ways they could be utilized in alleviating these ills. Consequently, the field of bacteriology is yielding diminishing returns, and the investigator has come to realize that further progress in this field will be made only after we have learned more about bacteria themselves; only after we have delved into the secrets of bacteria from the point of view of the pure scientist.

Electrophoretic studies of bacteria are relatively recent additions to the armamentarium of the investigator, but they bid well to contribute important information concerning the elemental nature of bacteria; information which, no doubt, may lead to new and worthwhile applications of bacteria in furthering man's conquest of disease.

The applicant has already made two worthwhile contributions to this phase of bacteriological investigation, and he feels that further contributions can be made if he is given the means of continuing his investigations.

In the following paragraphs, I have outlined problems upon which I have already done considerable work. The completion of these problems awaits only equipment for continuing work.

Plan of Investigation

Problem I. A statistical Analysis of the Accuracy of Electrophoretic Measurements.

It is the common practise of most investigators to report electrophoretic velocities correct to the second decimal place, and in many instances to differentiate between biological units

on a basis of such differences. These average values, obtained from a supposedly random sample of from ten to twenty individuals, usually ten, are derived, in the majority of cases, from parent populations that are hheterogeneous with respect to the velocities of the individual cells composing the population. Statistically, this procedure falls into the category of the technique of small samples, unless a sufficiently large sample is drawn in order to obtain a truly random sample.

Such a procedure is not followed by the average investigator working in the field of electrophoresis, and nothing is said concerning the spread or range of the populations worked with. In the words of Sir Francis Galton, "The knowledge of an average value is a meagre piece of information. How little is conveyed by the bald statement that the average income is 100 pounds compared with what we should learn if we were told how English incomes were distributed!".

The purpose of this first problem is to study the accuracy of electrophoretic measurements employing the best available cell and technique, and working with both homogeneous and heterogeneous populations. Preliminary experiments indicate that unless the parent population is very homogeneous a sample of 50 must be drawn in order to obtain a significant or trustworthy average. If this procedure is not followed, the average value must be calculated according to the technique of small samples.

Problem II. The Electrophoretic Velocity of Physiologically Young Bacteria.

Preliminary studies with physiologically young cultures of Escherichia coli have yielded results which indicate that such cells migrate faster than adult cells. Theoretically, this is the logical consequence of the lower isolectric point, for it has been shown that physiologically young bacteria have low isolectric points, and are relatively stable in suspension in virtue of their higher surface potential difference. Accordingly, such cells should migrate at faster velocities than cells with high isolectric points.

If it can be shown that physiologically young cells have higher electrophoretic velocities than adult cells, this would be additional evidence in support of the thesis that such cells differ from adult cells in the physico-chemical nature of the plasma membrane.

(Part of this problem has been published for me, but there still remains certain portions of it which are original with me).

Problem III. Chemical, Serological, and Electrophoretic Studies on Salmonella species.

Preliminary studies show that certain Salmonella species may be distributed into the following electrophoretic groups:

1. Cultures that are strictly homogeneous with respect to the velocity of the individual cells composing the culture, and which, on single-cell isolation, yield only homogeneous cultures.

2. Cultures that are very heterogeneous with respect to the velocity of the individual cells composing the culture, and which, on single-cell isolation, yield only heterogeneous cultures.

3. Cultures that have zero velocity, or a velocity very nearly zero, and which yield similar cultures.

This study would be conducted in an attempt to learn if there is any correlation between the serological, chemical, and electrophoretic properties of certain Salmonella organisms. If the surface potential difference of bacteria is in part a function of the chemical nature of the plasma membrane, it follows that chemical and serological analyses should lead to some degree of positive correlation with electrophoresis.

Problem IV. A Complete Investigation of the Electrophoretic Velocities and Disease Producing Propensities of the Green-Producing Streptococci.

As yet, no investigator has attempted a confirmation of the numerous studies made by Rosenow and his associates into the disease producing propensities of green streptococci of different electrophoretic velocities.

This problem is related to problem III, but significantly different in this respect: green-producing streptococci are heterogeneous with respect to the velocity of the individual cells composing a given culture. Rosenow has attached pathogenic significance to each of the frequency groups of a given culture, believing that the various velocities are closely correlated with biological properties, and that transmutations between the groups are functions of seasonal changes, atmospheric conditions, etc.

Conetmplated studies involve:

1. Attempted confirmations of various phases of Rosenow's studies.

2. Repetition of Rosenow's studies employing more advanced techniques and electrophoretic cells.

3. Studies on single-cell cultures of green-producing streptococci.

Problem V. Influence of the Culture Medium upon the Electrophoretic Velocity of Bacteria.

The applicant has already published data on the influence of growth, senescence, and death upon the electrophoretic velocity of bacteria. It remains to be determined whether or not electrophoretic phenomena are influenced by the type of culture medium employed, and its hydrogen ion concentration. Many investigators have attributed variations in their replicated data to the use of different culture media, but without adequate evidence in support of their contention.

Respectfully submitted by,

C. W. Buggs

C. W. Buggs
Assistant Professor of Biology

UNIVERSITY OF MINNESOTA
THE MEDICAL SCHOOL
MINNEAPOLIS

DEPARTMENT OF BACTERIOLOGY
AND IMMUNOLOGY

203 Millard Hall
May 14, 1934.

SCHOLARSHIP

Mr. George R. Arthur
Julius Rosenwald Fund
Chicago, Illinois.

My dear Mr. Arthur:

It seems as if I am really reaching the end of my formal education and at last I can breathe somewhat freely. My thesis has been completed and filed. Only the final oral exam is before me. That will come around the first of June.

Again I wish to express my appreciation to the Julius Rosenwald Fund for the support given me in my undertaking. Especially am I grateful to you for the personal interest shown in my progress.

Before sending out my "plea" for a position I thought it worthwhile to see if you had any suggestions. In the spring of '33 I sent out something like twenty-five letters, but to no avail. This year I am going to limit myself to four or five schools. Dr. Adams informed me some time ago that Howard would not be in position to make another addition to the Department of Bacteriology before 1935-'36, so that I see no need for writing Howard again. I should like to get something at Atlanta University, but Dr. Hope could offer nothing last year. I realize that my field is rather specialized, but in order to raise the standards of our schools such courses as bacteriology will have to be given sooner or later. My main reason for going into this field was that it was virgin as far as we were concerned. I see no reason why Atlanta University should not begin the teaching of bacteriology.

My training the last two years has been largely in the field of chemistry, and I feel adequately prepared to instruct in two fields of chemistry which I feel sure are not offered to any extent at Atlanta University or Morehouse. These fields are colloid chemistry and biochemistry. I could easily divide my time between bacteriology and one or both of these fields. The three are intimately connected. You may recall that my thesis was worked out in colloid chemistry (applied to bacteriological problems).

I should appreciate any suggestions you may have to offer and anything you may be able to do toward seeing me placed.

Mrs. Buggs is well and joins me in best wishes to you.

Very truly yours,

C. W. Buggs.

MAY 22 1934

P. S. My application for a National Research Fellowship will not come before the Board until September. It was necessary for me to have my thesis accepted before applying.

SCHOLARSHIP

February 6, 1934

My dear Mr. Buggs: The Julius Rosenwald Fund does not make recommendations with reference to applications for fellowship grants. I am sure that Mr. Embree will be very glad to answer in detail and recommend you very highly if the National Research Council should write him a letter with reference to your work at the University of Minnesota under the grants made by the Fund in the past.

With reference to your question concerning the National Research Council grants being awarded to Negroes, I do not know of any such grant ever having been given to a Negro. Of course, there may have been some about which we do not know. I read with a great deal of interest the copy of your letter to the Medical Fellowship Board of the National Research Council. I could understand it, I think primarily, because of the time you took to explain the details of your experiment at the time I was in Minneapolis. I sincerely hope that something can be done for you in the matter of placement next year. If you have any knowledge of an opening in any colleges in your field, we should of course, be interested in helping you to secure the job if anything can be done by us in that direction.

Very truly yours,

GEORGE N. ANTHUS

GRA:VH

Mr. C. W. Buggs
205 Millard Hall
University of Minnesota
Minneapolis, Minnesota

FEB 7 1934

SCHOLARSHIP
Buggs-CW

UNIVERSITY OF MINNESOTA
THE MEDICAL SCHOOL
MINNEAPOLIS

203 Millard Hall

DEPARTMENT OF
BACTERIOLOGY AND IMMUNOLOGY

January 22, 1934. 2/6

Mr. George R. Arthur
Julius Rosenwald Fund
Chicago, Illinois.

Dear Mr. Arthur:

It was my intention to write you a month or two ago in order to let the Julius Rosenwald Fund know that I was still forging ahead as I believe them to be still interested in my progress here at the University of Minnesota. However, that writing has been postponed until the present as I can now tell you in a simple and brief manner of some of the accomplishments I made while receiving aid from the Julius Rosenwald Fund.

The enclosed letter to the National Research Council will serve two purposes: 1) it will convey to you my plans for the immediate future; 2) it will give you a clear and simple idea of some of the results of my labor of the past eighteen months. I think, also, that this letter will give you a much clearer conception of my problem than you now entertain.

There are so many applicants for these fellowships that I feel that every bit of recommendation I can get will help. A recommendation from the Julius Rosenwald Fund should help me quite a bit, and I am wondering if such could be supplied.

Incidentally, do you know of any Negroes who have received fellowships from the National Research Council?

My sponsor, Dr. Stuart Mudd, is at the University of Pennsylvania. If the fellowship is granted I would work there with him.

I am afraid that I will have nothing to do next year if I do not get an appointment from the National Research Council. Dr. Adams was here two or three months ago and it seems as though there will not be another opening at Howard for two or three years. I consider it quite unfortunate that I could not accept his recent offer.

I should greatly appreciate anything the Julius Rosenwald Fund might be able to do toward recommending me to the National Research Council.

Mrs. Buggs is well and joins me in best regards to you.

FEB 7 1934

Sincerely yours,

C. W. Buggs.

Copy

Letter to be read by advisor before final copy made.

The Medical Fellowship Board
National Research Council
2101 Constitution Avenue
Washington, D. C.

Gentlemen:

In addition to the information given in my application for a fellowship in medicine of the National Research Council I should like to submit the following with reference to my proposed research project; its importance, its relation to existing knowledge in this field, and the facilities needed for its prosecution.

Following the development of a practicable apparatus for measuring accurately the mobility of a bacterium under the influence of a difference of electrical potential by Northrop in 1922, several investigators made various attempts to correlate the electrical surface density of bacteria with their biological activities; mainly with the virulence of a given strain. From such studies it was hoped that virulence diagnoses could be made readily and inexpensively. Further, it was, and still is, the belief of one investigator that studies of the electrical charge of bacteria (technically termed cataphoresis) lead to information which, in the case of many of the streptococcal diseases, makes a diagnosis, otherwise difficult or impossible, relatively simple.

However, a study of the literature of bacterial cataphoresis will reveal that the field is in a chaotic state. Paradoxical findings appear in a great number of the publications, while

there are as many negations for a given correlation as there are confirmations.

In our work here at the University of Minnesota we have approached the problem in what we feel to be a more logical manner than hitherto adopted. We feel that the chaotic state of the field is due to the fact that these various correlations have been attempted without first ascertaining as nearly as possible the various factors responsible for the magnitude of the charge upon a given bacterial species. That is, we believe that chemical and serological analyses will lead to the demonstration of the factors of greatest importance in maintaining a given charge on a bacterial species.

Before such chemical and serological studies were begun, however, we felt that less important, though necessary, experiments should be worked out in order to determine the trustworthiness of the results of these later investigations. For this reason our doctorate thesis deals entirely with what we term "preliminary work".

As most species of bacteria are composed of individuals showing great heterogeneity with reference to charge, we have attempted to work out from biometrical principles the trustworthiness of measurements made on a small sample of such individuals in characterizing the parent population. That is, our first step was to determine the experimental error due to the errors of random sampling. We feel that, as a preliminary work, this study is very important. It is the main orienting factor in determining the significance of any group of measurements.

This error of randon sampling has been entirely neglected by other investigators.

Two other factors have been greatly talked about in the literature but very little done about them. These are the variations in the charge of bacteria with their age and death (natural and artifical). It is quite obvious that such studies must of necessity be preceded by a study of the significance or trustworthiness of cataphoretic measurements of bacteria. We believe that our results on variations ofttthe charge of bacteria with age and death of the cells will go a long way toward elucidating the general problem of bacterial cataphoresis.

Our third study deals with the effect of the hydrogen ion concentration and salt concentration of the growth medium on the magnitude of the charge. This is practically the first attempt of an investigator to study the influence of the growth environment of bacteria on their surface charge. These studies have proved very important in that they give us some insight as to the direction of variation of the charge under certain conditions of growth. It is also probable that these studies will lead to newer knowledge concerning the role of potassium salts in bacterial metabolism.

With the above knowledge concerning the trustworthiness of measurements, the variations to be expected with cells of different ages, and the influence of the pH of the growth medium accumulated, and, with additional knowledge concerning the charge of bacteria when grown in media of different fundamental compositions which we are at present accumulating, we feel that we are prepared to

undertake the more serious and important study of chemical and serological analyses in relation to the cataphoretic behavior of bacteria.

My sponsor, Dr. Stuart Mudd, concurrs with me with respect to the importance of chemical and serological analyses of bacteria in leading to more fundamental viewpoints of the relation of bacterial charge to bacterial virulence, and perhaps bacterial indentification and classification. Dr. Stuart Mudd is the most conservative worker in this field I know of and has ample facilities (with a few additions) for the prosecution of our researches.

Trusting that my application will receive favorable consideration, I am

Very sincerely yours,

UNIVERSITY OF MINNESOTA
THE MEDICAL SCHOOL
MINNEAPOLIS

DEPARTMENT OF
BACTERIOLOGY AND IMMUNOLOGY

June 14, 1933

Mr. George R. Arthur
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

Dear Mr. Arthur:

I am inclosing a copy of a letter which I received from Dr. Adams this morning, also a copy of a letter from him under date of May 24. From this (the latter) communication, I was almost positive of the position. It is good, however, to know that he may give me another chance to locate at Howard. I am sending these letters to you as they may contain information which may be of immediate interest to you.

Very truly yours,

C. W. Buggs.

C. W. Buggs

CWB:H
Enc.2.

Copy.

HOWARD UNIVERSITY

Washington, D. C.

School of Medicine
Office of the Dean

June 12, 1933

Mr. Charles W. Buggs
Department of Bacteriology
and Immunology
The University of Minnesota
Minneapolis, Minnesota

Dear Mr. Buggs:

After having considered all available applicants for the position of Instructor in Bacteriology, Preventive Medicine and Public Health in the College of Medicine of Howard University for the school year 1933-1934, we have decided that it would not be well to call you away from your work at the University of Minnesota before you complete the requirements for the Doctor's degree.

Forced economy has required that our staff be cut to such a minimum which I am sure would not permit you to continue research here during the next school year.

The salary is rather small for a married man with the training you have. We would not care to have you come and suffer disappointments. We are not at all sure how soon it will be before salaries can be brought up out of the recently enforced reduction.

Your qualifications have impressed us and the excellent recommendations that have been furnished for you have impressed us also. I hope we may be able to interest you some time later with terms that will be much more attractive.

Sincerely yours,

(Signed) Numa P. G. Adams
Dean.

JUN 23 1933

COPY

HOWARD UNIVERSITY

Washington, D. C.

School of Medicine
Office of the Dean

May 24, 1933

Mr. C. W. Buggs
Department of Bacteriology
University of Minnesota
Minneapolis, Minnesota

Dear Mr. Buggs:

In my last letter to you I promised to take up with you again the question of a vacancy in our Department of Bacteriology, Preventive Medicine and Public Health for the school year of 1933-1934.

I am now in a position to state definitely that we have available an instructorship in Bacteriology, full-time, for one year, at a salary of $1,800.00 per year with the understanding that -

(a) the appointee shall be available for duty for eleven month's service during the year.

(b) the salary shall be subject to the same reduction the University may find it necessary to apply to other teachers during the year 1933-1934.

(c) this appointment is to expire automatically on June 30, 1934.

In accordance with the Federal Economy Act, the above mentioned salary is subject to a cut of 15 per cent. At present there is no indication that a further cut will be necessary for next year.

All initial appointments in this rank are for one year and will expire automatically subject to reappointment.

If you wish to consider this vacancy I shall be pleased to have you furnish me the following at your earliest convenience:

(1) Transcript of your educational record to date.

(2) Please fill out the enclosed personnel blank and furnish photograph as requested.

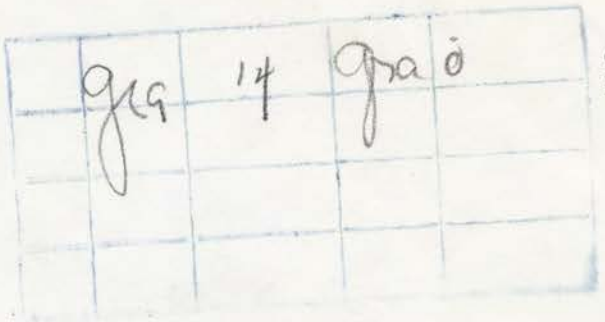
(3) Kindly furnish reference as to your qualifications for this position. Include please a letter certifying as to your good moral character. We do not doubt this, of course, but we always wish to present such a letter with our recommendations.

With kind regards, I am
Very truly yours,
(Signed) Numa P. G. Adams, Dean

HOWARD UNIVERSITY
WASHINGTON, D.C.

SCHOOL OF MEDICINE
OFFICE OF THE DEAN

SCHOLARSHIP



June Twelfth
1 9 3 3

Mr. George R. Arthur
Associate for Negro Welfare
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

Dear Mr. Arthur:

After having considered very carefully the application of Mr. Charles Wesley Buggs for appointment to the position of Instructor in Bacteriology, Preventive Medicine and Public Health in the College of Medicine of Howard University, we have decided that it would be best not to call Mr. Buggs from his work at Minnesota before he shall have completed his requirements for the Doctor's degree. I hope we may be able to offer him something worthwhile later. We were very much impressed with his training and the fine recommendations that have been furnished for him.

Sincerely yours

Numa P. G. Adams

Numa P. G. Adams
Dean

JUN 23 1933

UNIVERSITY OF MINNESOTA
THE MEDICAL SCHOOL
MINNEAPOLIS

May 29, 1933.

DEPARTMENT OF
BACTERIOLOGY AND IMMUNOLOGY

Mr. George R. Arthur
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois.

Dear Mr. Arthur:

I received a letter from Dr. Adams under date of May 24 in which he states that there is definitely an instructorship at Howard for next term. In view of this fact I will reject the Shevlin Fellowship if the Board of Trustees of Howard confirm Dr. Adams' recommendation. This, of course, should relieve the complication of making the additional grant of $200 in order that I might remain here for the summer session. I trust this will meet with your approval.

Mrs. Buggs is doing nicely. Was operated on the 19th and again on the 20th. She will be leaving the hospital this week.

With kind regards, I am

Very truly yours,
C. W. Buggs
C. W. Buggs

SCHOLARSHIP

May 8, 1933

My dear Mr. Buggs: I have received your letter of May fifth together with one from Dr. Larson. I am sure that we are very gratified to know that you received the Shevlin Fellowship in medicine. I shall have to take the matter up with Mr. Embree with reference to the appropriation of our last grant under the present conditions. The Julius Rosenwald Fund has been reluctant in the past to go in with other fellowship grants to help finance a student. The main basis of my appeal to Mr. Embree was that you would go to Howard at the end of the summer and that you needed to stay the entire summer at the University of Minnesota in order to get your Ph. D. Since this has been changed, I cannot at this time say just what Mr. Embree will do. I am leaving the city tomorrow for a week and will not be able to write you again until the twentieth of May.

I am sorry to hear that Mrs. Buggs will have to go to the hospital. I sincerely hope that neither one of the two operations you mention will be very serious.

JUN 12 1933

Very truly yours,

GRA:VH

GEORGE R. ARTHUR

Mr. Charles W. Buggs
809 Aldrich Avenue North
Minneapolis, Minnesota

UNIVERSITY OF MINNESOTA
THE MEDICAL SCHOOL
MINNEAPOLIS

DEPARTMENT OF
BACTERIOLOGY AND IMMUNOLOGY

SCHOLARSHIP

May 5, 1933

Mr. Geo. R. Arthur
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

Dear Mr. Arthur:

I am writing you with reference to recent developments in the case of Mr. Buggs. You will recall that in my talk with you during your visit here, I expressed the hope that it might be possible for Mr. Buggs to remain here for another year in order that he might complete the investigations which he now has under way.

We were fortunate in obtaining for Mr. Buggs the Shevlin Fellowship for the school year 1933-34. This fellowship carries with it a stipend of $500, which, however, cannot be drawn upon until October 15. We were then confronted with the problem of finding some way by which Mr. Buggs could maintain himself during the summer months. We applied to the Student Loan Fund and the Rockefeller Foundation, but in each case without success. Mr. Buggs finally concluded that he would move under a tree and live on herbs until October. Your letter of May 3 informing him that he had been granted an additional $200 from the Julius Rosenwald Fund was, therefore, a godsend to him. I am indeed pleased that it will now be possible for Mr. Buggs to remain in the department for another year. I am confident that he is the type of man who will be heard from in later years.

JUN 12 1933

I am leaving for Washington tomorrow. During my stay there I shall take the opportunity to visit Howard University and discuss with the dean of the medical school the possibility of an appointment there when he finishes his work here.

Very sincerely yours,

W. P. Larson

WPL:H

UNIVERSITY OF MINNESOTA
THE MEDICAL SCHOOL
MINNEAPOLIS

SCHOLARSHIP

DEPARTMENT OF
BACTERIOLOGY AND IMMUNOLOGY

Gra 13

April 12, 1933

Mr. George R. Arthur
The Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

OK
$200
EDR

Dear Mr. Arthur:

Mr. Buggs informs me that his application for a further grant which would enable him to complete his studies here has been denied because of inadequate funds. I am writing this letter in the hope that it may be possible for you to support Mr. Buggs until about September 1, in order that he may secure his Ph.D. degree. Mr. Buggs has no source of income other than that which he has received from your organization. His wife, who has been working and in that way contributing to his income, is now out of work and, I am told, has no prospect of employment during the spring and summer months. A grant of $225 would enable him to complete his course here.

It would be unfortunate if a man of Mr. Buggs' caliber and promise should be forced to discontimue his work now that he is so near his goal. As I have stated before, Mr. Buggs is a man of outstanding ability. He is the most brilliant and promising investigator that we have had in this department in many years. If given the opportunity I feel certain that he has the possibility of becoming an investigator and teacher of exceptional caliber.

JUN 12 1933

Yours very truly,

W. P. Larson

WPL:H

March 24, 1933

My dear Mr. Buggs: Please excuse my belated reply to your letter of March sixth. I have been in the East almost continuously since that time.

I think you are very fortunate to have received an offer to teach at Howard University. To be asked by the Howard University Medical School out of several hundred good teachers who are out of work this year I think is a tribute to the remarkable record you have made at the University of Minnesota. I do not believe that I should think about continuing on at the University should you be able to locate at Howard. As I told you in your laboratory, upon the occasion of my visit to Minneapolis, the Julius Rosenwald Fund will hardly be able to finance another fellowship grant for you. I am enclosing a copy of a letter from Mr. Hill of the General Education Board to whom I wrote in your behalf. I do not think at your age you will lose so very much in the slowing up of your research work, except as it may have to do with other persons in the field working on similar projects. It may be that you will be able to continue your research work at Howard University.

I am returning Dean Adams' letter of February 27th to you and your reply to him as of March 6th.

We have read the copy of the first few pages of your thesis and where we were able to follow it, we enjoyed it.

With best wishes for your health and with regards to Mrs. Buggs, I am

Very truly yours,

GRA:VH

GEORGE R. ARTHUR

Mr. Charles N. Buggs
809 Aldrich Avenue North
Minneapolis, Minn.

Enc.

HOWARD UNIVERSITY
WASHINGTON, D.C.

SCHOOL OF MEDICINE
OFFICE OF THE DEAN

March Eighth
1 9 3 2

Buggs - cr

Buggs

Mr. George Arthur,
Associate for Negro Welfare,
The Julius Rosenwald Fund,
900 So. Homan Avenue,
Chicago, Illinois.

Dear Mr. Arthur:

Dr. Mordecai W. Johnson has kindly referred to me for consideration and reply your letter concerning a young man who is studying Bacteriology on a fellowship grant and who is desirous of continuing his work at the Pasteur Institute.

Although we are not in position to state definitely that we could give employment to such a man at the end of the next two years, we should be pleased to know something of his previous training. We prefer to have a man who has already had medical training. If this man should turn out to be a first rate bacteriologist we may be able to place him by that time.

Very truly yours,

Numa P. G. Adams

Numa P. G. Adams,
Dean.

HW.

SCHOLARSHIP
Buggs - CW

809 Aldrich Ave., N.
Minneapolis, Minnesota
June 23, 1931.

To The Rosenwald Fund
New York, N. Y.

Gentlemen:

I, Charles Wesley Buggs, herewith beg to make formal application to the Rosenwald Fund for a Fellowship to pursue advanced education at home and abroad in the field of bacteriology. Accordingly, your indulgence is respectfully requested while I attempt to set forth briefly a history of my life and certain other facts which may convey to you the greatness of the fire of service and accomplishment which burns within my breast, but which as yet has found no outlet.

I am the third child of Dr. and Mrs. J. W. Buggs, there being five children in the family, two girls older, and two brothers younger than I. I was born in Brunswick, Georgia, August 6th, 1906, and received my education through the high school at St. Athanasius, Brunswick.

After receiving my diploma from St. Athanasius I entered the freshman class of Morehouse College, Atlanta, Georgia, in the fall of 1924, and there studied for the degree of Bachelor of Arts, intending to enter a medical college after the completion of my work. While at Morehouse I followed the well-beaten paths of the typical college youth by learning a little and forgetting a heap, and finally wound up in December of my senior year by marrying Miss Marguerite Bennett of Augusta, Georgia. Although I made no outstanding record at Morehouse, it was one that stood me well when I attempted to enter a northern university.

Immediately following my marriage it was predicted that I had seen the last of school, especially so as my eyes failed me for three weeks, following which I underwent an operation for appendicitis. However, I had the pleasure of finishing with my class in June, 1928, receiving the degree of Bachelor of Arts, having majored in zoology, with a minor each in physics, chemistry, and mathematics.

My entire outlook on life was changed with my marriage, and with it I experienced a change in personality. I at once became a serious-minded youth, and attempted to reach my goal by the only avenue left open to me, an indirect route.

During the school term of 1928-'29 I instructed at State College, Dover, Delaware, and attempted to follow graduate work at Chicago University during the fall of 1929. I found that I had insufficient funds, so that I returned to teaching in January, 1930. During the winter and spring of 1930 I instructed at Douglass High School, Key West, Fla.

Although I had no funds at the close of school (I was teaching at a salary of $45.00 per month) my wife and I decided that I had remained inactive long enough toward the actual realization of my goal, so that we began to cast around for a suitable place to work and attend school at the same time. I came to Minneapolis and here met Miss W. Gertrude Brown, Head Resident of Phyllis Wheatly Settlement House. She considered our case and was very anxious to help after we indicated our willingness to do any kind of work. Accordingly, she offered to Mrs. Buggs the only opening she had, that of housekeeper and cook, but did so rather reluctantly as she was almost positive the work was too strenuous, especially as Mrs. Buggs had recently suffered an injured shoulder. Her salary was to be $40.00 per month, room and board. To me Miss Brown gave the privilege of living in the house with Mrs. Buggs, and the opportunity of earning my board by serving meals and taking care of the kitchen after meals.

This we readily accepted, and through the great sacrifice of actual necessities, the unselfishness and economy of Mrs. Buggs, I have been able to remain at the University of Minnesota for over nine months. Our sole income has been $40.00 per month, which Mrs. Buggs has earned by hard work, and out of it we have clothed ourselves and paid tuition. To Mrs. Buggs goes all the credit, for my work at the University became of such a nature that it kept me at school until late at night, and I was cut off from the only means of earning my board. It has been impossible for us to pay it, and at the present time I am oweing to the Phyllis Wheatley House a board bill covering a period of seven months.

I entered the University of Minnesota with the determination to make good. It was my intention to work for a Master's Degree so that I could later demand a teaching salary sufficiently large to permit me to obtain at least two years of training in medicine before having to break into the program in order to earn more funds.

I entered the College of Science, Literature, and Arts as an unclassed student, and there came in contact with Dr. R. G. Green, professor of bacteriology in the Medical School. Dr. Green became greatly interested in what he termed my bacteriological technique, and invited me to enter the Graduate School, taking my major in bacteriology. He further stated that he was working on

epizootic fox encephalitis and that I was just the person he needed to do a comparative study of herpes encephalitis and fox encephalitis. I have done all of my major work under Dr. Green, and will complete requirements for the degree of Master of Science this summer.

I am enclosing for your consideration a recommendation for further advanced education from Dr. Green.

During my first quarter at the University of Minnesota Miss Brown, of the Phyllis Wheatley House, became interested in my scholastic record and evidenced it by getting in touch with Dr. Charles S. Johnson. I was introduced to Dr. Johnson and Miss Brown proceeded to impress him with my record and my need of financial help. Dr. Johnson at once recalled that Dr. Plotz, of the Pasteur Institute, Paris, France, was interested in training a Negro in bacteriology, but had, up to that time, found no suitable individual. He instructed me to get in touch with Dr. Plotz through Miss Elizabeth Walten of New York City, while he, in the meantime, would consider presenting my name to the Rosenwald Fund for a sustaining Fellowship.

Inclosed is a copy of a communication received from Dr. Plotz, in which he states that he is still desirous of training a Negro at the Pasteur Institute. In accordance with Dr. Plotz's request that I speak and read French fluently I have studied toward that end, and enclose herewith a certificate from Dr. Green to the effect that I have qualified for an examination in Scientific French at the University of Minnesota.

My humble request of you, Gentlemen, is that you consider me in the light of one with a keen and burning desire to serve humanity through a knowledge of medical science, but one who has been suppressed and handicapped through a lack of financial support. We are in dire need of men experienced in the way of research and experimental medicine, and now that I have within reach an opportunity to obtain expert training it seems as if it will be lost because of lack of funds. Negro hospitals are calling for experienced men, and here I see an avenue to serve humanity through a great institution. I am interested in hospital work and would enjoy nothing better that to serve a growing institution such as Provident Hospital, Chicago. As far as I have been able to ascertain, Negro hospitals are without experienced bacteriologists. Yet, the bacteriological and pathological laboratory form a part of the very foundation of medical progress and modern diagnosis. A partial verification of the fact that no Negroes are engaged in research or advanced bacteriological investigation is given in a personal communication from Dr. Julian H. Lewis. I enclose herewith a copy of this letter.

And now, Gentlemen, in the light of the above facts, I am respectfully asking that you consider me a

fairly good risk and invest a few hundred dollars in my future education, and in the advancement of Negro Institutions and medical science through the knowledge which I will be enabled to disseminate if given expert training.

As indicated in Dr. Plotz's and Dr. Green's letter , one year of study in America and two years abroad would give me a rare opportunity to become expertly trained and seasoned in bacteriological and hospital technology. One year at home is greatly desirable on account of the advanced type of work given at the Pasteur Institute. While here I would pursue work that would enable me to absorb to the maximum degree European scientific investigations, and at the same time would give me a full year of study toward the degree of Doctor of Philosophy. All of this work would be taken in the medical school, so that I would become thoroughly familiar with the ways and means of hospital life and organization.

For the first year, Gentlemen, I am respectfully requesting that you consider investing six hundred ($600.00) dollars in my education at the University of Minnesota. For the second year, I am asking that you consider investing twelve hundred dollars ($1200.00) to enable me to study at the Pasteur Institute, Paris France, together with transportation for my wife and me. If, during the first and second years of your investment you find that the risk is good and that the investment is profitable, I will respectfully request that you consider a third year's expenditure.

Thanking you for your kind and attentive indulgence to this rather lengthy request, I beg to remain

Very respectfully yours,

C. W. Buggs.

C. W. Buggs.

March 19, 1946

Dear Doctor Buggs: In Mr. Embree's absence from the office, I am herewith acknowledging and thanking you for the three reprints which have arrived.

Very truly yours,

SUMIKO OURA

SO Secretary to Mr. Embree

Dr. C. W. Buggs
Wayne University
Detroit, Michigan

Reprints:

The Value of Penicillin in the Treatment of Empyema
Appeared in The Journal of the Am. Med. Assoc. June 23, 1945, Vol.128, pp. 577-582(in collaboration)

Penicillin and Skin Grafting
Appeared in The Journal of the American Medical Association August 12, 1944, Vol. 125, pp. 1017-1019 (in collaboration)

The In Vitro Action of Streptomycin on Bacteria
Appeared in The Jounral of the Am. Med. Assoc. January 12, 1946, Vol. 130, pp. 64-67 (in collaboration)

May 28, 1945

Dear Doctor Buggs: Thank you for your good letter of May 25. In hearing of your plans to return to Dillard, my only regret was that of the loss of a person doing as distinctive a piece of work in race relations, as well as in biology, as you have been doing at Wayne. However, I understand the reasons for your decision and I respect them highly. It is a fine tribute to Dillard that with all the other opportunities before you, you elect to make your career there.

Very truly yours,

EDWIN R. EMBREE

ERE:SO

Dr. C. W. Buggs
College of Medicine
Wayne University
Detroit 1, Michigan

Biol

Please fill out and return in order ~~that~~ we may complete our records on former Rosenwald Fellows:

Name: (C)harles (W)esley Buggs

Present position: Assistant professor of bacteriology,

College of Medicine, Wayne University,

Address: 1512 St. Antoine St., Detroit 26, Michigan

Significant recent activities:

FELLOWSHIP

(Use additional sheet if desired)

BOARD OF EDUCATION
CITY OF DETROIT, MICHIGAN

WAYNE UNIVERSITY

WARREN E. BOW
PRESIDENT

DAVID D. HENRY
EXEC. VICE-PRESIDENT

January 24, 1944

	ERE	26	EDE	0
	VH	27	VH	0

Edwin R. Embree, President
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago 15, Illinois

Dear Mr. Embree:

Thank you for your gracious letter concerning the appointment of Dr. Charles W. Buggs on our staff. I believe he is going to be a very valuable member.

Sincerely yours,

Warren E. Bow

ops

Julius Rosenwald Fund

4901 Ellis Avenue
CHICAGO

FELLOWSHIPS

To

Mr. Charles W. Buggs
Marine Biological Laboratories
Woods Hole, Mass.

Payment Voucher No. 6786

Date August 31, 1943

September installment on fellowship grant - - - - - - - - $150.00

Ck. 29334

Accounts	Appropriation No.	Debit	Credit
Negro Fellowships	41-7	$150.00	

Prepared by	Checked by	Posted by	
NT			Comptroller

FELLOWSHIPS

(15) Buggs, C. W.

August 24, 1943

Dear Doctor Norris: In response to your letter of August 18, I am glad to recommend Dr. C. W. Buggs without reservation. He has proved to be an unusually resourceful and successful teacher. His ability in the field of research is outstanding. I regard him as one of the ablest of the younger biologists regardless of race or color.

Very truly yours,

EDWIN R. EMBREE

ERE:SO

Dr. Edgar H. Norris, Dean
Wayne University
Board of Education
Detroit 26, Michigan

WARREN E. BOW
President

FELLOWSHIPS

DAVID D. HENRY
Executive Vice-President

WAYNE UNIVERSITY
BOARD OF EDUCATION
DETROIT 26, MICHIGAN

COLLEGE OF MEDICINE
OFFICE OF THE DEAN

Buggs, C.W

August 18, 1943

ERE	20	EDE	24	
VH	9½	VH	0	
			353	

Mr. Edwin Embree, President
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

Dear Mr. Embree:

We have under consideration the appointment of Dr. C. W. Buggs to a position in our Department of Bacteriology.

Dr. Buggs has given your name as a reference. I would be pleased to hear from you in regard to his character, and to have your opinion of his ability and personality.

I will appreciate any information you may give, and you may be sure that it will be treated in a confidential manner.

Yours very truly,

Edgar M. Norris

Edgar M. Norris, M.D.
Dean

ehn:rh

Julius Rosenwald Fund

4901 Ellis Avenue
CHICAGO

FELLOWSHIPS

To

Mr. Charles W. Buggs

Marine Biological Laboratories

Woods Hole, Massachusetts

Payment Voucher No. 6705

Date July 30, 1943

August installment on fellowship grant - - - - - - - - $150.00

Ck.#29230

Accounts	Appropriation No.	Debit	Credit
Negro Fellowships	41-7	$150.00	

Prepared by	Checked by	Posted by	
AM			Comptroller

Marine Biological Laboratory
WOODS HOLE, MASSACHUSETTS

Brick, 330

VH 7/13 VH 0
mw 0
FELLOWSHIPS

July 11, 1943

Mrs. William C. Haygood
Julius Rosenwald Fund
Chicago, Illinois

My dear Mrs. Haygood:

I must apoligize for not acknowledging receipt of your letter of the 26th of May in which you so kindly permitted me to fulfil the terms of my fellowship grant with three summers here at Woods Hole. As University Marshal, I was in the midst of Commencement arrangements when your letter arrived, and I filed it without replying. It occurred to me today, in going through my correspondence with the Rosenwald Fund, that your letter was unanswered.

I therefore wish to express my appreciation for the generosity of the Fund in allowing me to continue this summer work as a Rosenwald Fellow.

I have made considerable progress on my problem dealing with the physiology and biochemistry of Medusae. The bibliographic work will be completed this summer, and with the major part of the physiological studies behind me, I have a distinct feeling that I could make better progress on the biochemical phase at the Department of Biochemistry of the University of Minnesota. The Marine Biological Laboratory has facilities primarily for work on living material. Consequently, when the time comes for me to perform the chemical analyses I think I will request permission to finish the work at the University of Minnesota.

I again wish to express appreciation for the consideration given me.

Very sincerely yours,

C. W. Buggs

C. W. Buggs

Julius Rosenwald Fund

4901 Ellis Avenue
CHICAGO

To

Dr. Charles W. Buggs
Marine Biological Laboratories
Woods Hole, Massachusetts

Payment Voucher No. 6645

Date July 1, 1943

FELLOWSHIPS

July installment on fellowship grant - - - - - - - - - $150.00

Ch. #29166

Accounts	Appropriation No.	Debit	Credit
Negro Fellowships	41-7	$150.00	

Prepared by	Checked by	Posted by	
MDU			Comptroller

Julius Rosenwald Fund

4901 Ellis Avenue
CHICAGO

FELLOWSHIPS

To

Mr. Charles W. Buggs

Dillard University

New Orleans, Louisiana

Payment Voucher No. 6422

Date May 26, 1943

Installment on fellowship grant - - - - - - - - - $300.00

Ck. #28921

Accounts	Appropriation No.	Debit	Credit
Negro Fellowships	41-7	$300.00	

Prepared by	Checked by	Posted by	
AM			Comptroller

FELLOWSHIPS

May 27, 1943

Dear Doctor Buggs: Mrs. Haygood's letter of May 26 changes the terms of your original grant so that I am now able to follow the payment plan outlined in your letter of May 15. The first payment of $300 is enclosed. Three additional checks for $150 each will be sent to you at the end of June, July, and August. These last three checks will be mailed to you at Woods Hole.

In order to straighten out the record on the payments made last summer on your fellowship grant, we sent checks as follows:

May 4, 1942	$150
May 29, 1942	125
June 4, 1942	50
July 1, 1942	100
July 21, 1942	200
	$625

Very truly yours,

DOROTHY A. ELVIDGE

DAE:AM

Dr. C. W. Buggs
Dillard University
New Orleans, Louisiana

FELLOWSHIPS

May 26, 1943

Dear Doctor Buggs: Since it is impossible for you to obtain leave from Dillard University for the duration, I feel that the substitution of the three summers at Woods Hole can be considered as fulfilling the terms of your fellowship grant.

I have checked with Miss Elvidge and our records show that you received only $625 of your grant last summer. The payment of $750 for this summer's work would thus leave a balance of $825 for next year.

I hope that you will have an interesting and productive summer.

Sincerely yours,

VANDI V. HAYGOOD

VH:MLU

Dr. C. W. Buggs
Dillard University
New Orleans, Louisiana

FELLOWSHIPS

DILLARD UNIVERSITY
NEW ORLEANS

May 20, 1943

	DE	5/24	DE	5/27

Miss Dorothy A. Elvidge
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Ill.

Dear Miss Elvidge:

I have already written Mr. Haygood that it will be impossible for me to attend the University of Chicago next fall. Conditions here made it imperative that I forego my sabbatical leave. What disposition is to be made of the remainder of the grant is yet to be determined.

Instead of spending \$625 last summer, I spent \$825, [no] for you sent me a check of \$200 on July 22nd. I estimate that I can make it on \$75 less than I spent last year, in as much as one \$150 item at the Laboratory has been eliminated. That is why I requested \$750. If agreeable with Mr. Haygood, I will return to Woods Hole during the summer of 1944 on the remainder of the grant, \$725.

Very sincerely yours,
C. W. Buggs.
C. W. Buggs

Sent only 625 last year. Of which \$100 was supposed to have been for Sept
\$625 less \$150 — \$475

May 18, 1943

Dear Mr. Buggs: I have your letter of May 15th outlining a payment plan for your work this summer at Woods Hole. Based on the estimates in your letter of March 30, 1942, you were awarded $2200 for the following:

2 summers at Woods Hole	@ $373	$ 746
3 quarters at the University of Chicago	@$386	1158
Transportation		296
		$2200

During your first summer at Woods Hole, you received $625 of your grant. If $750 is paid for this summer's work, it will leave only $825 for your three quarters at the University of Chicago beginning this coming September. If the balance of your grant is to be spread over the remaining twelve months of the fifteen-month period for which the award was made, monthly checks ought not to exceed $135.

Very truly yours,

DAE:YY

DOROTHY A. ELVIDGE

Mr. C. W. Buggs
Dillard University
New Orleans, Louisiana

FELLOWSHIPS

DILLARD UNIVERSITY
NEW ORLEANS

May 15, 1943

	44	18	44	26

Mr. William C. Haygood
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

My dear Mr. Haygood:

I have had to postpone my sabbatical leave for the duration. It is possible for me, however, to spend summers at the Marine Biological Laboratory, and I have written Miss Elvidge that I will be returning to Woods Hole the first week in June.

The matter of the disposition of the remainder of the grant is now to be considered. Will it be possible for me to take a third summer at Woods Hole? Frankly, I am convinced that the knowledge and inspiration, and the actual amount of work gained and performed at the Laboratory last summer surpassed what I could have accomplished at the University of Chicago. I was definitely discouraged by Dr. William Bloom from following formal course work, and the type of research I am conducting can be done only at Woods Hole. The work on medusae will require several more summers, but the actual collections and physiological tests can be concluded in about six months.

I sincerely hope that such an arrangement can be effected.

1,625
2,450
3,825

Very truly yours,

C. W. Buggs

(C. W. Buggs)

FELLOWSHIPS

DILLARD UNIVERSITY
NEW ORLEANS

May 15, 1943

	DE	5/17	DE	18

Miss Dorothy A. Elvidge
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

My dear Miss Elvidge:

I plan to leave here for Woods Hole on the 3rd or 4th of June. Will it be possible for you to send checks against the fellowship awarded April 18th, 1942, as follows?:

May 24th	$300.00
June 29th	150.00
July 30th	150.00
August 30th	150.00

The first check may be sent to me here at Dillard; the others to Woods Hole.

Very truly yours,

C. W. Buggs

(C. W.) Buggs

	WCH	15	WCH

DILLARD UNIVERSITY
NEW ORLEANS

September 14, 1942

Mr. William C. Haygood
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

Dear Mr. Haygood:

Please accept my thanks for deferring my fellowship until June, 1943. I hope that by that date conditions will be such as to permit me to remain away from my duties here for the full length of the remaining portion of the fellowship.

Very sincerely yours,

C. W. Buggs

C. W. Buggs

FELLOWSHIPS

September 8, 1942

Dear Doctor Buggs: I am naturally sorry that you will not be able to pursue your fellowship project in consecutive months, but I realize that the situation at Dillard requires your presence on the campus. I am accordingly deferring your fellowship until June, 1943.

I am glad that the summer at Woods Hole was pleasant and profitable, and we shall look forward to having you back on the fellowship roster next summer.

Sincerely yours,

WILLIAM C. HAYGOOD

WCH:MLU

Dr. Charles W. Buggs
Dillard University
New Orleans, Louisiana

DILLARD UNIVERSITY
NEW ORLEANS

FELLOWSHIPS

September 3, 1942

Bugg, Charles W.

	WCH	8	WCH	8
	ERE		EDr	9
	DE		IG	0

Mr. William C. Haygood
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

My dear Mr. Haygood:

Several things have developed here at the University that have made it necessary for President Dent to ask me to remain here this academic year. He was to have written a covering letter in support of my request for a deferment of the remainder of my Fellowship, but he was called out of the city before this could be done. As the time for my departure for the University of Chicago is fast approaching, I thought it wise to send this letter on to you and have President Dent write on his return.

The introduction of a Division of Nursing in the curricular framework of the University has brought many problems of organization. The pre-clinical science courses, as well as several of the applied courses, are of immediate concern to the Division of the Sciences of which I am Head. President Dent, Dean Moses, and Miss Miller, Head of the Division of Nursing, seem to think that my presence is necessary for getting the program under way. I am therefore respectfully asking if a deferment of the remainder of my Fellowship can be arranged. If this is possible, I would return to the Marine Biological Laboratory in June, 1943, and enter the University of Chicago in September, 1943.

I am hoping that the Committee on Fellowships will find my reason for requesting this deferment sufficiently valid to grant it. Should a deferment be impossible, I will have to relinquish the fellowship in order to render these services which I think are vital to the success of our programs at Dillard and take my chance of having the Committee make the grant anew.

I am happy to be able to report a most enjoyable and profitable study period at Woods Hole this summer. I pursued formal work in marine embryology, did bibliographic work on the biochemistry and physiology of medusae in preparation for research here and at Waveland, Mississippi during August and the first half of September, and began a study of and the compilation of the researches and publications of the late Dr. Ernest E. Just. It is my desire to follow this latter project more fully next summer. I received a very fine introduction to experimental

DILLARD UNIVERSITY
NEW ORLEANS

embryology from the lectures of and personal talks with Dr. Viktor Hamburger of the University of Washington. This field, along with physiological genetics, is probably one of the most promising in zoology. It is a field of investigation which can be followed with a minimum of equipment, and I am hoping that we will be able to pursue vigorously such research here at Dillard. I look forward with much eagerness to resuming my studies as a Rosenwald Fellow in furtherance of this research.

Trusting that this request for a deferment of the remainder of my grant will be given favorable consideration, I am

Very sincerely yours,

C. W. Buggs

C. W. Buggs

FELLOWSHIPS

August 18, 1942

Dear Doctor Buggs: We do not have on file for you the usual information which we seek from fellowship candidates, owing to the rather informal handling of your application. Will you, therefore, please fill out the enclosed blank and return it to us at your early convenience? We are preparing material for the biennial report and need some factual material. You need not, of course, send the supplementary papers requested in the blank.

Sincerely yours,

MARGARET L. UTLEY

Secretary to Mr. Haygood

Dr. C. W. Buggs
Marine Biological Laboratory
Woods Hole
Massachusetts

FELLOWSHIPS

July 22, 1942

Dear Doctor Buggs: The enclosed check for $200 covers the August 1 and September 1 installments on your fellowship grant. The next payment will not be due until about September 20 when you have asked for the sum of $200. We shall expect to hear from you again before that date giving us your Chicago address.

Very truly yours,

DAE:AM

DOROTHY A. ELVIDGE

Dr. Charles W. Buggs
Marine Biological Laboratory
Woods Hole, Massachusetts

Julius Rosenwald Fund

4901 Ellis Avenue
CHICAGO

FELLOWSHIPS

To

Mr. Charles W. Bugge

Marine Biological Laboratory

Woods Hole, Massachusetts

Payment Voucher No. 4903

Date July 21, 1942

August and September 1 installments on fellowship grant - - - - - $200.00

Ck.#27229

Accounts	Appropriation No.	Debit	Credit
Negro Fellowships	41-7	$200.00	

Prepared by	Checked by	Posted by	
AM			Comptroller

Marine Biological Laboratory
WOODS HOLE, MASSACHUSETTS

July 19, 1942

	DE	7/21	DE	7/22
	MLW		MLW	0

Miss Dorothy A Elvidge
Julius Rosenwald Fund
Chicago, Ill.

Dear Miss Elvidge:

Thank you for your letter of July 3. Im sorry that I was so hasty, but I was quite concerned over meeting my obligations on time.

I do not have an account in Brunswick, so that the checks will have to be sent directly to me.

It is undecided just how long I will remain here. My stay is dependent upon how long jellyfish last. As I may leave rather hurriedly, I am asking if you will send July + August checks this month - that is, a payment of $200. I note on my letter of May 1st that I requested a check for Sept. 24, to be sent to Woods Hole. This will have to be changed as I think Chicago U opens well before that date. I will write concerning this at a later date.

Very truly yours,

C. W. Briggs.

SCHOLARSHIP

APPLICATION FOR FELLOWSHIP

JULIUS ROSENWALD FUND, CHICAGO, ILLINOIS

900 South Homan Avenue

Date July 3, 1931.

PERSONAL HISTORY

Name in full Charles Wesley Buggs

Present address 809 Aldrich Ave. N., Minneapolis, Minn.

Permanent address 1311 Mansfield Street, Brunswick, Ga.

Place of birth Brunswick, Ga. Date of birth August 6, 1906

Single, married, widowed, divorced Married

Name and address of wife or husband 809 Aldrich Ave. N, Minneapolis, Minn.

Number of children None Age and sex — — —

Dependents One To what extent Relation Wife

Father's name J. W. Buggs Address Brunswick, Ga Occupation Physician

HEALTH OF APPLICANT

Weight 125 Height 5 ft 5 in. Previous illnesses —
feet inches details and date

Illnesses during past twelve months

Physical impairment—degree and how long existing

Most recent complete physical examination—when and by whom May 21, 1931.
University of Minnesota Health Center.

Physician's recommendations Yearly examination

Have these been acted upon?

General health of family Excepting minor troubles - Good.

EDUCATION

Give a summary of your education in the following form:

	Name of Institution	Period of Study	Degrees, Diplomas, Certificates (give dates)
ACADEMIC:			
High School	St. Athanasius	12 years	High School diploma 1924
Normal			
College or University	Morehouse College	4 years	B.A. 1928
Graduate	U. of Minnesota	1 year	working for M.S.
PROFESSIONAL:			
Music			
Art			
Technical			

ACCOMPLISHMENTS

Positions held (professional, teaching, scientific, administrative, business):

Name of Institution or Organization	Title of Position	Years of Tenure (give dates)	Under Direction of
State College of Delaware	Instructor	1928-1929	Dr. Grossley, R. S.
Douglass High School, Key West, Fla.	Instructor	1929-1930	Prof. Hutchings, C. G.

REFERENCES

Submit a list of references from whom further confidential information may be obtained:

Name of Reference	Where and in what way does this person know you?	Address
Pres. S.H. Archer	Character and Collegiate life.	Morehouse College, Atlanta, Georgia.
Dr. R.G. Green.	Graduate study.	University of Minn. Medical School.
Rev. N.H. Gamble	Religious life at home.	1426 Amherst St. Brunswick, Ga.
Miss W.G. Brown	family life	Phyllis Wheatley House Minneapolis, Minn.

Give a list of the scholarships or fellowships you have previously held or now hold:

Present position? From To Salary?

Do you seek further training for this or another position? What and where?

Have you positive assurance of a position after completion of further study?

If so, what is the position?

By whom is assurance given?

What course of study do you wish to take? Research in Bacteriology, Ph.D.

For what degree are you working? Master of Science

What institution offers best opportunity for this study? Pasteur Institute, Paris.

When does the course begin and when does it end?

Have your credits been accepted without condition?

Courses you propose to take:

Major Bacteriology

Minor Pathology

What financial assistance can you depend upon from present employer, school, family, or organization?

If you are a student and employed outside of school, how many hours per day do you work?

What are they?

Where employed? How much do you earn?

Will this continue? How long?

What is the total amount required for the proposed period of study?

How much can you provide?

SUBJECTS STUDIED SINCE COMPLETION OF HIGH SCHOOL

Please group courses by subjects, such as English, Science, History, etc.

Name of Subject	Institution (school or college)	Number of Semesters	Year
Chemistry		Minor	
Physics		Minor	
Mathematics		Minor	
Zoology		Major	
Philosophy			
Economics			
French			
German			
English			
Bacteriology, Histology, Parasitology			
Refer to letter to the Rosenwald Fund			
written May 23rd, 1931.			

(OVER)

In addition to filling out the application blank, we are asking that you write an essay of not more than five hundred words, stating the major problem in your field, as you see it, and your reason for believing that additional training will enable you to help solve that problem, or, at least to make a contribution as a result of a wider experience. (Please use pages 5 and 6 for this essay.)

Refer to letter written to the Rosenwald Fund, May 23rd, 1931.

FELLOWSHIPS

July 3, 1942

Dear Mr. Buggs: July 1 is the beginning of our fiscal year, and fellowship payments for that month had to be issued on the first. That was the reason for the delay in getting your June 29 payment to you. I shall see that future payments reach you on the dates which you have designated.

It has occurred to me, however, that it might be more convenient to you if we sent your checks directly to the National Bank of Brunswick, Georgia, for deposit to your account. If you would like to have us follow this plan in the future, please let me know.

Very truly yours,

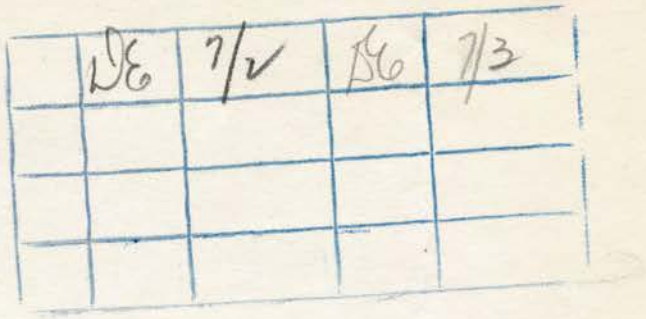
DAE:MLU

DOROTHY A. ELVIDGE

Mr. C. W. Buggs
Marine Biological Laboratory
Woods Hole
Massachusetts

Marine Biological Laboratory
WOODS HOLE, MASSACHUSETTS

Wednesday, July 1st, 1942



Miss Dorothy A. Elvidge
Julius Rosenwald Fund
Chicago, Illinois

Dear Miss Elvidge:

For fear that the check which I requested be sent on or before the 29th of June has not yet been sent, I am sending this reminder. The only thing I possess of worth is a good credit rating, especially with the National Bank of Brunswick, Ga. I am very anxious not to default on any of my obligations, but unless the checks reach me as indicated I will not be able to meet them on time.

check mailed 6/30

With appreciation for your kindness, I am

Very truly yours,

C. W. Buggs

C. W. Buggs

Julius Rosenwald Fund

4901 Ellis Avenue
CHICAGO

To Mr. Charles W. Buggs

Woods Hole, Massachusetts

Payment Voucher No. 4846

Date July 1, 1942

Fourth payment on fellowship grant - - - - - - - - - - - - - $100.00

Ck. #27156

Accounts	Appropriation No.	Debit	Credit
Negro Fellowships	41-7	$100.00	

Prepared by	Checked by	Posted by	
RH			Comptroller

Julius Rosenwald Fund

4901 Ellis Avenue
CHICAGO

FELLOWSHIPS

To

Dr. Charles W. Buggs
c/o D. A. Elvidge

Payment Voucher No. 4699

Date June 4, 1942

Third payment on fellowship granted 4/18/42 - - - - $50.00

Ck.#26995

Accounts	Appropriation No.	Debit	Credit
Negro Fellowships	41-7	$50.00	

Prepared by	Checked by	Posted by	
AM			Comptroller

FELLOWSHIPS

June 4, 1942

Dear Doctor Buggs: In accordance with your request, I am enclosing our check for $50, and have changed our records so that the payment due you September 20 will be for $200 instead of $250.

Very truly yours,

DOROTHY A. ELVIDGE

DAE:AM

Dr. Charles W. Buggs
Woods Hole, Massachusetts

FELLOWSHIPS

DILLARD UNIVERSITY

NEW ORLEANS

June 2, 1942

	DE	6/4	DE	6/4

Miss Dorothy A. Elvidge
4901 Ellis Avenue
Chicago, Illinois

Dear Miss Elvidge:

I am sorry to have miscalculated, but I now find that the sum of $125.00 will be insufficient to get me out of New Orleans and maintain me at Woods Hole during the month of June.

I am therefore respectfully asking if you will send an additional $50.00 to me at Woods Hole, Mass., and deduct this from the $250.00 check for the month of September. I will need the money by the 16th of June.

Please accept my thanks for this consideration.

Very truly yours,

C. W. Buggs

C. W. Buggs

Julius Rosenwald Fund

4901 Ellis Avenue
CHICAGO

FELLOWSHIPS

To Mr. Charles W. Buggs
Dillard University
New Orleans, Louisiana

Payment Voucher No. 4625

Date May 29, 1942

Second payment on fellowship awarded 4/18/42 - - - - - - - - - - - - - $125.00

Ck. #26907

Accounts	Appropriation No.	Debit	Credit
Negro Fellowships	41-7	$125.00	

Prepared by	Checked by	Posted by	
McK			Comptroller

May 4, 1942

Dear Doctor Buggs: We shall be pleased to follow the payment plan outlined in your letter of May 1, sending each monthly check to the address which you have designated. (Before the October 30 payment is due, we shall expect to receive from you your Chicago address.) Our check for $150 is enclosed to cover the first payment.

Very truly yours,

DOROTHY A. ELVIDGE

DAE:RH

Dr. Charles W. Buggs
Dillard University
New Orleans, Louisiana

Julius Rosenwald Fund

4901 Ellis Avenue
CHICAGO

FELLOWSHIPS

To

Dr. Charles W. Buggs

Dillard University

New Orleans, Louisiana

Payment Voucher No. 9316

Date May 4, 1942

First payment on fellowship granted 4/18/42 - - - - - - - - - - - - - - $150.00

Ck.#9316 W. F.

Accounts	Appropriation No.	Debit	Credit
Negro Fellowships	41-7	$150.00	

Prepared by	Checked by	Posted by	
AM			Comptroller

DILLARD UNIVERSITY
NEW ORLEANS
May 1, 1942

Miss Dorothy A. Elvidge
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

	DE	5/4	DE	5/4

Dear Miss Elvidge:

In answer to your letter of April 27th, I would like to submit the following schedule and dates of payments on the grant made me:

1	On or before May 9th	Dillard University	$150.00˘
2	On or before June 4th	Dillard University	125.00
3	On or before June 29th	Woods Hole	100.00
4	On or before July 30th	Woods Hole	100.00
5	On or before August 30th	Woods Hole	100.00
6	On or before September 24th	Woods Hole	250.00
7	On or before October 30th	Chicago (address later)	100.00
8	On or before November 29th	Chicago	100.00
9	On or before December 29th	Chicago	200.00
10	On or before January 30th	Chicago	100.00
11	On or before February 27th	Chicago	100.00
12	On or before March 30th	Chicago	200.00
13	On or before April 29th	Chicago	100.00
14	On or before May 10th	Chicago	150.00˘
15	On or before June 4th	Chicago	125.00
16	On or before July 30th	Woods Hole	100.00
17	On or before August 30th	Woods Hole	100.00
			$2200.00

˘ Tuition to the Marine Biological Laboratory, Woods Hole, Mass.

I trust that this distribution meets with your approval.

Very truly yours,

C. W. Buggs

C. W. Buggs
Professor of Biology and
Head, Division of the Sciences

FELLOWSHIPS

April 27, 1942

Dear Doctor Buggs: I have seen the recent correspondence which you have had with Mr. Haygood in connection with the fellowship grant awarded to you a short time ago. It is customary for us to make payment in monthly installments spread over the period for which the award was made. However, if you would prefer to receive larger payments in the months in which your tuition will be due, that is entirely agreeable to us.

When you are ready to begin work under your grant, please write me, giving the monthly payment plan best suited to your needs, and the address to which your checks should be mailed.

Very truly yours,

DOROTHY A. ELVIDGE

DAE:AM

Dr. Charles W. Buggs
Dillard University
New Orleans, Louisiana

DILLARD UNIVERSITY
NEW ORLEANS

April 23, 1942

Mr. Edwin R. Embree, President
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

My dear Mr. Embree:

This is acknowledgment to you personally of my gratitude for the very handsome grant the Julius Rosenwald Fund has made me to assist me in my zoological studies and research work. I assure you that the benefits to be derived from the use of the funds will be greater than those derived from the funds placed at my disposal by the Fund while I was at the University of Minnesota, for I am much more mature and I hope possessed of a little more wisdom than I had nine years ago. I am confident that I will return to my duties here after my months of study and research refreshed in mind and spirit, and that my rejuvination will be reflected in the quality and quantity of work I and my students will accomplish.

With kindest personal regards and best wishes,
I am

Very sincerely yours,

C. W. Buggs

C. W. Buggs

DILLARD UNIVERSITY
NEW ORLEANS

WCH 23 WCH 8
DAE 86 4/27

April 21, 1942

Mr. William C. Haygood
Director for Fellowships
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

Dear Mr. Haygood:

I am indeed grateful for the confidence the Julius Rosenwald Fund has placed in me by awarding me a grant of $2,200 for studies in zoology and research in the embryology and physiology of marine life at the University of Chicago and at Woods Hole for a fifteen-month period. The grant is accepted with deep appreciation and a determination to make this period of study the most profitable I have yet experienced.

Very sincerely yours,

C. W. Buggs

C. W. Buggs

April 1, 1942

Dear Mr. Buggs: Mr. Embree has given me your letter of March 30, including your budget estimate and the general plan of work. I shall be glad to bring this to the Committee for discussion at its final meeting.

Sincerely yours,

WILLIAM C. HAYGOOD

WCH:McK

Dr. C. W. Buggs, Head
Division of the Sciences
Dillard University
New Orleans, Louisiana

Comm. Folder —

DILLARD UNIVERSITY
NEW ORLEANS

B.D: Please return to me

March 30, 1942

air mail

	ERE	31	EDR	0
	WH		WCH	31
			FELLOWSHIPS	

Mr. Edwin R. Embree
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

Buffs, CW

My dear Mr. Embree:

Pursuant to our conversation on yesterday I am submitting herewith an estimate of expenses for three quarters study at the University of Chicago and two summers at Woods Hole:

Estimate of quarterly expenses at the University of Chicago

Regular tuition, registration and health service fees	$106
Rent	75
Board	90
Laundry and cleaning	25
Textbooks, laboratory fees, supplies	45
Incidentals	45
	$386

For three quarters $1158

Estimate of expenses for each summer of formal work at Woods Hole

Tuition for the summer	$150
Rent	84
Board	84
Laundry and cleaning	25
Incidentals	30
	$373

For two summers ..... $ 746

Transportation for the entire study period and research expenses at Woods Hole or Gulfside, Mississippi during the later part of August and the month of September (exclusive of c. $125 of a Sigma Xi grant)
..... $ 296

DILLARD UNIVERSITY
NEW ORLEANS

Mr. Edwin R. Embree: (2)

Total amount requested for 15 months study $2200

If this fellowship grant is made the University will extend me sabbatical leave on half salary. This sum would permit me to meet my personal obligations here.

Formal work contemplated at Woods Hole include two courses in invertebrate zoology, one in embryology and one in physiology. Research work during August and September would center around the biochemistry and physiology of medusae.

Work at the University of Chicago would be directed toward three goals:

1. A general orientation in zoology through formal courses, conferences, and seminars with the view of becoming a more proficient teacher;

2. A development of zoological research techniques with the view of stimulating and fostering a live Division of the Sciences here at Dillard; and

3. To study the Chicago Plan with reference to the biological and physical sciences in order that our organizational problems here might be better understood and met.

I sincerely hope, Mr. Embree, that this plan of study receives the approval of your committee on awards, and that the Fund will find it possible to grant the requested fellowship.

Very sincerely yours,

C. W. Buggs

C. W. Buggs
Professor of Biology and
Head, Division of the Sciences

Compliments of
C. W. Buggs

Reprinted from The Journal of the American Medical Association
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PENICILLIN AND SKIN GRAFTING

JOHN WINSLOW HIRSHFELD, M.D.
MATTHEW A. PILLING, M.D.
CHARLES WESLEY BUGGS, PH.D.
AND
WILLIAM E. ABBOTT, M.D.
DETROIT

Few patients are more miserable than those with large unhealed third degree burns. Early skin grafting of the burned areas is the only means of quickly returning these patients to a useful life. The longer this procedure is delayed, the greater the immediate threat of death and the ultimate development of scars and deformity. The aim of all treatment, therefore, is reepithelization of the burned areas as promptly as possible. In general, it requires from one to three months to achieve this aim. The chief causes for the prolonged healing are (1) the necessity of deferring grafting until the burned tissue has sloughed and the granulating bed is ready to accept a graft, (2) the necessity for multiple grafting operations because of the lack of sufficient donor sites or the inability of the patient to tolerate grafting of the entire burn at one time and (3) the necessity of grafting the same area more than once because previous grafts have partially or completely failed to take.

Harvey and Connor [1] have devised a method of rapidly removing the dead tissue. Ordinarily it requires fifteen to forty days for burned tissue to separate. By shortening this time to a few days they have overcome one of the greatest factors prolonging the convalescence

From the Department of Surgery and the Department of Bacteriology, Wayne University College of Medicine, and the Division of Surgery, Detroit Receiving Hospital.
The work described in this paper was done, under a contract recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and Wayne University.
1. Harvey, S. C., and Connor, G. J.: The Healing of Deep Thermal Burns, read before the American Surgical Association, Chicago, May 3, 1944.

of burned patients. Although lack of donor sites will always remain as a limiting factor, improvements in the care of burned patients have made it possible and will continue to make it possible to graft larger areas at one operation. The necessity of grafting the same area more than once remains, therefore, as the chief factor tending to prolong the convalescence of these patients.

Skin grafts fail to take because of (1) infection, (2) failure to maintain the graft in contact with the recipient site and (3) the lack of adequate blood supply in the recipient site. Any one skilled in the art of skin grafting has at his command the means of maintaining a skin graft in contact with the recipient site and of insuring an adequate blood supply for the graft. However, in spite of the most careful preparation of the granulating bed a certain number of split thickness grafts are partially or completely lost because of infection.

Padgett [2] reported the percentage of takes of a large series of split thickness grafts applied to contaminated and to aseptic recipient sites. The analysis of his results (table 1) shows that infection is the most common cause of partial or complete loss of such a graft.

In approximately one third of the cases in which grafts were placed on contaminated recipient sites, 25 per cent or more of the graft was lost. In only about two thirds of these patients were satisfactory takes obtained in which only 10 per cent or less of the graft was lost. In contrast, satisfactory takes were obtained in 98 per cent of the grafts done on aseptic recipient sites. Furthermore, a review shows that many patients whose first grafts failed also lost large parts of successive grafts. This has been our experience and has usually been due to infection of the granulating bed with sulfonamide resistant Streptococcus haemolyticus or Staphylococcus aureus.

A large denuded area of the body usually becomes infected with Pseudomonas pyocyaneus, Proteus vulgaris, Escherichia coli or other gram negative bacilli of intestinal origin. There is yet no chemotherapeutic agent that will adequately control these organisms. Fortunately, in most cases they seem to act primarily as saprophytes and do not interfere with the growth of split thickness grafts. Many burns, however, become

2. Padgett, E. C.: Skin Grafting, Springfield, Ill., Charles C Thomas, Publisher, 1942.

infected with beta hemolytic streptococci, Staphylococcus aureus and other coagulase positive micrococci. It is these organisms that are responsible for the failure of skin to grow when transplanted to granulating surfaces. Although the sulfonamides control many hemolytic streptococcus infections, they are ineffective against the occasional resistant strain and against Staphylococcus aureus and the other coagulase positive micrococci. While their use has improved the results of skin grafting, especially in the presence of susceptible hemolytic streptococci, it has not solved the problem.

TABLE 1.—*Padgett's Results*

Percentage of Graft Lost	Number of Cases	
"Fresh Burns"		
Total grafts	44	
0 - 10	28 (63.6%)	
11 - 20	2 (4.5%)	In 31.8% of the cases
21 - 25	1 (2.3%)	21% or more of the graft
26 - 40	1 (2.3%)	was lost
41 - 100	12 (27.2%)	
Grafts on Other Obviously Contaminated Recipient Sites		
Total grafts	17	
0 - 10	9 (52.9%)	
11 - 20	2 (11.8%)	In 35.3% of the cases 21% or
21 - 30	2 (11.8%)	more of the graft was lost
31 - 100	4 (23.5%)	
Grafts on Aseptic Recipient Sites		
Total grafts	151	
0 - 10	148 (98%)	In only 2% of the cases
11 - 25	2 (1.4%)	11% or more of the graft
26 - 100	1 (0.6%)	was lost

Penicillin is an extremely powerful bacteriostatic and bactericidal agent that has the advantage of acting not only against Streptococcus haemolyticus but also against Staphylococcus aureus. It seemed important, therefore, to determine whether its administration at the time of skin grafting would improve the percentage of takes.

Nineteen split thickness grafts were performed on 17 patients who were receiving penicillin intramuscularly. In general, grafting was done as soon as the slough had separated, usually three to four weeks after the burn had occurred. In 5 instances, however, grafting was delayed because of (1) the slow separation of a deep slough, (2) the necessity for multiple operations or (3) the admission of patients to our hospital some time after they had been burned. The initial dressings consisted of a wide variety of substances, zinc oxide ointment, glass cloth and cellucotton, zinc

TABLE 2.—*Details of Treatment*

Patient	Age	Days Elapsing Between Injury and Grafting	Location	Size of Graft	Cultures Before Grafting	Cultures at First Dressing	Dosage of Penicillin	Percentage of Take	
A. T.	83	28	Shoulder and arm	65 sq. in.	M. aurantiacus coagulase —; diphtheroids	M. aurantiacus coagulase —; diphtheroids; gram + cocci	10,000 units every 2 hours for 5 doses before grafting 10,000 units every 2 hours for 5 days after grafting	100%	
J. B.	52	..	Foot	30 sq. in.	Ps. pyocyaneus; diphtheroids	M. aurantiacus coagulase —; M. epidermidis coagulase —; B. coli; diphtheroids	None before grafting 5,000 units every hour for 5 days after grafting	100%	
M. M.	30	30	Thighs	35 sq. in.	M. aurantiacus coagulase —; Ps. pyocyaneus; diphtheroids	M. epidermidis coagulase —; M. aurantiacus coagulase +; Ps. pyocyaneus; diphtheroids; aerobic gram + rods	5,000 units every hour for 12 doses before grafting 5,000 units every hour for 5 days after grafting	95%	
W. C.	52	66	Leg and foot	90 sq. in.	M. varians coagulase +; Ps. pyocyaneus; Ps. fluorescens; aerobic gram + rods	Gram + rods; Ps. fluorescens; Ps. pyocyaneus	5,000 units every hour for 18 hours before grafting 5,000 units every hour for 5 days after grafting	100%	
B. P.	40	25	Shoulders and scalp	54 sq. in.	M. varians coagulase +; Ps. fluorescens; M. tetragenes; aerobic gram + rod	M. varians coagulase +; Ps. fluorescens; diphtheroids	10,000 units every hour for 18 hours before grafting 10,000 units every hour for 4 days after grafting	95%	
I. S.	5	20	Back and chest	50 sq. in.	M. aurantiacus coagulase +; beta hemolytic streptococcus; B. coli; diphtheroids; B. alkaligenes	Ps. pyocyaneus; diphtheroids; M. epidermidis coagulase +	5,000 units every hour for 24 hours before grafting 5,000 units every hour for 4 days after grafting	95%	
C. H.	10	180	Chest, axilla and arm	125 sq. in.	M. varians coagulase +; gram + rod; gram neg. rod; M. aurantiacus coagulase +; M. epidermidis coagulase —	M. varians coagulase +; diphtheroids	5,000 units every hour for 5 days before grafting 5,000 units every hour for 9 days after grafting	95%	(This loss was due to hematoma beneath graft)
D. T.	3	20	Chest and abdomen	30 sq. in.	M. aurantiacus coagulase +; M. varians coagulase +; diphtheroids; gram neg. rods	M. aurantiacus coagulase +; diphtheroids; B. coli; B. aerogenes	None before grafting 5,000 units every hour for 2 days after grafting, then 2,500 units every hour for 3 days after grafting	100%	
B. M.	5	60	Knee	50 sq. in.	Ps. pyocyaneus; M. epidermidis	Ps. pyocyaneus; diphtheroids;	5,000 units every hour for 18 hours before grafting		
					coagulase —	M. epidermidis coagulase +	5,000 units every hour for 2 days after grafting, then 2,500 units every hour for 3 days after grafting	95%	
R. B.	5	40	Arms and shoulders	42 sq. in.	M. aurantiacus coagulase +; Ps. pyocyaneus	M. aurantiacus coagulase +; Ps. pyocyaneus	5,000 units every hour for 12 hours before grafting 5,000 units every hour for 4 days after grafting	90%	
B. M.	38	30	Leg	16 sq. in.	M. aurantiacus coagulase +; M. epidermidis coagulase —; Ps. pyocyaneus; aerobic gram + rod	Beta hemolytic streptococcus; Ps. pyocyaneus; M. epidermidis coagulase —	5,000 units every hour for 12 hours before grafting 5,000 units every hour for 4 days after grafting	95%	
C. W.	1	19	Chest	30 sq. in.	M. varians coagulase +; B. coli; beta hemolytic streptococcus; aerobic gram + rod	Ps. pyocyaneus; gram + rod	1,000 units every hour for 12 hours before grafting 1,000 units every hour for 5 days after grafting	95%	
L. W.	10	25	Trunk	135 sq. in.	Ps. pyocyaneus	Ps. pyocyaneus	5,000 units every hour for 12 hours before grafting 5,000 units every hour for 5 days after grafting	90%	
L. W.	10	44	Trunk	30 sq. in.	Ps. pyocyaneus; Proteus vulgaris	Ps. pyocyaneus; Proteus vulgaris	5,000 units every hour for 12 hours before grafting 5,000 units every hour for 5 days after grafting	100%	
R. M.	43	25	Thigh	60 sq. in.	M. varians coagulase +; Proteus vulgaris; Ps. pyocyaneus	Proteus vulgaris; Ps. pyocyaneus	5,000 units every hour for 12 hours before grafting 5.000 units every hour for 5 days after grafting	80%	
J. V.	52	28	Hand	28 sq. in.	Ps. pyocyaneus; M. aurantiacus coagulase +; M. varians coagulase +; B. aerogenes	M. aurantiacus coagulase —; Ps. pyocyaneus; B. aerogenes; aerobic gram + rod	5.000 units every hour for 12 hours before grafting 5,000 units every hour for 5 days after grafting	100%	
G. R.	10	25	Thighs	160 sq. in.	Proteus vulgaris; beta hemolytic streptococcus; Staph. aureus	Proteus vulgaris; Beta hemolytic streptococcus; Staph. aureus	5,000 units every hour for 12 hours before grafting 5,000 units every hour for 5 days after grafting	90%	
G. R.	10	43	Leg	72 sq. in	Proteus vulgaris; Ps. pyocyaneus	Proteus vulgaris; Ps. pyocyaneus	5,000 units every hour for 12 hours before grafting 10,000 units every 2 hours for 5 days after grafting	85-90%	
J. C.	46	25	Arm and hand	64 sq. in.	M. varians coagulase +; M. aurantiacus coagulase +; B. coli	None	5,000 units every hour for 24 hours before grafting 5,000 units every hour for 24 hours after grafting	100%	

peroxide in a carbowax base, and several other experimental ointments. The dressings were changed at intervals of five to fourteen days, depending on the patient's condition and the requirements of certain studies that were in progress on these patients. In only 2 instances were wet dressings employed. At the time of grafting the dressings were removed in the operating room, and the exudate was washed away with warm isotonic solution of sodium chloride. If the granulations were excessive they were cut away; otherwise the grafts, which were cut with the Padgett dermatome, were placed directly on the granulating bed and held in place with fine silk sutures. A single layer of fine mesh gauze impregnated with zinc oxide ointment was placed next to the graft. This was covered with a few layers of ordinary gauze, and the entire area was then covered with mechanics' waste and wrapped with elastic bandage. The initial dressing was changed on the fourth, fifth or sixth day.

All the patients received penicillin intramuscularly. The dose and the duration of therapy varied somewhat from patient to patient. In general, therapy was started about twelve hours before operation and was continued until the time of the first dressing. The exact details of therapy are given in table 2. With one exception, from 90 to 100 per cent of the transplanted skin took in every instance. The exception occurred in an uncooperative alcoholic addict who had third degree burns of the perineum, both thighs and legs. Only 80 per cent of the grafts placed on his groin and thighs took. The loss in this case was probably due to failure of the dressings to hold the grafts in place.

The loss in all cases occurred at the margin of the grafts where they overlapped the new epithelium growing in from the margins of the burned area. This thin layer of new epithelium prevents the graft from taking, and, unlike normal skin, it is not strong enough to survive when covered with a graft. The result is a slough of both the new epithelium and the margin of the graft. If the new epithelium is cut away and the graft joined to normal skin, this marginal loss does not occur.

The administration of penicillin did not seem to alter the bacterial flora a great deal; cultures taken at the time of the first dressing from the margins of the grafts and from the sutures usually yielded the same organisms

that were present on the granulating surface before grafting. In spite of their persistence, they did not seem to affect the growth of the graft. Penicillin, therefore, must hold them in check until the skin has a chance to become established in its new bed.

Though penicillin has been administered to only 17 patients at the time of skin grafting, we believe that its use has the following definite advantages:

1. It permits early grafting. Split thickness grafts can be successfully applied as soon as the slough has separated without further time consuming preparation of the granulating area.

2. It appears to prevent the loss of skin from infection that ordinarily occurs in about one third of the cases in which split thickness grafts are placed on contaminated recipient sites.

Before penicillin was available, we performed over a hundred grafts in patients with third degree burns. Although many excellent takes were obtained, in about one third of the cases 25 per cent or more of the graft was lost because of the occurrence of infection. Therefore the consistency with which excellent takes were obtained in this series of 19 grafts has been very impressive to us. We are presenting the method with the hope that others will try it.

Printed and Published in the United States of America

Compliments of
C. W. Buggs

The In Vitro Action of Streptomycin on Bacteria

C. W. BUGGS, Ph.D., BERNICE BRONSTEIN, M.S.
JOHN WINSLOW HIRSHFELD, M.D.
and
MATTHEW A. PILLING, M.D.
Detroit

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THE IN VITRO ACTION OF STREPTOMYCIN ON BACTERIA

C. W. BUGGS, Ph.D., BERNICE BRONSTEIN, M.S.
JOHN WINSLOW HIRSHFELD, M.D.
and
MATTHEW A. PILLING, M.D.
Detroit

Streptomycin is effective against a variety of gram negative and gram positive bacteria both in vivo and in vitro.[1] However, its rational use in the treatment of disease must be preceded by an evaluation of dose intervals and sizes with a determination of bacterial susceptibility to its action. There are definite in vitro differences in the sensitivity of bacteria to streptomycin and within a given species strains may be found varying from extreme susceptibility to high resistance. As the blood concentration of streptomycin reaches a peak shortly after parenteral injection and then gradually falls to zero [2] it becomes necessary, for rational therapy, to determine whether a sufficiently high blood concentra-

From the Department of Surgery and the Department of Bacteriology, Wayne University College of Medicine, and the Division of Surgery, City of Detroit Receiving Hospital.

This work was supported by grants from Merck and Company, Inc., Rahway, N. J., and from the Theodore A. McGraw Fund.

1. Feldman, W. H., and Hinshaw, H. C.: Effects of Streptomycin on Experimental Tuberculosis in Guinea Pigs: A Preliminary Report, Proc. Staff Meet., Mayo Clin. **19:** 593-599, 1944. Heilman, F. R.: Streptomycin in the Treatment of Experimental Tularemia, ibid. **19:** 553-559, 1944; Streptomycin in the Treatment of Experimental Infections with Micro-Organisms of the Friedländer Group (Klebsiella), ibid. **20:** 33-39, 1945. Jones, Doris; Metzger, H. J.; Schatz, Albert, and Waksman, S. A.: Control of Gram-Negative Bacteria in Experimental Animals by Streptomycin, Science **100:** 103-105, 1944. Robinson, H. J.; Smith, Dorothy G., and Graessle, O. E.: Chemotherapeutic Properties of Streptomycin, Proc. Soc. Exper. Biol. & Med. **57:** 226-231, 1944. Schatz, Albert; Bugie, Elizabeth, and Waksman, S. A.: Streptomycin, a Substance Exhibiting Antibiotic Activity Against Gram-Positive and Gram-Negative Bacteria, ibid. **55:** 66-69, 1944. Schatz, Albert, and Waksman, S. A.: Effect of Streptomycin and Other Antibiotic Substances on Mycobacterium Tuberculosis and Related Organisms, ibid. **57:** 244-248, 1944. Waksman, S. A.; Bugie, Elizabeth, and Schatz, Albert: Isolation of Antibiotic Substances from Soil Micro-Organisms, with Special Reference to Streptothricin and Streptomycin, Proc. Staff Meet., Mayo Clin. **19:** 537-548, 1944.

2. Buggs, C. W.; Pilling, M. A.; Bronstein, Bernice, and Hirshfeld, J. W.: The Absorption, Distribution and Excretion of Streptomycin in Man, J. Clin. Investigation, to be published.

tion is being maintained with reference to the sensitivity of the bacteria isolated from the patient. In many cases it may be found that a smaller dose or a longer interval between doses is sufficient to maintain a blood concentration which is more than ample to inhibit the in vitro growth of the invading bacterium. On the other hand, blood level and sensitivity determinations may indicate that a larger dose given at more frequent intervals is needed.

Our purpose in this communication is to report (1) the sensitivities of several species of bacteria to streptomycin, (2) to correlate these sensitivities with the serum concentrations of streptomycin that may be maintained in patients receiving the drug and (3) to determine whether the bacteria investigated developed a resistance to streptomycin in vivo.

SOURCES OF THE BACTERIA INVESTIGATED

The bacteria studied were isolated from 38 patients with various types of infections, among which were peritonitis, thoracic empyema, septicemia, infected wounds and burns, urinary tract infections and pelvic abscesses. Urine or pus from each case was cultured before and at intervals during streptomycin treatment and the organisms present were isolated in pure culture. Complete identification of all bacteria was not made, this being limited to Proteus vulgaris, Escherichia coli, Aerobacter aerogenes, Pseudomonas aeruginosa, alpha and beta hemolytic streptococci and the staphylococci. Other organisms were grouped according to their morphology, gram staining reaction and oxygen requirement. After the aerobes were obtained in pure culture they were screened for their sensitivity to streptomycin, following which their sensitivity over a narrower range was determined. The action of streptomycin on the anaerobes was not tested.

SCREENING FOR THE APPROXIMATE SENSITIVITY TO STREPTOMYCIN

An aqueous solution of streptomycin [3] having a concentration of 448 S [4] units was prepared from a weighed amount of the dry product. Twofold serial dilutions

3. The streptomycin was provided through Dr. D. F. Robertson of Merck and Company, Inc., Rahway, N. J.

4. An S unit of streptomycin, synonymous with an E. coli unit, is that amount of streptomycin which will inhibit the growth of a standard strain of E. coli in 1 cc. of nutrient broth or other suitable medium.

of this solution were made in nutrient broth, using 0.4 cc. of the streptomycin solution. The dilution was carried through thirteen tubes. An inoculum of 0.3 cc. of a 1 : 10,000 dilution of an eighteen to twenty-four hour culture of the test organism was now added to each tube, as well as to a control tube and a tube which contained 0.4 cc. of undiluted streptomycin solution. The final dilutions of the streptomycin gave concentrations ranging from 256 units to 0.03 unit. The tubes were incubated for eighteen to twenty-four hours and read on the basis of the presence or absence of turbidity.

If more than 2 units of streptomycin was required to inhibit growth, the bacterium was retested in a series of tubes containing gradually increasing concentrations of streptomycin in order to arrive at a closer approximation of the organism's sensitivity. This additional step was taken because of the 100 per cent error inherent in the twofold serial dilution method.

DETERMINATION OF SENSITIVITY VALUES WITHIN NARROWER RANGES THAN THOSE POSSIBLE WITH THE TWOFOLD SERIAL DILUTION METHOD

Various concentrations of streptomycin solutions were prepared in double the desired strength and added in 0.5 cc. amounts to 0.5 cc. of double strength nutrient broth which contained from 1,000 to 10,000 of the test bacteria per cubic centimeter. If the screen test of an organism showed its sensitivity to be 4 S units, it was retested with individual solutions of streptomycin containing from 1 to 8 units in steps of 1 unit of streptomycin per cubic centimeter. In like manner, organisms with screened sensitivities of 8, 16, 32 and 64 units were retested in various concentrations of streptomycin as given in table 1. Column 3 of this table gives the concentrations of streptomycin to which the organisms were exposed and the range of error which may occur in the end point. Organisms which were sensitive to 128 or 256 units in the screen test were not retested except in a few isolated instances.

RESULTS OF SENSITIVITY TESTS

The sensitivity to streptomycin of bacteria that were studied is given in table 2. These values may be compared with the serum concentrations of streptomycin in patients following the intramuscular or intravenous

injection of streptomycin ranging from 25,000 to 1,000,000 S units which were reported by Buggs, Pilling, Bronstein and Hirshfeld,[2] who found that 500,000 S units of streptomycin administered intramuscularly or intravenously was sufficient to maintain a serum concentration which was at a level of 10 to 15 units at

TABLE 1.—*Solutions Used for Sensitivity Tests and the End Points as Read from Individual Tubes*

Screened Sensitivity, S Units/Cc.	Solutions Used for Further Tests, S Units/Cc.	End Points as Read from Individual Tubes, S Units/Cc.	Error
4	2	1	0
	4	2	
	6	3	
	8	4	
	10	5	
	12	6	
	14	7	
	16	8	
8	8	4	−1 unit
	12	6	
	16	8	
	20	10	
	24	12	
	28	14	
	32	16	
16	16	8	−1 to −3 units
	24	12	
	32	16	
	40	20	
	48	24	
	56	28	
	64	32	
32	32	16	−1 to −7 units
	48	24	
	64	32	
	80	40	
	96	48	
	112	56	
	128	64	
64	64	32	−1 to −15 units
	96	48	
	128	64	
	160	80	
	192	96	
	224	112	
	256	128	

the end of four hours. Theoretically, then, all bacteria reported in this paper with a sensitivity of 8 units or less would be inhibited over a period of at least four hours by a parenteral injection of 500,000 S units of streptomycin.

Escherichia Coli.—Nineteen of 26 strains of Escherichia coli, 73 per cent, were found to be sensitive to a

concentration of 8 units or less of streptomycin. Six of the strains were inhibited by concentrations of streptomycin between 12 and 32 units, while only one strain

TABLE 2.—*Sensitivities of Bacteria to Streptomycin*

Determinations made in nutrient broth which contained 0.25 per cent sodium chloride

Organism and Sensitivity, S Units/Cc.	Number of Strains
E. coli from 21 Patients	
1	5
2	1
4	4
5	4
6	3
8	2
12	1
16	2
32	3
>256	1
	26
P. vulgaris from 2 Patients	
2	1
4	2
6	1
8	2
	6
Ps. aeruginosa from 13 Patients	
1	1
4	2
5	1
8	1
16	1
32	1
40	2
100	1
>256	9
	19
A. aerogenes from 13 Patients	
1	2
2	6
3	3
4	1
5	4
6	1
16	1
20	1
>256	1
	20
S. aureus from 14 Patients	
0.03	3
0.06	2
0.125	2
0.5	1
1	4
2	5
3	1
4	2
5	1
6	1
16	1
32	1
128	1
>256	2
	27
S. albus from 12 Patients	
0.03	1
0.06	7
0.125	6
0.25	5
1	2
128	1
>256	4
	26
Alpha hemolytic streptococci from 18 Patients	
0.06	1
0.5	1
1	2
2	2
4	5
5	3
6	5
8	7
16	3
32	2
>256	6
	37
Beta hemolytic streptococci from 10 Patients	
0.06	2
0.125	1
1	1
4	2
5	3
8	2
32	2
>256	2
	15
Diphtheroids from 19 Patients	
0.03	1
0.06	3
0.125	7
0.25	2
0.5	3
1	1
7	1
256	6
>256	12
	36

had a resistance greater than 256 units. The latter strain was isolated from the urine of a patient before streptomycin therapy was begun and may be assumed to have been naturally resistant. Four of the twenty-six strains were isolated from 1 patient and three strains

from another, but in neither of these cases did the organism acquire an increased tolerance for streptomycin during therapy.

Proteus Vulgaris.—Six strains of Proteus vulgaris which were isolated from 2 patients were found to be sensitive to streptomycin, a concentration of 8 units or less being sufficient to inhibit the in vitro growth of all of them. Five of the strains were isolated during a twelve day period from an abdominal abscess of 1 of the 2 patients. Originally the organism was sensitive to 2 units of streptomycin, but after twelve days of therapy it required 8 units to inhibit its growth. In this instance Proteus vulgaris probably developed a tolerance for streptomycin. The increase in resistance, however, is not beyond the blood concentration of streptomycin that may be maintained over a period of at least four hours in a patient who has received 500,000 S units of the drug, either intramuscularly or intravenously.

Pseudomonas Aeruginosa.—The majority of the strains of Pseudomonas aeruginosa were very resistant to streptomycin, and in 2 instances it appeared that the organism developed an increased tolerance for the drug during therapy. In 1 case the resistance of the organism as recovered from bile before treatment was started was 32 units of streptomycin. Three days later, when the organism was again isolated, its resistance had increased to more than 256 units. In the second case Pseudomonas aeruginosa was isolated from an infected ankle. It was sensitive to 20 units of streptomycin. Seven days later a reisolation of this organism was made. It now had a resistance greater than 256 units.

Of the nineteen strains of Pseudomonas aeruginosa reported in table 2, only five of them, 26 per cent, were sensitive to 8 units or less of streptomycin on primary isolation. The remaining fourteen strains required from 16 to more than 256 units for in vitro inhibition.

Aerobacter Aerogenes.—Seventeen of the twenty strains studied, 85 per cent, were sensitive to concentrations of streptomycin well within ranges that may be obtained in blood, only three of them requiring more than 6 units for the complete inhibition of growth. The one strain with a resistance greater than 256 units was the second isolation of this organism from the urine of a patient under treatment with streptomycin. When

first isolated, nine days previously and two days after therapy was begun, the organism was inhibited by 1 unit of streptomycin. It would thus appear that this strain developed a decided resistance to streptomycin during its eleven days' exposure to the drug. The two strains with sensitivities of 16 and 20 units of streptomycin were primary isolations from 2 patients a few days after therapy was begun. They may have developed an increased tolerance for the drug during this period of therapy.

Staphylococci.—The vast majority of the staphylococci studied proved to be very sensitive to streptomycin, many of them being inhibited by less than 0.1 unit of the drug.

Twenty-seven strains of Staphylococcus aureus were tested. Twenty-two of these strains, or 81 per cent, were sensitive to 6 units or less of streptomycin when first isolated, and only one of the twenty-six strains presumably developed a tolerance for the drug during the course of treatment. One of the two strains requiring more than 256 units of streptomycin for inhibition was a primary isolation from a case of osteomyelitis after six days of therapy. The second of these two strains was isolated from an infected decubitus ulcer which was treated locally and parenterally with streptomycin. When first isolated this organism was sensitive to 6 units of streptomycin. On the second isolation, six days later, the sensitivity was 128 units. After three additional days of exposure to the drug the organism was able to tolerate 256 units of streptomycin.

Twenty-one of 26 strains of Staphylococcus albus, 81 per cent, were sensitive to 1 unit or less of streptomycin. In 1 instance a strain apparently developed a tolerance for the drug during thirteen days of therapy. When first isolated its sensitivity was 0.06 unit, but thirteen days later, and on two additional occasions, the resistance of the organism as isolated from the same patient was greater than 256 units. The fourth strain reported with a resistance greater than 256 units was a primary isolation following six days of therapy.

Thirteen additional strains of micrococci were tested for their sensitivity to streptomycin. These were identified as Staphylococcus epidermidis, Micrococcus candidus and Micrococcus aurantiacus. Eleven of the thirteen

strains, or 85 per cent, were sensitive to 2 units or less of streptomycin.

Alpha Hemolytic Streptococci.—Thirty-seven isolations of alpha hemolytic streptococci were made from 18 patients during their course of treatment with streptomycin. Twenty-six of the strains, or 70 per cent, were sensitive to 8 units or less of streptomycin. The remaining eleven strains required 16 or more units for inhibition. In 2 instances it appeared that alpha hemolytic streptococci developed a tolerance for the drug. In a case of urinary tract infection this organism was isolated from urine on five different occasions during a period of nine days. The sensitivities were 1, 2, 4, 8 and 256 units of streptomycin. The second instance in which an alpha hemolytic streptococcus developed an increasing tolerance for streptomycin occurred with a strain isolated from a gunshot wound. Its sensitivity on primary isolation was 16 units, but twenty-seven days later when reisolated from the wound it grew very well in the presence of 256 units of streptomycin. The remaining four strains, resistant to 256 units of streptomycin, were primary isolations before therapy was begun.

Beta Hemolytic Streptococci.—Eleven of fifteen strains of beta hemolytic streptococci, or 73 per cent, were found to be sensitive to 8 units or less of streptomycin. Two strains with a sensitivity of 32 units were isolated from 1 patient before therapy was begun, and two strains that were resistant to more than 256 units were isolated from another patient twenty-one and twenty-eight days after therapy had been started. These strains may have become resistant during the course of therapy.

Diphtheroids.—The diphtheroids were found to be either extremely sensitive or very resistant to streptomycin. Thirty-six strains were isolated from 19 persons. Seventeen of these strains were sensitive to 1 unit or less of streptomycin, one required 7 units for inhibition, 6 required 256 units and 12 strains were not inhibited by 256 units of the drug. No attempt was made to identify these organisms as to species, but on two different occasions diphtheroids with a great tolerance for streptomycin were isolated from lesions which, on an earlier date, had yielded diphtheroids that were sensitive.

COMMENT

A study of the sensitivity of bacteria to antibiotics is complicated by the extreme difficulty encountered in determining with any degree of accuracy whether or not the same organism is being isolated when cultures are obtained over a period of days or weeks from a given patient. Thus, is a strain of Staphylococcus aureus isolated from a patient on one date the same organism as that isolated from the patient on a later date? At times a given organism will either disappear from an infectious process or will be present in such small numbers that it is not recovered when a culture of the infection is made. At some later date this same species will reappear. Is it the same organism that was originally present or has the patient become reinfected with another strain of the bacterium?

The problem assumes clinical importance under the following circumstances: A bacterium is isolated from a patient just before therapy with an antibiotic is begun. It is found to be very sensitive to the drug and, in view of this sensitivity, the dosage of the drug is reduced or is given at longer intervals. At a later date the same species of bacterium is reisolated and is found to be resistant to the antibiotic. May we assume that the resistant strain developed from the sensitive strain under the lower therapeutic dose or is it (1) a new invader with natural resistance or (2) a naturally resistant strain which was originally present in the lesion but for some reason was not isolated when the first culture was taken?

In the case of bacteremias it is probably safe to assume that tolerance for a given antibiotic has developed when a resistant strain is isolated subsequent to the isolation of a sensitive strain, but with open wounds this assumption may not be justified.

It often happens that two or even three colonies of Staphylococcus aureus are fished for identification and sensitivity tests from a streak plate made from an infectious process. On testing the sensitivity of these colonies, all but one of them may prove to be sensitive to the antibiotic. At a later date a second culture of the lesion is made but only one Staphylococcus aureus colony is picked. It is resistant to the drug. Is this the organism which was originally resistant or has one

of the susceptible strains developed a tolerance for the drug during therapy?

There appears to be no practical solution to this problem. It seems wiser therefore to maintain as high a concentration of the antibiotic in the body fluids as is possible.

SUMMARY

Two hundred and twelve strains of bacteria, isolated from 38 patients with miscellaneous infections while under treatment with streptomycin, were tested for their susceptibility to this antibiotic. The sensitivities obtained were correlated with the blood concentrations of streptomycin known to be attained in patients under therapy.

1. The majority of the strains of Escherichia coli, Proteus vulgaris, Aerobacter aerogenes, staphylococci and streptococci were susceptible in vitro to the blood concentration of streptomycin that can be maintained in the average patient over a four hour period when given in 500,000 S unit doses. This blood concentration is known to be from 5 to 7.5 or 8 S units per cubic centimeter of blood.

2. The majority of the strains of Pseudomonas aeruginosa investigated were found to be very resistant to streptomycin.

3. Resistant strains of a given bacterium were isolated from patients subsequent to the isolation of sensitive strains. It was assumed that these resistant strains developed from the sensitive strains.

4. Diphtheroids were found to be either extremely susceptible or very resistant to streptomycin.

5. A method was adopted for determining the sensitivity of bacteria to antibiotics within narrower limits than those obtainable with the twofold serial dilution method.

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THE VALUE OF PENICILLIN IN THE TREATMENT OF EMPYEMA

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DETROIT

Penicillin is almost nontoxic for man, yet it exerts a powerful antibacterial action against a wide variety of micro-organisms. Unlike the sulfonamides, penicillin is not inhibited by pus or other products of tissue destruction.[1] When given intravenously or intramuscularly, it penetrates poorly into collections of pus, but if it is injected directly into an abscess it remains there for some time and may be found in considerable concentration as long as twenty-four to forty-eight hours after its injection.[2] These unusual properties of penicillin have led some workers [3] to treat empyema by aspiration of the pus, followed by instillation of penicillin. Theoreti-

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cally, if this form of treatment is to be successful, the following conditions should prevail:

1. The causative bacteria must be susceptible to penicillin.

2. It must be possible for penicillin instilled in the empyema to contact all of the bacteria. Some empyemas are loculated so that it is impossible to reach all of the pockets with an aspirating needle.

3. The cavity must not contain pieces of necrotic lung or large clots of fibrin. Many empyemas of long standing, especially those caused by pneumococci, contain clots of fibrin several inches in diameter. An occasional empyema contains a piece of necrotic lung in the interstices of which bacteria are protected. Penicillin will not sterilize an empyema until these fibrin clots and pieces of necrotic lung are removed.

4. The anatomic conditions such as bronchial fistulas that cause constant reinfection of the cavity and allow the penicillin to escape must not be present. Bronchial fistulas, present more often than is generally realized, not only permit constant contamination of the cavity by organisms from the mouth but make it impossible to keep penicillin in the empyema.

5. The lung must be capable of reexpanding. Since reexpansion of the lung is the means by which empyema is cured it is obvious that, if the lung is not capable of reexpanding, aspiration of pus and instillation of penicillin will not suffice to heal the lesion.

There is no doubt that penicillin when properly used will obviate the need of surgical drainage in certain cases of empyema. Those responding to penicillin are chiefly the cases that have been detected relatively early when the pus is still thin and those in which none of the complications described are present. There is also no doubt however that, even when the complications described are present, penicillin can be of considerable aid as an adjunct to surgery. By means of penicillin and aspiration a large empyema can often be transformed into a small one that the lung can obliterate more quickly after rib resection. It is also possible to tide a critically ill patient over a period during which surgical intervention is hazardous. However, if the empyema is not bacteriologically and anatomically such

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that it will respond to penicillin therapy, to persist with aspiration of pus and instillation of penicillin is useless. An empyema is cured by expansion of the lung. Once the pleura becomes so thick that the lung cannot reexpand, an empyema cannot be cured by any means short of an operation designed to move the chest wall in to meet the lung. Such a procedure is serious and deforming and often must be done in stages. Drainage of an empyema by resecting a small section of rib under local anesthesia is such a trivial procedure compared to the operation for obliteration of chronic empyema that one is not justified in risking the possibility of having to do the latter in hopes of avoiding the former. It is rational then to treat an empyema by aspiration of pus and instillation of penicillin as long as rapid improvement is being made. If the patient becomes afebrile and the fluid decreases in amount, becomes sterile on culture and resembles the penicillin that was injected, satisfactory progress is being made. However, if the patient has a persistent fever, if the pus continues to accumulate and if the cavity fails to decrease rapidly in size, surgical drainage should be accomplished without further temporizing.

To summarize, use penicillin:

1. To cure small empyemas without loculation, lung sequestrums or bronchial fistulas.
2. To make large empyemas smaller.
3. To tide over a critically ill patient until he can be operated on safely.

The following cases, selected from those that have been treated with penicillin at the City of Detroit Receiving Hospital, illustrate these points:

REPORT OF CASES

CASE 1.—C. M., a Negro aged 39, was admitted on April 15, 1944 with multiple stab wounds, one of which involved the left chest wall, the diaphragm and the stomach. Because the patient had consumed a large meal and considerable alcohol shortly before injury, his stomach was full and there was extensive soiling of the peritoneum. The wounds were repaired, and the chest and abdomen were closed without drainage. Postoperatively a pleural effusion developed on the left. On the fifth day following injury the abdominal wound disrupted. This was resutured under general anesthesia. The temperature, which had been elevated from the time of the first opera-

tion, remained elevated. On May 8, twenty-two days after admission, 60 cc. of pus was obtained from the left pleural cavity. Nonhemolytic streptococci and unidentified anaerobic cocci were recovered from the pus. The streptococci were sensitive to 0.04 unit per cubic centimeter of penicillin in vitro; the sensitivity of the anaerobic cocci to penicillin was not tested. Beginning on May 12 the empyema was aspirated daily and each aspiration followed by the instillation of 50,000 units of sodium penicillin in a few cubic centimeters of saline solution. The pus maintained its purulent character but gradually decreased in amount. On June 10, only 1 cc. could be obtained, and no further aspirations were done. The temperature became normal after thirteen days of therapy, and the patient has remained well to date.

Cultures of the pus were as follows:

May 8 and 13, nonhemolytic streptococci and unidentified anaerobic cocci.

May 14, aerobic gram positive spore forming bacilli.

May 17 and 25, nonhemolytic streptococci and unidentified anaerobic cocci.

June 4 and 9, no growth.

In this instance the empyema was small, was not loculated, was easily aspirated and was caused by organisms susceptible to penicillin. Aspiration of the pus followed by instillation of pencillin was therefore sufficient to cure the lesion. However, it required twenty-three days to sterilize the empyema and thirty days of therapy in spite of the sensitivity of the streptococcus to penicillin. The morbidity was about equal to that which would have accompanied surgical drainage; hence, while the treatment was successful, it had no great advantage over surgery. If, on the seventeenth day, it had been decided to do a rib resection because the pus had not yet been sterilized, the period of morbidity would have been longer than thirty days. Often during the treatment of empyema with penicillin it is difficult to decide whether the therapy is effective. Sometimes the patient improves clinically but the pus does not become sterile. At other times the pus becomes sterile but the patient remains febrile. Under such circumstances it is difficult to decide whether persistence in the treatment will result in a cure or whether rib resection will ultimately be necessary. If one resorts to rib resection after three weeks of penicillin therapy, the period of morbidity is prolonged.

However, if one persists for many more weeks, one is risking the occurrence of chronic empyema if the treatment is not effective. The next case illustrates these difficulties:

CASE 2.—J. B., a white man aged 51, was admitted on Feb. 18, 1944 with type II pneumococcic pneumonia involving the right lower lobe. Treatment with sulfamerazine resulted in a slight improvement, but the patient's temperature remained elevated. On March 1 250 cc. of thick pus yielding a type II pneumococcus was aspirated from the right pleural cavity. Following removal of the pus, the patient's temperature fell to normal and remained normal until March 6, when it rose again to 102-103 F. On March 6 the empyema was aspirated and 50,000 units of penicillin was instilled into the cavity. Aspiration and instillation were repeated twice daily for three days and then once daily for sixteen more days until March 25. Cultures of the pus during this period were as follows:

March 6 and 7, type II pneumococci.

March 8, 9, 10, 12, 13, 14 and 15, sterile.

March 24, type II pneumococci.

Although the pus appeared to become sterile shortly after the instillation of penicillin, the patient did not improve clinically. His temperature remained elevated and pus continued to accumulate. In spite of the large amount of pus that was present, it was often difficult to withdraw much with a syringe because, as was subsequently shown at operation, large clots of fibrin blocked the needle. Since the patient failed to improve, it was decided to supplement the local instillation of penicillin with penicillin given intramuscularly. From March 14 to March 25 the patient received 10,000 units of penicillin intramuscularly every two hours in addition to the daily injection of 50,000 units in the empyema. During this regimen his temperature approached but did not reach normal, and the pus continued to accumulate. On March 24, after six negative cultures, pneumococci were again recovered from the pus. Accordingly it was decided to do a rib resection. Operation on March 28 disclosed a large cavity containing almost a liter of thick pus in which were many huge clots of fibrin. The pus obtained at operation was sterile. The character of the pus and the presence of fibrin apparently had prevented aspiration of the cavity.

This patient required rib resection after three weeks of very intensive penicillin therapy. The cavity was unilocular and easily accessible but contained so much thick material that it was impossible to aspirate the pus properly. The probable location of the pneumo-

cocci in the protected meshes of the fibrin was perhaps responsible for the positive culture on March 24, after twenty days of therapy, and for the continued accumulation of pus. Sixty-five days were required for healing. In this case reliance on penicillin prolonged rather than shortened the period of morbidity.

Case 3 illustrates the improvement that penicillin therapy can bring about in putrid empyema, but it at the same time illustrates one of the dangers of this form of treatment. The patient, feeling so much better because of the therapy, refused operation and left the hospital while viable streptococci could still be recovered from the pus in his chest. He may well develop chronic empyema.

Case 3.—H. W., a white man aged 64, was admitted complaining of pain in his right chest of three days' duration. He had signs of right lower lobe pneumonia, but no pneumococci were found in the sputum. His temperature ranged between 100 and 102 F. He developed fluid in the right pleural cavity, and on Oct. 19, 1944 the chest was aspirated and a large quantity of pus obtained. Alpha hemolytic streptococci were recovered on culture. Unfortunately no anaerobic cultures were made, but the foul character of the pus indicated that anaerobes must have been present. There was some delay in obtaining penicillin, so the chest was not aspirated again until October 25, when 1,500 cc. of very foul pus resembling pea soup in appearance was obtained. Following the aspiration, 50,000 units of penicillin in about 80 cc. of saline solution was instilled in the empyema. On October 27 550 cc. of pus, which was no longer foul, was obtained. The temperature fell to normal on this day and remained normal for the rest of the hospital stay. Aspiration of pus and instillation of 50,000 units of penicillin was done daily until November 9. Although the fluid decreased in amount, only about 100 cc. being obtained the last few times it remained purulent and, except for an isolated sterile culture on November 2, always contained viable streptococci. On November 9, after two weeks of therapy, rib resection was advised, but the patient felt so well that he refused operation. Penicillin therapy was stopped. Aspiration on November 23 yielded 50 cc. of thin, brown, odorless fluid from which streptococci were grown on culture. Aspiration on December 4 yielded only 4 cc. of fluid, but on December 7 30 cc. was obtained. X-rays still revealed an encapsulated empyema.

On December 8 the patient left the hospital against advice. Although the empyema may in this case go on to resolution, the patient left the hospital with fluid

which still contained streptococci in his pleural space. It is well known that such lesions may remain quiescent for months or even years and then flare up. We are inclined to believe, therefore, that eventually the patient will develop chronic empyema. There is no doubt that penicillin improved this patient's condition by reducing the size of the empyema and by killing the anaerobes, which were apparently originally present in the pus. If rib resection had been done when his chest contained 1,500 cc. of foul pus, a long time would have been required for reexpansion of the lung. However, if rib resection had been done after reduction in the size of the empyema cavity by one to two weeks of penicillin therapy, expansion would have occurred rapidly. Used to reduce the size of an empyema before operation, penicillin is of considerable value.

CASE 4.—O. H., a white man aged 47, was admitted on Oct. 9, 1944 with multiple stab wounds, one of which had entered the peritoneal cavity, lacerating the omentum and the liver. The patient had consumed sufficient alcohol to make him very uncooperative, and it was necessary to use general anesthesia in order to keep him quiet enough to permit repair of his wounds. Postoperatively he developed pleural effusion on the right. On October 20 aspiration of the right pleural cavity yielded 1,100 cc. of thin, brown fluid. No culture was made. The patient's temperature at this time was 101-102 F. Treatment with sulfadiazine was begun, the initial dose of 4 Gm. being followed by 1 Gm. every four hours. The temperature declined over a three days period to 99-100 F., where it remained until November 1, when the chest was again aspirated. Only a small amount of very thick pus was obtained. Type VIII and type XV pneumococci were recovered from the pus; 50,000 units of penicillin was injected into the empyema. Aspiration followed by injection of 50,000 units of penicillin was repeated daily until November 6, The cultures became negative after twenty-four hours of therapy. The temperature also fell to normal after twenty-four hours of therapy and remained normal. The patient has remained well to date.

This patient was treated successfully by only a few injections of penicillin. The good response in this case, as in the following one, was probably due to the small size of the empyema and the susceptibility of the organisms to penicillin.

CASE 5.—E. S., a white man aged 42, was admitted on March 28, 1944 for treatment of peritonitis caused by perforation of a peptic ulcer three days previously. Although his tempera-

ture was only 99-100.6 F. the patient was critically ill. On April 5 his temperature rose to 103 F. and he developed signs of a subdiaphragmatic abscess. On April 8 the posterior subdiaphragmatic area was explored; no definite pus was encountered, but the entire area contained fresh fibrinous adhesions between which were collections of clear fluid. There was no improvement following the operation, and by April 12 pleural effusion had developed. The temperature remained elevated. Fluid was aspirated from the right chest on April 14, but it clotted rapidly and no cultures were made. On April 17 the anterior subdiaphragmatic space was opened and a large abscess drained; beta hemolytic streptococci and Escherichia coli were recovered. Following drainage the patient's condition improved somewhat, but his temperature continued to rise and it was obvious that another collection of pus was present. On May 1 200 cc. of thin pus was aspirated from the right pleural cavity. Beta hemolytic streptococci, which were sensitive to 0.01 unit of penicillin per cubic centimeter, were recovered from the pus. On May 5 aspiration was repeated and 40,000 units of penicillin was instilled in the cavity. Aspiration and instillation were repeated daily for three days, and then 50,000 units of penicillin was injected daily for four days. The pus became sterile after the first twenty-four hours of treatment and decreased rapidly in amount. The last attempt at aspiration on May 15 yielded only a few cubic centimeters of fluid. The empyema has not recurred.

Case 6.—V. B., a white woman aged 26, admitted on May 15, 1944, had had a pelvic operation three weeks prior to admission at another hospital, following which some sort of pulmonary complication occurred. This had not subsided, and she was acutely ill when she was admitted to the Detroit Receiving Hospital. On May 17 200 cc. of very foul, green pus was aspirated from the right pleural cavity. An anaerobic nonhemolytic streptococcus and alpha hemolytic streptococci were cultured from the pus. On May 20 the patient suddenly became critically ill. She was cyanotic and dyspneic and on physical examination exhibited not only signs of hydropneumothorax on the right but also numerous moist rales throughout the left lung. Her temperature was 104 F. It was believed that she had developed a bronchopleural fistula and had soiled the left lung with pus from the empyema. The empyema was completely aspirated and 50,000 units of penicillin was injected. Aspiration and instillation were repeated daily for thirteen days and the patient was also given 10,000 units of penicillin intramuscularly every hour for twenty-two days in order to control the soiling of the left lung. The patient's general condition improved slowly. Twenty-four hours after the onset of therapy the temperature fell to 100-101 F., where it remained for nine

days before leveling off at normal, 100 F. The pus that was aspirated decreased steadily in quantity, lost its foul odor and changed to a thin brown fluid. The cultures were as follows:

May 19 and 20, 1944 alpha hemolytic streptococci and anaerobic nonhemolytic streptococci.

May 23, aerobic gram positive spore forming bacilli.

May 24, 25 and 27, sterile.

Although the empyema decreased in size, the bronchopleural fistula prevented the lung from reexpanding completely, and the patient continued to have a low grade fever. On May 8 a rib resection was done. This disclosed a small empyema into which there were several bronchial openings. Cultures from the walls of the cavity yielded anaerobic nonhemolytic streptococci.

In this instance penicillin therapy apparently saved the life of a critically ill patient. The penicillin that was given intramuscularly controlled the infection in the left lung, while further soiling was prevented by a combination of aspiration of the empyema and instillation of penicillin. By these means the patient's condition was improved and the size of the empyema was greatly reduced. When rib resection was finally done it was a simple procedure in a patient who was in good condition.

The next case illustrates a similar but more complicated problem:

Case 7.—E. S., a white man aged 39, was admitted on Oct. 21, 1944 with type II pneumococcic pneumonia involving the right lower and middle lobes. He had been ill at home for seven days. At the time of admission his temperature was 105 F. and he was comatose. Because of his serious condition he was treated with penicillin, receiving an initial dose of 30,000 units intravenously and 20,000 units intramuscularly. This was followed by 15,000 units intramuscularly every three hours for fourteen days. Over the course of a week the temperature gradually fell to levels of 99-100 F. and considerable improvement had occurred. On November 4, when penicillin was discontinued, his temperature rose abruptly to 102 F. and remained at about this level until November 10, when it again fell almost to normal. In spite of the lowered temperature he continued to show anorexia, lethargy, a cough and weakness. During the next few weeks he improved slightly but had periods with a relatively normal temperature alternated with periods of fever. Because of the persistent signs of infection, consolidation of the right lower lobe, the absence of demonstrable empyema and x-ray evidence suggestive of multiple abscess formation, it was decided to reinstitute systemic penicillin ther-

apy. On November 29 an initial dose of 20,000 units was given intramuscularly followed by 15,000 units every three hours. Penicillin was continued until December 17. On December 2 fluid was detected in the right pleural space and aspiration yielded 30 cc. of thick pus from which Staphylococcus aureus was recovered. Following aspiration 50,000 units of penicillin was instilled into the empyema. This procedure was repeated daily until December 11. Considerable difficulty was encountered in aspirating the empyema. At times 20 to 30 cc. of pus was obtained, while at other times nothing could be aspirated. It was apparent that a bronchial fistula existed, since the patient coughed and expectorated some of the solution each time it was injected.

In spite of systemic administration and the instillation of penicillin directly into the empyema, the patient failed to improve, and on December 12 a rib resection was done. The findings at operation were adequate to explain both the difficulties encountered at aspiration and the failure of the patient to improve. The empyema was fairly large, extending from the posterior axillary line to the paravertebral region and from the seventh to the ninth rib. There were several bronchial fistulas opening into the cavity, which contained a piece of necrotic lung about 3 inches in diameter. Traversing the cavity were several large vessels that could have given rise to a fatal hemorrhage at any time. Aspiration had been difficult for two reasons: (1) bronchial fistulas had provided sufficient drainage to prevent the accumulation of any great quantity of pus; (2) a lung sequestrum had covered the needle, making it impossible to aspirate either air or pus through it. Under such circumstances penicillin therapy could not have been expected to cure the lesion. Furthermore, the constant hazard of severe hemorrhage from the vessels traversing the cavity made it dangerous to delay surgical treatment.

The next case demonstrates the seriousness of delaying surgical drainage when large vessels traverse an abscess cavity.

Case 8.—E. B., a Negro woman aged 23, admitted on Oct. 29, 1943 with an abscess near the base of the left upper lobe, had had a tonsillectomy six weeks previously. Pleural effusion developed; the patient became extremely dyspneic and had frequent small hemoptyses. On November 9 200 cc. of foul, thin, purulent fluid was aspirated from the left pleural cavity. Anaerobic hemolytic streptococci, anaerobic nonhemolytic streptococci and several unidentified anaerobic bacilli and cocci were recovered from the pus. Penicillin therapy was initiated on November 10. Ten thousand units was injected into the empyema daily, and 50,000 units was given intramuscularly every hour for twelve hours. The dose was then reduced to

10,000 units intramuscularly every hour. This was continued for fifteen days.

Improvement was slow but progressive. The amount of sputum decreased, the patient was able to dispense with the oxygen tent, and her appetite improved. The foul odor promptly disappeared from the fluid aspirated from the chest, and anaerobic streptococci were not recovered from it after the fourth day of therapy. Because of a shortage of penicillin the dose was decreased on the morning of the twelfth day to 5,000 units per hour. On November 22, the thirteenth day of treatment, only a small amount of sterile fluid was obtained on aspiration, and the temperature became normal. On November 23, the fourteenth day, it was necessary to decrease the dose again, and from this time until her death she received only 2,500 units every two hours. On November 25, the sixteenth day, she felt worse, and her temperature rose. That evening she had a fatal hemoptysis. At autopsy the empyema was found to be completely obliterated. An abscess about 1 inch in diameter was present in the left upper lobe and was surrounded by considerable consolidated lung containing many small abscesses. A large eroded vessel traversed the cavity.

This case might be considered a success so far as treatment of the empyema was concerned, and it illustrates the remarkable improvement that can be obtained in critically ill patients through the use of penicillin. It also illustrates, however, that penicillin cannot be expected to correct certain anatomic changes; when these are present, surgical intervention should be prompt.

CASE 9.—G. G., a white man aged 63, who had been a tramp all his life, admitted to the hospital on Nov. 15, 1944 with a massive pleural effusion, had been ill for over a month, but he could not give a satisfactory account of his illness. He was very malnourished. On November 20 1,650 cc. of rather thin, foul, purulent fluid was aspirated from the right chest. More fluid was present, but the patient became so weak that aspiration had to be discontinued. Cultures of the fluid yielded beta hemolytic streptococci. On November 22 930 cc. of foul pus was aspirated and 50,000 units of penicillin instilled in the empyema. Aspiration and instillation were repeated daily for three days and then every other day for twenty-three days. The amount of fluid that could be aspirated decreased from 1,440 to 250 cc., and the cultures became negative on the tenth day of therapy. The patient did not improve a great deal, however. He continued to have a temperature of 99 to 100 F., his appetite was poor and he developed diarrhea. No cause for the diarrhea could be found.

Because of the persistent accumulation of pus after twenty-three days of therapy, failure of the cavity to decrease significantly in size during the last week of therapy and the patient's persistent poor condition and low grade fever, rib resection was done under local anesthesia on December 16. The cavity held about 250 cc. and was unilocular. Following operation beta hemolytic streptococci were again recovered from the empyema. The patient's course after operation was progressively downhill, and he died on Jan. 6, 1945. Death was due to multiple pulmonary infarcts. The empyema itself was progressing well.

This patient was in extremely poor condition when he was admitted to the hospital, and the delay of seven days between admission and the onset of therapy did not improve it. Whether the outcome would have been different if treatment had been instituted earlier or if surgical drainage had been done is not pertinent to this discussion. The point is that in an empyema of this size and duration twenty-three days of penicillin therapy were not adequate to effect a cure. During the last week of treatment pus continued to accumulate, and the cavity did not decrease in size.

CASE 10.—B. W., a white girl aged 2 years, was admitted on Jan. 3, 1944 with postpneumonic empyema, bronchopleural fistula and tension pneumothorax. Intercostal drainage was done the next day, releasing purulent fluid under pressure. Cultures showed type III pneumococci. Sulfamerazine therapy for the next fifteen days resulted in little or no improvement, and on January 18 penicillin was begun. Cultures yielded a coagulase positive Staphylococcus albus, which was sensitive to 0.156 unit of penicillin per cubic centimeter. Four thousand units of penicillin was injected intramuscularly every hour, and 40,000 units of calcium penicillin was instilled into the empyema cavity every twelve hours. The intercostal catheter was clamped off after each instillation of penicillin and was opened again one hour before the next injection. When there was no change in the patient's condition after six days of penicillin therapy a rib resection was done. Immediately the temperature fell to normal, and improvement was steady thereafter. Penicillin was discontinued three days after the operation.

In this case penicillin was of no value as far as could be determined. Failure to cure the lesion was to be expected in the presence of a bronchial fistula, but one would have expected some improvement in the child's general condition as a result of the therapy.

CASE 11.—J. C., a white man aged 67, was admitted on Dec. 15, 1944 with a putrid empyema known to be of at least three weeks' duration. On December 16 550 cc. of foul pus was removed. There was no growth aerobically, but a smear of the pus showed that it contained staphylococci, streptococci and diphtheroids. No anaerobic culture was made. On December 18 900 cc. of pus was removed and 100,000 units of penicillin was instilled. At this time the patient's temperature was 102 F. Aspiration of pus was repeated on December 19, 20, 21 and 23, 100,000 units being instilled on December 19 and 50,000 units thereafter. The pus lost its foul odor but did not decrease in amount, and the patient continued to have a temperature of 101-102 F. He developed abscesses in the chest wall at the sites of aspiration, so penicillin was discontinued and the empyema was drained.

It is possible that the patient might have responded to penicillin if treatment had been continued. However, his course during the first five days did not seem to indicate that this would occur, and in view of the infection in the chest wall it seemed safer to resort to surgical treatment.

CASE 12.—L. R., a colored woman aged 20, admitted on Jan. 20, 1944 suffering from disseminated lupus erythematosus, developed pneumonia of undetermined etiology in the left lower lobe on February 10. This improved somewhat with sulfamerazine therapy, but an effusion occurred and persisted. On March 2 1,500 cc. of green pus was aspirated from the left pleural cavity. Alpha hemolytic streptcocci, which were inhibited by 0.02 unit of penicillin per cubic centimeter, were recovered from the pus. On March 9 and for sixteen days thereafter the empyema was aspirated daily, and 50,000 units of penicillin was instilled after each aspiration. The pus became sterile after two days of therapy, and the amount of fluid that could be aspirated decreased rapidly. Small loculated collections of fluid formed that could be seen in the x-ray films for a month after treatment had been stopped, but these slowly disappeared. The patient died on June 30 from other causes. At autopsy the empyema cavity was found to be obliterated except for one very small collection of 8 to 10 cc of purulent appearing material. This was sterile on culture.

This case was successfully treated probably because of the extreme sensitivity of the infecting organism to penicillin. If the organism had been more resistant, it would have persisted in the loculation that formed and would have prevented a successful outcome.

CASE 13.—E. W.,[4] a white woman aged 26, was first admitted to the hospital in October 1943 with bilateral pulmonary tuberculosis and a large cavity on the right. Attempts to collapse the lung and obliterate the cavity were unsuccessful, so an intrapleural pneumolysis was done in two stages soon after the patient's admission. On December 13 x-rays for the first time showed fluid collected at the right base. On Jan. 19, 1944 the temperature suddenly rose to 104 F. and the patient experienced frequent chills. There was concurrent increase in the amount of fluid, and the patient became very ill. Aspiration and culture revealed no organisms, but anaerobic cultures were not done. The cavity in the lung was well collapsed, and the patient was responding well as far as the tuberculosis was concerned. Because of this good response and also because the disease was bilateral, her physician did not want to give up the pneumothorax. Consequently it was maintained, and the pleural cavity was aspirated frequently. The fluid became foul and increased in amount until 1,500 cc. was being aspirated every few days. At each aspiration the cavity was irrigated with saline solution and 50 cc. of hexylresorcinol was instilled.

On February 19 1,000 cc. of fluid was aspirated and 50,000 units of calcium penicillin was instilled. The fluid at this time was particularly foul, and cultures yielded an anaerobic streptococcus, unidentified anaerobic cocci and organisms resembling diphtheroids. Penicillin was injected twice daily for the next nine days, during which time the fluid became odorless and decreased in amount. From February 28 to March 6 the patient received intravenously 100,000 units of sodium penicillin daily and then 50,000 units intravenously every day to March 13, when all medication was stopped. During this time the temperature came down and the patient gained weight and felt very well; the temperature remained normal with only occasional rises to 100 F. On March 21 the phrenic nerve was crushed. The temperature again rose on April 3 and the fluid became purulent. On April 14 225 cc. of thick greenish pus was aspirated, and after saline irrigation 50,000 units of sodium penicillin was instilled in 100 cc. of saline solution. This amount was repeated daily until April 24, then 50,000 units every two days to June 2, and then once weekly until June 26. During this time the amount of fluid aspirated varied between 150 and 200 cc. Cultures yielded anaerobic cocci and diphtheroids. The temperature at the time penicillin was started on April 14 was varying from 100 to 101 F. During the rest of April the temperature varied from normal to 100 F., with occasional rises to 101 F. and one to 103 F. Through May, however, the temperature was higher than 99 F. on only two occasions.

4. This case is reported with the permission of Dr. W. A. Hudson.

After penicillin was stopped, 100 to 150 cc. of fluid was aspirated occasionally through July 24. Cultures were sterile until this date, when an anaerobic nonhemolytic streptococcus was again found. The cultures are listed as follows:

Feb. 19, 1944, anaerobic diphtheroids; gram-positive rods.
February 21, anaerobic gram-positive rods.
February 25 and March 1, 4, 6, 8, 10 and 13, sterile.
March 27, anaerobic cocci.
April 11, anaerobic gram-positive rods.
April 15, anaerobic cocci; diphtheroids.
April 17 and 22, sterile.
April 24, anaerobic cocci.
May 1, anaerobic gram-positive cocci; anaerobic streptococci.
May 8, sterile.
May 15, anaerobic gram-positive rods and diphtheroids; aerobic alpha streptococci and diphtheroids.
May 22, sterile.
May 29, anaerobic cocci; Alcaligenes sp.
June 5, 6, 19 and 26 and July 3, sterile.
July 24, anaerobic nonhemolytic streptococci.

During the next six months the patient improved slowly. Penicillin in doses of 25,000 units to 50,000 units intrapleurally was necessary biweekly to prevent the reaccumulation of fluid. During this time it was finally decided to do an upper stage thoracoplasty; this was done in September 1944. The wound healed by first intention and at present, February 1945, the patient has only a small empyema cavity remaining and is about to be discharged to her home.

This case illustrates the value of penicillin in holding a putrid empyema in check, but it also illustrates the fact that an empyema is cured only when the cavity is obliterated. This may be accomplished by reexpansion of the lung or, as in this case, by moving the chest wall in to meet the lung. Any chemotherapy that is not accompanied by obliteration of the empyema is bound to fail.

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THE ABSORPTION, DISTRIBUTION, AND EXCRETION OF STREPTOMYCIN IN MAN [1]

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Streptomycin, an antibiotic first isolated by Schatz, Bugie and Waksman (1) from the culture filtrate of *Actinomyces griseus,* has been shown to be effective both *in vitro* and *in vivo* against many gram-negative and gram-positive bacteria (1 to 7). There is also some evidence, based on the treatment of experimentally infected guinea pigs, that it may be of benefit in infections caused by *Mycobacterium tuberculosis* (8, 9). Systemic administration of streptomycin to animals has shown that they can tolerate doses that are well within the therapeutic range. These findings present the probability that streptomycin might be of value in controlling some of the human infections which do not respond to chemotherapeutic agents available at the present time. However, before streptomycin can be employed for the treatment of infections in humans, it is necessary to learn something concerning its absorption and excretion by man and about its distribution in his body. The purpose of this paper is to present the results of studies which were designed to provide this information.

MATERIAL USED AND METHODS

Streptomycin hydrochloride [2] was obtained from the manufacturer as a powder in sealed rubber-stoppered bottles which contained 1,000,000 E. coli or S units.[3] The powder was dissolved in a small amount, usually 10 ml., of sterile distilled water or physiological saline solution, and the resulting volume measured. The amount required for the desired dose was then calculated and given intramuscularly, intravenously, intrathecally, intrapleurally, or orally. Samples of blood, cerebrospinal fluid, ascitic fluid, and pleural fluid were obtained at suitable intervals. In some instances, pus was obtained either by aspiration or at the time of operation. All samples of peritoneal fluid obtained from patients with perforated peptic ulcer were collected when the abdomen was opened. The patients in whom urinary excretion studies were performed voided either prior to or immediately following the withdrawal of blood for assay purposes. If the patients were unable to void at the required intervals, they were catheterized. In some instances an indwelling catheter was employed.

The concentration of streptomycin in the various specimens was determined by 1 of 2 methods: (*1*) a twofold serial dilution method was employed for the assay of body fluids estimated to contain 1 unit or less of streptomycin per ml. and (*2*) the cylinder cup method recommended by Stebbins and Robinson (10) was employed for the assay of fluids estimated to contain more than 1 unit of streptomycin per ml.

The twofold serial dilution method

This method has an inherent error of 100 per cent, but when employed for the assay of fluids with a streptomycin content of less than 1 or 2 units per ml., the error is not significant nor clinically important. The assay was carried out by 2-fold serial dilution in Kahn tubes, 0.4 ml. of the fluid under test being diluted with 0.4 ml. of nutrient broth and inoculating these dilutions with 0.3 ml. of a $1:10^{-4}$ dilution of a culture of *Staphylococcus aureus* that has a sensitivity to streptomycin of 0.0875 unit per 0.7 ml. of nutrient broth. Undiluted specimens were also tested. The concentration of streptomycin in the last tube showing inhibition of the test organism is obtained by multiplying 0.0875 by 2.5 and by the dilution factor.

The cup method of Stebbins and Robinson

Some difficulty was experienced with the cup method during the initial phases of the work, and for this reason assays were not completed on a number of samples for from 2 to 3 weeks after they had been collected. However, subsequent assays, made on other samples within 2 days of collection and thereafter at weekly intervals for a month, demonstrated that no significant loss of potency occurred in urine (filtered or unfiltered), serum, pus, spinal fluid, ascitic fluid, or pleural fluid within 4 weeks.

The actual assay of the various specimens by the cup

[1] This work was supported by grants from the Theodore A. McGraw Fund and from Merck and Company, Inc., Rahway, N. J.

[2] Provided through the courtesy of Dr. D. F. Robertson of Merck and Company, Inc.

[3] An E. coli or S unit of streptomycin is that quantity which when dissolved in 1 ml. of nutrient broth or agar will just suffice to inhibit the growth of a given strain of E. coli.

TABLE I

Excretion of streptomycin in the urine (E. coli units)

Patient	Age	Dose and route of administration	Concentration of streptomycin in E. coli units per ml. of serum				Units per ml. of urine	Units excreted per period	Units per ml. of urine	Units excreted per period	Units per ml. of urine	Units excreted per period	Units per ml. of urine	Units excreted per period	Units per ml. of urine	Units excreted per period	Total	Amount excreted
	years		*5 minutes*	*1 hour*	*2 hours*	*4 hours*	*0 to 5 minutes*		*5 minutes to 1 hour*		*1 to 2 hours*		*2 to 4 hours*		*4 to 24 hours*			*per cent*
W. S.	30	25,000 I.M.	0	1.5	1.25	0	0	0	0	0	0	0	3.2	1,632	0	0	1,632.0	6.5
I. B.	40	25,000 I.M.	0	1.5	1.25	0	0	0	0	0	0	0	14	1,526	0	0	1,526	6.1
J. I.	33	25,000 I.V.	3.0	1.25	0	0												
E. W.	24	25,000 I.V.	2.5	1.25	0	0												
W. K.	41	50,000 I.M.	0	2.6	2.0	1.25	0	0	7.4	976.8	30.0	1,380.0	46.0	3,910	6.0	3,510.0	9,776.8	19.5
J. M.	16	50,000 I.M.	0	2.8	1.8	0	0	0			62.4	8,174.4	31.5	1,417.5	0	0		
E. K.	41	50,000 I.V.	6.3	2.5	0	0	0	0	26.8	4,958.0	12.6	5,229.0	12.6	5,418.0	4.0	9,640.0	25,245.0	50
E. L.	29	50,000 I.V.	7.3	2.5	2.5	0	29.4	1,793.4	122.5	16,537.5	68.6	8,575.0	32.4	7,776	4.0	8,140	42,821.9	85.6
J. R.	34	200,000 I.M.	1.25	11.1	7.9	4.0	0	0	220	27,500	95	18,050	80.5	16,502.5	35.0	33,950	96,002.5	48
M. R.	55	200,000 I.M.					0	0	330	9,900	390	15,600	260	33,800	11.4	24,966	84,266.0	42
B. G.	33	200,000 I.M.	2.7	5.8	4.6	3.3			86.4	17,193.6	59.4	17,820	104.0	63,232	20.8	58,240	156,485.6	78.2
G. H.	45	200,000 I.V.	21.4	8.0	6.2	2.9	99	4,752	780	30,420	960	23,040	255	26,775	100	98,500	183,487	91.7
J. S.	20	200,000 I.V.	25.0	9.1	6.2	3.7	121.3	14,162.5	48.0	18,720	53.2	20,216	94.0	26,320	66	48,180	128,598.5	64
H. H.	57	400,000 I.M.	0.0	10.3	17.2	13.9	0	0	84.0	8,736	472.0	41,064	340.0	41,480	124.0	124,000	215,280	53.8
V. S.	30	400,000 I.M.	6.5	10.5	3.8	8.3	2.3	218.5	590.0	76,700	18.0	1,800	150.0	30,750	25	54,625	164,093.5	41
A. S.	47	400,000 I.V.	32.4	11.8	8.3	5.6	21.8	12,862	446.0	28,925	165.0	34,650	74.0	44,400	18	72,540	193,377	48
A. D.	58	400,000 I.V.	40	14.2	9.5	5.6	4.4	1,034	900.0	54,000	237.5	29,687.5	280.0	43,400	30	42,900	171,021.5	42.7
L. L.	26	400,000 I.V.	44.5	17.8	10.9	7.5												
T. D.	65	500,000 I.M.	10.5	42.0	25.0	18.4	12.6	1,638	365.0	41,975	252.5	42,840	16.8	8,668	126.3	185,029.5	280,151.3	56
E. H.	64	500,000 I.M.	7.8	6.2	16.2	13.6	2.9	272.6	475	35,150	620	34,100	640	118,400	255.0	169,575	357,497.6	71
W. H.	57	500,000 I.V.	46.8	21.8	14.1	7.8	108	17,280	615.0	54,120	375.0	69,375	171.3	79,654.5	143.8	176,874	397,303.5	79
A. L.	63	500,000 I.V.	72.0	26.0	17.6	11.5	62.3	13,394.5	435	18,705	505	61,610	150	39,750	126	284,130	417,589.5	83.5

0 = No streptomycin detected.

method was always preceded by a screen test of various dilutions. This was done in order to determine the dilution necessary to give a concentration between 5 and 15 units, as this range on the standard reference curve is the most accurate. Pooled serum from normal persons was used for diluting serum, and where necessary, because of their viscosity or high streptomycin content, it was also used for diluting pus, peritoneal, and chest fluid. The streptomycin concentrations reported for pus and chest fluid, and to some extent for peritoneal fluid, are somewhat lower than they should be, for in most instances the material assayed had a higher viscosity than the serum standards. Sterile distilled water was used for diluting urine and cerebrospinal fluid. After ascertaining the correct dilution, assays were done in quadruplicate, each specimen being assayed in a Petri dish containing 1 or 2 of the reference concentrations. All plates were incubated for a period of 15 to 18 hours at a temperature of 30° C.

RESULTS

Serum concentrations of streptomycin following single intramuscular and intravenous injections

As would be expected, streptomycin was present in higher concentrations in the serum 5 minutes after a single intravenous injection than after an equal quantity had been given intramuscularly (Table I and Figure 1). In general, this difference persisted throughout the first hour following the injection, but at 2 and 4 hours, the concentrations of streptomycin following a single intravenous dose did not differ markedly from the concentrations reached at these intervals following a single intramuscular injection. There is a tendency, however, for the serum concentration to remain higher for a longer period of time following the intramuscular route than when given intravenously.

In general, as the dose of streptomycin was increased the concentration of streptomycin in the serum increased and remained high longer than it did following the administration of small doses (Figures 2 and 3). The increase, however, was not proportional to the dose given. This may, in

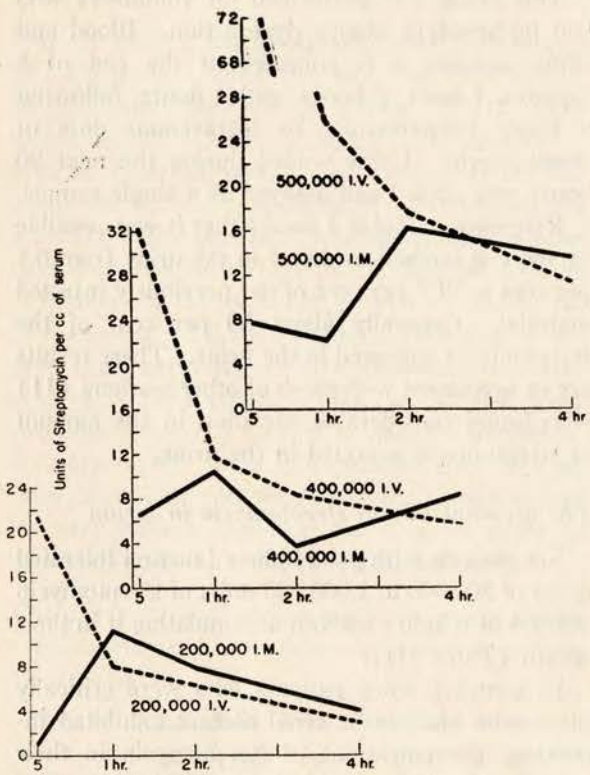

FIG. 1. SERUM CONCENTRATIONS OF STREPTOMYCIN FOLLOWING DOSES OF 200,000, 400,000, AND 500,000 UNITS

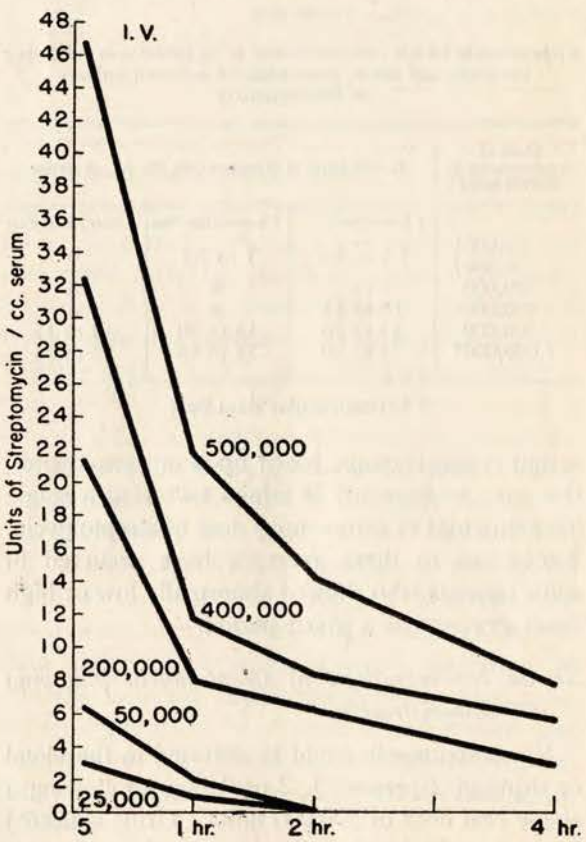

FIG. 2. SERUM CONCENTRATIONS OF STREPTOMYCIN OBTAINED OVER A 4-HOUR PERIOD AFTER INTRAVENOUS ADMINISTRATION OF 25,000 50,000, 200,000, 400,000 AND 500,000 UNITS

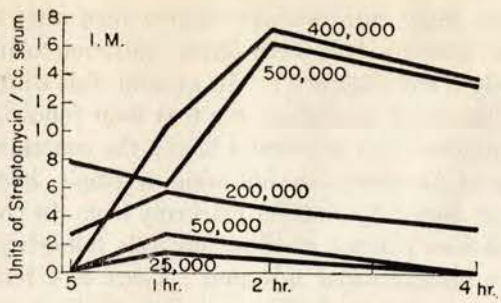

FIG. 3. SERUM CONCENTRATIONS OF STREPTOMYCIN OBTAINED OVER A 4-HOUR PERIOD AFTER INTRAMUSCULAR ADMINISTRATION OF 25,000, 50,000, 200,000, 400,000 AND 500,000 UNITS

part, be explained by individual variations. If the experiments had been conducted upon a single individual, a more precise picture of the serum concentration in relation to the dose might have been obtained. Table II shows the approximate

TABLE II

Approximate serum concentrations of streptomycin following various-sized doses, administered intramuscularly or intravenously

Dose of streptomycin in E. coli units	E. coli units of streptomycin per ml. of serum		
	1 hour after dose	*2 hours after dose*	*4 hours after dose*
25,000 } 50,000 }	1.5 to 2.5	1 to 2.5	0
200,000	10	6	3
400,000	10 to 15	8	6
500,000	15 to 20	15 to 20	10 to 15
1,000,000*	25 to 50	25 to 45	15 to 25

* Intramuscular data only.

serum concentrations, based upon our experience, that may be expected in adults following a single intramuscular or intravenous dose of streptomycin. Exceptions to these averages have occurred in some patients who showed abnormally low or high concentrations at a given period.

Serum concentrations of streptomycin following oral administration

No strepotmycin could be detected in the blood or urine of 2 persons 1, 2 or 4 hours following a single oral dose of 500,000 units. Urine collected from 4 to 24 hours following the dose likewise contained no demonstrable streptomycin. After a single oral dose of 1,000,000 units, streptomycin appeared in the serum of 2 persons in concentrations of 0.22 unit at the end of 1 hour. No streptomycin was detected at the end of 2 and 4 hours following the dose. Twenty-four-hour samples of urine contained about 0.5 unit of streptomycin per ml. In 2 persons, after an oral dose of 2,000,000 units, a concentration of 0.22 unit was found in the serum of one at 1, 2, and 4 hours, and a concentration of 0.44 unit at 2 and 4 hours in the serum of the other. No streptomycin could be detected in the serum of this second patient at the end of 1 hour. Twenty-four-hour samples of urine from these patients contained about 1.5 units of streptomycin per ml. Data have been presented (11) which indicate that the failure of streptomycin to appear in the serum in therapeutic amounts following oral administration is due to poor absorption rather than to destruction of streptomycin in the gastro-intestinal tract since 72 to 110 per cent of the daily dose could be detected in the feces.

The excretion of streptomycin in the urine

This study was performed on volunteers who had no apparent kidney dysfunction. Blood and urine samples were collected at the end of 5 minutes, 1 hour, 2 hours, and 4 hours, following a single intramuscular or intravenous dose of streptomycin. Urine voided during the next 20 hours was pooled and assayed as a single sample.

Reference to Table I shows that it was possible by the cup method to detect in the urine from 6.1 per cent to 91.7 per cent of the previously injected material. Generally about 50 per cent of the streptomycin appeared in the urine. These results are in agreement with those of other workers (11) who found considerable variation in the amount of streptomycin excreted in the urine.

The accumulation of streptomycin in serum

Six patients with good kidney function tolerated doses of 500,000 to 1,000,000 units of streptomycin every 4 or 6 hours without accumulating it in their serum (Table III).

In contrast, some patients who were critically ill or who had severe renal disease exhibited increasing concentrations of streptomycin in their serum when given similar doses (Table IV). For example, H. S., a boy 4 years of age with tuberculous meningitis, had a serum level of 31.8 units

TABLE III

Streptomycin serum levels in patients with good renal function and not critically ill. Intramuscular injections

Patient	Age	Dose of streptomycin in E. coli units	E. coli units of streptomycin per ml. of serum at the indicated intervals following injection			Diagnosis
	years		*2 hours*	*4 hours*	*6 hours*	
E. B.	14	1,000,000 every 6 hours After 7,000,000 After 11,000,000	36.6 48.0 48.4	22.5 25.0 42.0	17.4 20.0 24.4	Peritonitis—ruptured appendix
R. H.	26	1,000,000 every 6 hours After 9,000,000 (Dose cut to 500,000 units every 6 hours) After 14,500,000	21.4	31.0	20.2 23.6 13.6	B. coli bacteremia and urinary tract infection
B. S.	18	500,000 every 6 hours After 1,500,000 After 7,500,000			 11.2 12.0	Diabetes mellitus and B. coli urinary tract infection
R. D.	15	500,000 every 6 hours After 1,500,000 After 7,500,000			 15.2 16.8	Urinary tract infection
M. D.	21	500,000 every 6 hours After 1,500,000 After 7,500,000			 15.2 13.8	B. coli urinary tract infection
L. N.	43	500,000 every 6 hours After 4,000,000 After 7,500,000			 14.2 14.2	Diabetes mellitus and urinary tract infection

6 hours after a single intramuscular injection of 750,000 units. Since the boy was critically ill, therapy was continued by giving 750,000 units intramuscularly every 6 hours. He received a total of 2,250,000 units. Six hours after the last dose, the serum concentration of streptomycin was 171 units per ml. The accumulation may have been due to the size of the dose rather than to inability of the patient to excrete or destroy the streptomycin. However, similar retention of the drug has been observed in adults who were seriously ill. These findings, plus the fact that some individuals seem to excrete or destroy streptomycin very rapidly make it imperative that the concentration of streptomycin in serum be determined for each patient receiving the drug in order to regulate the dose intelligently and safely.

The appearance of streptomycin in cerebrospinal fluid following intramuscular and intravenous injections

Cerebrospinal fluid from 5 patients with no meningeal involvement was assayed following a single injection of 500,000 units of streptomycin. Four of the patients received the antibiotic intravenously; 1 received it intramuscularly. Lumbar puncture was performed from 1½ to 3 hours after streptomycin was administered. In no instance could streptomycin be detected in the cerebrospinal fluid. In a sixth patient, a boy with tuberculous meningitis, streptomycin was detected in the cerebrospinal fluid in a concentration of 13.2 units 3 hours after the intramuscular administration of 750,000 units. At this time, the serum concentration was 95.2 units. Six hours after receiving a total of 2,250,000 units of streptomycin at the rate of 750,000 units every 6 hours, this patient had a serum concentration of 171 units per ml., and a concentration of 41.6 units per ml. was found in his cerebrospinal fluid. Although in normal individuals streptomycin does not penetrate the blood-brain barrier to appear in the cerebrospinal fluid following a single systemic injection of 500,000 units, the single case of tuberculous meningitis reported in this paper demonstrates that streptomycin may penetrate into the cerebrospinal fluid after systemic injection if the meninges are inflamed.

Streptomycin administered by intrathecal injection

Five volunteers were each given a single dose of streptomycin intrathecally. Two of the patients

received 10,000 units, 2 received 15,000 units, and 1 received 20,000 intrathecally (Table V). Spinal fluid was withdrawn after 24 hours at which time a cell count was made and the fluid assayed by means of the cup method for its streptomycin content. The 24-hour assay values of spinal fluid seem to indicate that from 15,000 to 20,000 units of streptomycin administered intrathecally is sufficient to give therapeutic concentrations over a 20- or 24-hour period. All but 1 of the patients listed in the table (V) complained of symptoms, such as pain in the cervical region and headache. These patients also exhibited an increase in the number of cells in the spinal fluid. Since all of these patients had received streptomycin from the same lot, streptomycin from another lot was administered to 2 additional patients. One patient received 15,000 units and one received 20,000 units. Neither patient developed any of the symptoms experienced by the previous groups of patients, but both of them showed an increase in the spinal fluid cell count. Whether these irritative phenomena are due to a property of streptomycin or to an impurity in the preparations employed is not known. Until this point has been settled, it would seem wiser to be cautious in the intrathecal injection of streptomycin.

The appearance of streptomycin in peritoneal fluid following systemic administration

A single intravenous dose of 500,000 units of streptomycin was given to 4 patients with perforated peptic ulcer shortly after their admission to the hospital. Samples of peritoneal fluid were obtained at operation, and blood samples were drawn at approximately the same time. Streptomycin was detected in therapeutic amounts in the peritoneal fluid of all the patients (Table VI). These data indicate that systemic administration of the drug should be efficacious shortly after the onset of peritonitis. Whether streptomycin penetrates into peritoneal fluid or pus in peritonitis of longer duration is unknown.

The appearance of streptomycin in ascitic fluid following systemic administration

Single doses of streptomycin in 500,000-unit amounts were administered to 5 patients with ascites due to cirrhosis of the liver, or cardiac failure. Four received the drug intramuscularly and one received it intravenously. Streptomycin was detected in the ascitic fluid in appreciable amounts, especially in view of the large amount of fluid removed from one of the patients. The concentrations ranged from 1.75 to 12.5 units per ml.

TABLE IV

Streptomycin serum levels in patients critically ill. Intramuscular injections

Patient	Age	Dose of streptomycin in E. coli units	E. coli units of streptomycin per ml. of serum at the indicated intervals following injection					Diagnosis
	years		*1 hour*	*2 hours*	*3 hours*	*4 hours*	*6 hours*	
M. C.	37	1,000,000 every 4 hours After 4,000,000 After 10,000,000				34.2 40.5	11.8 27.0	Recurrent multiple abscesses
H. S.	4	750,000 every 6 hours After 2,250,000		106.0	95.2	55.3	31.8 171.0	Tuberculous meningitis
A. D.	50	2,000,000 by cont. I.V. drip over a 24-hour period for a total of 5,000,000 units. Changed after 5,000,000 to 1,000,000 every 6 hours I.M. After 6,000,000 After 7,000,000 After 10,000,000	 77.6	 71.2		 80.8 95.2	 65.6	Generalized peritonitis. B. coli bacteremia
M. W.	39	1,000,000 every 6 hours After 22,500,000	173.0			152.0	173.0	Abdominal abscess
D. H.	37	1,000,000 every 4 hours After 9,000,000				>160		Intestinal obstruction. Pelvic abscess
M. B.	59	500,000 every 6 hours After 11,500,000					>160.0	Diabetic. Gangrene right leg with urinary infection

TABLE V

Results of intrathecal administration of streptomycin

Patient	Age	Dose	CSF after 24 hrs.	Cell count before administration of streptomycin	Cell count 24 hours after administration of streptomycin	Symptoms
	years		*units per ml.*			
F. M.	37	20,000	20.2	20 100 per cent Lymph.	292—80 per cent polymorphonuclear leukocytes. 20 per cent lymphocytes	General malaise for 24 hours. Edema and erythema of face for 12 hours
A. H.	49	15,000	13.5	4	1500—90 per cent polymorphonuclear leukocytes	Headache. Pain in the cervical region
F. K.	59	15,000	25.4	3	243—89 per cent polymorphonuclear leukocytes	General malaise. Occipital headache
R. S.	34	10,000	0.875			No complaints
Q. W.	51	10,000	3.7	3	180—80 per cent polymorphonuclear leukocytes	Frontal headache. Pain in the cervical region

2 to 4 hours following administration of the drug (Table VII).

The appearance of streptomycin in pleural fluid following systemic administration

Streptomycin, like penicillin, was found to appear only slowly in 3 thoracic empyemas following systemic administration. About 1 unit per ml. of pus could usually be detected in 3½ hours after a single intramuscular dose of 500,000 or 1,000,000 units. This value is probably low, due to the viscosity of the material assayed. In 2 cases of tuberculosis in which fluid was aspirated from the chest, streptomycin was detected in amounts of 2.4 and 3.0 units per ml. of fluid after the administration of 1,000,000 and 500,000 units, respectively.

TABLE VI

The appearance of streptomycin in peritoneal fluid of patients with perforated peptic ulcer

Patient	Age	Dose of streptomycin in E. coli units	Time after dose	Concentration of streptomycin in E. coli units	
				In serum	In peritoneal fluid
	years		*hours*		
G. H.	45	500,000 I.V.	1 1½	21.5	22.0
W. S.	45	500,000 I.V.	2 2½	15.0	14.9
Z. B.	39	500,000 I.V.	1¼ 1¾	25.5	16.2
E. M.	50	500,000 I.V.	1¼ 1½	19.5	17.8

Toxic manifestations of streptomycin

A number of toxic symptoms were observed in the patients who received streptomycin. Among these were flushing of the skin, headache, and a sense of fullness in the head shortly after injection of the drug. Two patients who were given 500,000 units intravenously over a 1- to 2-minute period complained of a bad taste in the mouth, dizziness, and respiratory difficulty. Both patients lost consciousness for a period of 3 to 5 minutes, during which time the pulse was imperceptible.

TABLE VII

The appearance of streptomycin in ascitic fluid following systemic injection

Patient	Age	Dose of streptomycin in E. coli units	Time after dose	E. coli units of streptomycin		Diagnosis
				In serum	In ascitic fluid	
	years		*hours*			
J. D.	53	500,000 I.M.	3½		2.25	Cirrhosis of liver
J. W.	60	500,000 I.M.	4	12.8	4.8	Cardiac decompensation
F. H.	54	500,000 I.M.	4	10.2	3.2	Cirrhosis of liver
L. C.	60	1,000,000 I.M.	2½	28.0	12.5	Cardiac decompensation
L. B.	46	400,000 I.M.	2	3.5	1.75	Cardiac decompensation

Recovery was rapid in both instances, and no abnormal sequellae were noted.

Forty-five patients received the drug therapeutically for from 1 to 18 days. The total dose administered to these patients varied from 1,500,000 to 30,500,000 units. Of this group, 13 exhibited toxic symptoms other than those described above. Three developed fever which subsided when streptomycin was discontinued. A rash occurred in 2 patients. Nine patients complained of generalized aching, a feeling of weakness, and pain in the joints. One patient who had a very high concentration of streptomycin in her serum (173 units per ml. 6 hours after receiving 22,500,000 units intramuscularly, at the rate of 1,000,000 units every 6 hours) developed painful swelling of her wrists. All of these toxic symptoms disappeared promptly when the drug was discontinued. They seemed to occur more frequently with certain lots of streptomycin than with others. Whether they are caused by a property inherent in streptomycin or whether they are due to impurities which can be eliminated by improvement in the process of manufacture is as yet unknown. It can be said, however, that many patients tolerated large doses of streptomycin quite well and in them it was possible to maintain serum concentrations within a therapeutic range.

SUMMARY

The absorption and excretion of streptomycin following systemic and oral administration was studied in 22 persons. Doses of 25,000 to 500,000 units were given intramuscularly or intravenously, and doses of 500,000 to 2,000,000 units were given orally. Generally, after intramuscular or intravenous injection, about 50 per cent of the dose was excreted in the urine within 24 hours. Streptomycin was not absorbed from the gastro-intestinal tract following a single dose of 500,000 units, but traces appeared in both blood serum and urine after doses of one and two million units.

Serum concentrations of streptomycin following the systemic administration of 25,000 and 50,000 units were less than 3 units per cu. cm. at the end of 1 hour. No streptomycin was detected in the serum of 7 out of 8 patients at the end of 4 hours following injection of these amounts. Doses of 500,000 units, given either intramuscularly or intravenously every 6 hours, seemed to maintain a serum level adequate to combat bacteria whose growth is inhibited by concentrations of 5 to 7.5 units of streptomycin per ml. of culture medium. The serum concentrations during the first few minutes after the injection of a given dose of streptomycin intravenously were much higher than those attained following a similar dose administered intramuscularly. In general, however, by the end of 1 hour, the serum concentrations were approximately equal whether the drug had been given intravenously or intramuscularly. This condition persisted until the end of the fourth hour when the concentrations following the intramuscular injection were found to be slightly higher than those following the intravenous injection.

No streptomycin was found at the end of three hours in the spinal fluid of 5 normal persons after a single dose of 500,000 units given intramuscularly or intravenously. When administered intrathecally in doses ranging from 10,000 to 20,000 units, streptomycin was detected in the spinal fluid in concentrations of 0.875 to 25.4 units at the end of 24 hours. Some toxic manifestations, pain in the cervical region, headache, and an increase in spinal fluid cell count, followed the injection of 10,000 to 20,000 units of streptomycin intrathecally.

Streptomycin was found to penetrate into the peritoneal cavity in substantial amounts in early cases of peritonitis resulting from ruptured peptic ulcer following a single intravenous injection of 500,000 units.

Streptomycin in amounts ranging from 1.75 to 12.5 units per ml. was detected in ascitic fluid following systemic injection. Like penicillin, streptomycin injected intramuscularly did not penetrate into empyema cavities in therapeutic amounts although traces could be detected in the pus.

A number of patients complained of flushing of the skin, a sense of fullness in the head, or headache shortly after the intramuscular or intravenous injection of a large dose of streptomycin. Two patients who were given 500,000 units intravenously over a 1- to 2-minute period complained of a bad taste in the mouth, dizziness, and respiratory difficulty. Both patients lost consciousness for 3

to 5 minutes during which time the pulse was imperceptible. Recovery in both instances was rapid and no abnormal sequellae occurred.

Thirteen of 45 patients who received streptomycin therapeutically for 1 to 18 days complained of generalized muscular aching, a feeling of weakness, or pain in the joints. Three of these patients developed drug fever, and a rash occurred in 2. All of these symptoms cleared when the drug was discontinued.

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With Compliments to
Mr. Embree.
Buggs

Streptomycin in the Treatment of Surgical Infections

Report of Experiences with Its Use

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SURGEONS are called on to treat a number of infections which do not respond to the usual surgical measures or to the forms of chemotherapy that have been available. They are frequently complicated by the presence of intestinal fistulas, intestinal obstruction, urinary obstruction, pieces of dead bone, necrotic fascia or tendon and poor blood supply. Because of these factors and because several types of bacteria are usually present, it is difficult to compare these infections with one another or to classify them for purposes of evaluating therapy. In these respects, they differ significantly from such diseases as pneumococcic pneumonia, meningococcic meningitis, typhoid and gonococcic urethritis, all of which have a simple etiologic agent and run a fairly typical course.

Examples of these infections can be found in any surgical service. They are usually difficult to treat, often persisting for many weeks. For these reasons it is important to search for new methods of treatment and, in spite of the difficulties involved, to attempt to evaluate such new methods.

The new antibiotic, streptomycin, is known from the results of both in vitro and in vivo experiments [1] to be effective against many

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(Footnote continued on next page)

gram-negative and gram-positive bacteria. Since most of the infections under discussion are caused by a mixture of gram-positive and gram-negative organisms, it is important to test the efficacy of streptomycin in their treatment. The purpose of this paper is to present the results of treatment of 55 such infections with streptomycin.

MATERIALS AND METHODS

Streptomycin hydrochloride was supplied by the manufacturer in sealed rubber-capped bottles.[2] The manufacturer's assay value was accepted, and for systemic administration the material was dissolved in sterile isotonic solution of sodium chloride to make concentrations of 10,000 to 100,000 S units [3] per cubic centimeter. The solutions were prepared just before use. Streptomycin was customarily given intramuscularly, either by intermittent injection or as a continuous infusion. In a few instances, it was given intravenously as a continuous infusion in concentrations of 1,000 S units per cubic centimeter of isotonic solution of sodium chloride. For local use in wounds, concentrations from 250 to 1,000 S units per cubic centimeter were employed. The material was usually applied as a slow continuous drip through a small rubber tube incorporated in the dressing. Frequent samples of blood were withdrawn from patients who received streptomycin systemically, and the concentration of streptomycin in the serum was determined by the cup plate method of Stebbins and Robinson.[4] Whenever feasible, the causative organisms were isolated and their in vitro resistance to streptomycin was determined.

RESULTS

Bacteremia.—Nine patients with bacteremia were treated (table 1). In 5 instances, treatment was successful in that the blood stream was sterilized and the patient recovered. In 3 instances treatment failed,

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TABLE 1.—*Effects of Streptomycin in Cases of Bacteremia*

Patient	Source of Infection	Bacteria Recovered	Resistance in Vitro, Units/Cc.	Dose and Route of Administration	Serum Level, Units per Cc.	Other Therapy	Results
S. W.	Suppurative arthritis	H. influenzae	Not done	50,000 units every 3 hr. intramuscularly for 87 doses; discontinued for 5 days; started again, 250,000 units every 3 hr. intramuscularly for 31 doses	After 1st dose: 1 hr. 0.875; 2 hr. 0.44; 3 hr. 0.44; after 7th dose: 3 hr. 0.44	.....	Blood sterile after 2 doses but joints remained swollen and patient did not improve; blood culture positive 24 hr. after 1st course of therapy ended; blood positive all through 2d course; patient later cured with sulfadiazine
K. L.	Sinusitis	Staph. albus	256	1,000,000 units every 6 hr. intramuscularly for 42 doses; 6,000,000 units daily as continuous intramuscular infusion for 5 days	After 42d dose: 4 hr. 83; during dose of 44th million: about 100.4; 2 hr. after therapy was discontinued: about 112	Penicillin; sulfathiazole	Failure; multiple pulmonary abscesses and cavernous sinus thrombosis
S. V.	Unknown	K. pneumoniae	0.25	1,000,000 units every 6 hr. intramuscularly for 7 doses; 500,000 units every 6 hr. for 16 doses	Not done	Sulfathiazole	Cure
L. L.	Infection of urinary tract	A. aerogenes	3	2,000,000 units per 24 hr.; continuous intravenous infusion for 3 days	15.2 at end of 24 hr. of therapy	.....	Cure
W. T.	Infection of urinary tract and wound	A. aerogenes	2	500,000 units every 6 hr. intramuscularly for 24 doses	After 1st dose: 2 hr. 7; 4 hr. 28; 6 hr. 3.5; after 24th dose: 2 hr. 47.5; 4 hr. 38.3	.....	Patient recovered; blood stream sterilized rapidly, but wound abscess drained on 6th day of therapy; contained alpha hemolytic streptococci, A. aerogenes, Esch. coli; sensitive to 8, 2 and 16 units of streptomycin per cubic centimeter respectively
R. H.	Urinary infection	Esch. coli	Not done	1,000,000 units every 6 hr. intramuscularly for 12 doses; 500,000 units every 6 hr. for 12 doses	After 1st dose: 1 hr. 19.4; 2 hr. 21.4; 4 hr. 31; 6 hr. 20.2; after 6th dose: 6 hr. 23.6; after 16th dose: 6 hr. 13.6	.....	Cure
K. L.	Diabetic gangrene of foot	Esch. coli	32	500,000 units every 6 hr. intramuscularly for 20 doses	.....	.....	Infection of blood stream cured, but other organisms in urine, namely A. aerogenes and Str. viridans, which were extremely resistant, persisted
A. D.	Ruptured appendix	Esch. coli	5	2,000,000 units per 24 hr. as continuous intravenous infusion for 36 hr.; then 1,000,000 units every 6 hr. intramuscularly for 5 doses	After 1st intramuscular dose: 6 hr. 65.6; after 2d intramuscular dose: 1 hr. 77.6; 2 hr. 71.2; 4 hr. 80.8; 6 hr. 65.6; after dose of 5th million: 4 hr. 95.2	.....	Patient died; autopsy showed extensive peritonitis, multiple hepatic abscesses and pyelophlebitis; B. coli recovered from the abscesses
A. G.	Pyelitis	Esch. coli	40	1,000,000 units every 6 hr. intramuscularly for 8 doses; stopped for 24 hr. because of reaction, then 1,000,000 units every 6 hr. for 7 doses	After 1st dose: 6 hr. 40; after 1st dose of second course: 6 hr. 114.5	.....	Patient in critical condition when therapy started; blood promptly sterilized but patient became stuporous 2 hr. after receiving 8th dose of 1,000,000 S units; blood pressure 85/20; therapy resumed after 24 hr. but patient died after 7,000,000 units; autopsy revealed cirrhosis of liver and pyelonephritis

and in 1 instance (A. G.) the patient died in spite of sterilization of her blood. The cause of death in this case is uncertain. The patient became comatose after receiving 8,000,000 S units of streptomycin over a forty-eight hour period. Therapy was discontinued, and during the ensuing twenty-four hours the condition of the patient improved. Therapy was started again, but the patient gradually failed, and she died after receiving an additional 7,000,000 S units over forty-two hours. Autopsy revealed cirrhosis of the liver and pyelonephritis.

An analysis of these cases reveals that although streptomycin sterilizes the blood promptly it does not sterilize walled-off collections of pus (patients W. T. and A. D.), even though a serum concentration of streptomycin is present which, on the basis of in vitro tests, is more than adequate to inhibit growth of the organisms in the abscess. The following case illustrates this point.

W. T., a white man, 41 years of age, had had the left kidney removed a number of years ago. Shortly before he consulted us a stone became impacted in the right ureter, and on March 9, 1945 he was examined by means of a cystoscope and a catheter was passed to the right renal pelvis. The day of cystoscopy chills and fever developed and the patient became extremely ill. During the next few days, in spite of penicillin therapy and an adequate urinary output, he failed to improve. On March 16 the stone was removed surgically. Chills and fever persisted; the man became critically ill and on March 21, and again on March 22, Aerobacter aerogenes was recovered from his blood stream. Streptomycin therapy was initiated on March 22 in doses of 500,000 S units intramuscularly every six hours and continued until March 28, a total of 12,000,000 S units being given. In vitro the organism was inhibited by 2 units of streptomycin per cubic centimeter. The concentration of streptomycin in the patient's serum was as follows:

	Time After Dose, Hr.	Units per Cc. of Serum
First dose	2	7.0
	4	28.0
	6	3.5
Second dose	2	47.5
	4	38.3

After one day of treatment, the temperature, which had varied from 97 to 104 F., leveled off at 100 to 100.5 F., and subsequent blood cultures were sterile. On March 27, the sixth day of therapy, a small abscess in the wound was drained. The temperature fell to normal the following day and remained so. Streptomycin was discontinued on March 28. The following organisms were recovered from the wound abscess:

	In Vitro Sensitivity to Streptomycin, Units per Cc.
Alpha hemolytic streptococci	8
Aerobacter aerogenes	2
Escherichia coli	16

In spite of the fact that all these organisms were inhibited in vitro by concentrations of streptomycin less than the patient presumably had in his serum during most of his therapy, they were not killed but persisted and caused fever until the abscess was drained.

Peritonitis.—Streptomycin was administered to 12 patients with peritonitis, caused in 5 instances by perforation of the appendix, in 6 by rupture of a peptic ulcer and in 1 by a perforation of a carcinoma of the cecum. The results of therapy in these cases (table 2) are difficult to assess. First, peritonitis is an unpredictable disease. Some patients who appear critically ill recover with surprising rapidity, while others, who at first do not seem as sick, may die or recover only after a protracted illness. Second, the bacterial flora in peritonitis is usually complex, and often all the offending organisms are not recovered by the usual methods of culture. Third, some of the patients in cases reported in this paper had penicillin or sulfadiazine in addition to streptomycin, because the surgeons in charge were reluctant to withhold any treatment which might be of benefit to a patient who was critically ill.

Because of the reasons listed, it is unwise to conclude a great deal from this small group. It is apparent, however, that in these cases streptomycin had no spectacular effect. The patients with peritonitis resulting from perforation of the appendix followed the course that one was accustomed to observe before the advent of chemotherapy. One patient with generalized peritonitis who had been sick for three days recovered after nineteen days. Another, who had been ill for only two days, recovered after six days. In this instance, however, the peritonitis was rather mild. Pus which was aspirated from the peritoneum yielded only Staphylococcus albus, diphtheroid bacilli and nonhemolytic streptococci. In a third patient, who was also treated conservatively, a pelvic abscess formed but the patient finally recovered, after twenty-four days. In a fourth patient (A. D.), who was reported in the group with septicemia, pylephlebitis with hepatic abscess developed and the patient finally died. It should be observed that in this instance streptomycin therapy was not instituted until the patient was almost moribund. The pylephlebitis and hepatic abscess were probably already present. None of these patients were operated on. The fifth patient, a girl 14 years of age, had an appendectomy after the appendix had perforated. In spite of treatment with streptomycin an infection of the wound and a pelvic abscess developed, but the patient recovered after about three weeks. Similarly, the patients in whom peritonitis was the result of perforation of a peptic ulcer did not recover spectacularly under treatment. The patient whose peritonitis was due to perforation of a carcinoma of the cecum had been ill for ten months and was admitted to the hospital with a large intra-abdominal abscess. A fecal fistula followed drainage of the abscess. Although the patient's general condition was so poor that further intervention was not warranted, an ileotransverse colostomy was done. It was discovered at this operation that the patient had a plastic peritonitis. In spite of vigorous strepto-

TABLE 2.—*Effects of Streptomycin in Cases of Peritonitis*

Patient	Source of Infection	Bacteria Recovered	Resistance in Vitro, Units/Cc.	Dose and Route of Administration	Serum Level, Units per Cc.	Other Therapy	Results
E. B.	Appendicitis; appendectomy	A. aerogenes Esch. coli Alpha hemolytic streptococci	2 5 —	1,000,000 units every 6 hr. intramuscularly for 26 doses	After 1st dose: 2 hr. 36.6; 4 hr. 22.5; 6 hr. 17.4; after 7th dose: 2 hr. 48; 4 hr. 25; 6 hr. 20.4; after 11th dose: 2 hr. 48.4; 4 hr. 42; 6 hr. 24.4	None	Recovery after 3 wk.; pelvic abscess developed which subsided without drainage and wound infection containing A. aerogenes resistant to 5 units per cc.; alpha streptococci resistant to 16 units per cc.; B. melaninogenicus and unidentified gram-negative rod
H. M.	Appendicitis; no operation	Esch. coli Ps. aeruginosa A. aerogenes	6 41 5	250,000 units every 6 hr. intramuscularly for 43 doses	.....	Penicillin 15,000 units every 3 hr. intramuscularly for 56 doses	Recovery after 24 days; pelvic abscess developed, which subsided spontaneously
T. D.	Appendicitis; no operation	Esch. coli Gram-negative rods, unidentified Bacteroides melaninogenicus; anaerobic gram-positive coccus; anaerobic streptococci	4 32	1,000,000 units every 4 hr. for 19 doses, then every 6 hr. for 4 doses intramuscularly	.....	Penicillin	Recovery after 19 days
C. B.	Appendicitis; no operation	Staph. albus; diphtheroid; gamma streptococci	..	1,000,000 units every 6 hr. for 20 doses intramuscularly	.....	Penicillin 15,000 units every 3 hr.	Recovery; temperature elevated 6 days
A. D.	Appendicitis; no operation	Esch. coli	5	2,000,000 units per 24 hr. continuous intravenous infusion for 1½ days, then 1,000,000 units every 6 hr. for 5 doses	After 1st dose intramuscularly; 6 hr. 65.6; after 2d dose intramuscularly: 1 hr. 77.6; 2 hr. 71.2; 4 hr. 80.8; 6 hr. 65.6; after 5th dose intramuscularly: 4 hr. 95.2	.....	Death; autopsy showed extensive peritonitis, pylephlebitis and liver abscess
A. O.	Peptic ulcer perforated	Alpha hemolytic streptococci	..	1,000,000 units every 6 hr. intramuscularly for 16 doses	.....	Penicillin 15,000 units every 3 hr.	Temperature elevated for 7 days; recovery
E. P.	Perforated ulcer	Anaerobic coccus; alpha hemolytic streptococci	..	1,000,000 units every 6 hr. intramuscularly for 17 doses	.....	Penicillin 15,000 units every 3 hr.	Temperature elevated for 5 days
W. M.	Perforated ulcer	Alpha hemolytic streptococci	..	1,000,000 units every 6 hr. for 29 doses	.....	Penicillin 15,000 units every 3 hr.	Temperature elevated for 7 days
F. G.	Perforated ulcer	B. subtilis; alpha hemolytic streptococci; anaerobic diphtheroid; anaerobic gram-positive coccus	0.25	1,000,000 units every 6 hr. for 25 doses intramuscularly	.....	Penicillin 20,000 units every 2 hr. intramuscularly	Wound infection developed from which were recovered: yeast resistant to more than 256 units per cc. alpha streptococci, anaerobic diphtheroid, Staph. albus resistant to 0.5 unit per cc.; rash and drug fever; afebrile on 9th postoperative day, 3 days after drug discontinued
F. Mc.	Perforated ulcer	No growth	..	1,000,000 units every 6 hr. intramuscularly for 13 doses	.....	Penicillin 15,000 units intramuscularly every 3 hr.	Temperature normal in 3 days
P. T.	Perforated ulcer	No culture	..	500,000 units every 6 hr. intramuscularly for 17 doses	.....	.....	Temperature normal after 5 days
B. K.	Perforated carcinoma of the cecum	Staph. aureus; alpha hemolytic streptococci; Esch. coli; anaerobic diphtheroid; anaerobic gram-positive rod with spores, not identified	8	1,000,000 units intraperitoneally at operation; 1,000,000 units every 12 hr. intramuscularly for 26 doses	.....	.....	No benefit; wound infection developed; death

mycin therapy, 1,000,000 S units in the abdomen at operation and 1,000,000 intramuscularly every twelve hours for twenty-six doses, the patient failed to improve and the wound became infected. Culture of material from the wound yielded a hemolytic Staphylococcus aureus, an alpha hemolytic streptococcus, Esch. coli, an anaerobic coccus and an unidentified anaerobic gram-positive sporulating rod. The staphylococcus was sensitive to 8 units of streptomycin per cubic centimeter and the colon bacillus to 8 units also. Although this patient was perhaps not suitable for treatment, it is in such circumstances that help is needed.

It has been shown that streptomycin can be recovered from peritoneal exudate after systemic administration.[5] If the organisms causing peritonitis are susceptible to streptomycin, such treatment should be beneficial. Apparently the reason that treatment with streptomycin was not attended by spectacular success is that peritonitis is usually a mixed infection and a number of the bacteria involved are resistant to streptomycin. Among the most important of the resistant organisms are the non-spore-forming anaerobes.

Infections of Soft Tissues.—In this group there were 3 patients with pelvic abscess due to salpingitis or perforation of the bowel and 3 patients with wounds of the back or buttocks, in 1 of whom the wound followed injection of liver extract into the gluteal muscles, in 1 it was a shotgun wound of the back and in 1 a large undermined area of the lower part of the back and buttocks, which had started as a decubitus ulcer. There were, in addition, 6 patients with the following infections: hepatic abscess secondary to pelvic inflammatory disease, infected nephrectomy wound of flank, infected wound of the abdominal wall following ileotransverse colostomy, abscess of the breast, abscess of subcutaneous tissue of the thigh and cellulitis of subcutaneous tissue of the thigh. In only 1 of the cases can it be established that streptomycin played an important role in curing the infection. Failure in the other cases can be attributed to the presence of anaerobic non-spore-forming organisms, resistant aerobes or an inadequate dose of streptomycin.

The following case illustrates the type of response that occurred in this group.

M. W., a 39 year old Negro woman, had an exploratory laparotomy on March 24, 1945 and was found to have diffuse peritonitis due to pelvic inflammatory disease. The wound was closed without drainage. On April 1, 1945 an abscess presented in the lower aspect of the wound and was drained. A large quantity of foul yellow pus continued to escape from the abscess, which extended into the pelvis. Alpha and beta hemolytic streptococci, Bacteroides melaninogenicus,

5. Buggs, C. W.; Pilling, M. A.; Bronstein, B., and Hirshfeld, J. W.: The Absorption, Distribution and Excretion of Streptomycin in Man, J. Clin. Investigation **25**:94-102, 1946.

an anaerobic gram-positive coccus and anaerobic diphtheroids were recovered from the pus. Streptomycin therapy was started on April 4, the patient receiving 500,000 S units intramuscularly every six hours and 500,000 units in 1,000 cc. of isotonic solution of sodium chloride dripped constantly in the wound during twenty-four hours. On April 7 the intramuscular dose was increased to 1,000,000 S units every six hours. On April 11 the drip in the wound was discontinued, and by April 13 the intramuscular therapy was stopped because of severe toxic symptoms in the form of fever, generalized myalgia and painful swelling of the shoulder and wrist joints. Six hours after the last intramuscular dose of streptomycin, the serum concentration was 173 S units per cubic centimeter. Although the wound had improved a great deal, several observers agreed that the improvement was no more than would have occurred without chemotherapy. The alpha and beta hemolytic streptococci had been eliminated, but the anaerobes remained unchanged. In addition, Staph. aureus and an aerobic diphtheroid had appeared. The wound finally closed, and the patient was discharged, only to return three weeks later with a recurrent abscess.

The experience with this group of cases indicates that streptomycin is not effective against Bacteroides melaninogenicus and many of the anaerobic cocci which play such a prominent part in infections originating from the intestine or female genital organs. Unfortunately, many of the soft tissue infections which harbor gram-negative organisms such as Esch. coli, which are susceptible to streptomycin, also contain these resistant anaerobes. Until an antibiotic is found which will at least inhibit these organisms, the use of streptomycin will produce only partial improvement. If some means is found to control the organisms that are resistant to streptomycin, the use of a combination of the two agents should be extremely effective.

Infections of the Urinary Tract.—Streptomycin was given to 13 patients with infections of the urinary tract. In 7 of these patients therapy eliminated the infecting organisms from the urine, while in 6 the urine was not sterilized. In 5 of the 6 cases with unsatisfactory outcomes failure was due to the presence of organisms which were resistant at the time therapy was instituted, while in 1 case the organisms appeared to be extremely susceptible when therapy was started but, for some reason, acquired resistance rapidly and were not eliminated. After parenteral administration a large proportion of the streptomycin is excreted in the urine,[5] and it is logical to expect that streptomycin will be effective in the treatment of urinary infections provided the organisms are susceptible. Many of these infections are mixed, and, since some of the organisms are apt to be resistant, streptomycin often will have to be used in combination with other agents in order to insure success.

Infections of Bone.—There were only 2 patients in this group.

One was a 38 year old Negro woman in whom painful swelling of the right thigh developed four months before she was admitted to the hospital. This had occurred shortly after a confinement. On admission to the hospital, April 17, 1945,

she was found to have an extensive soft tissue abscess of the right thigh, which apparently had its source in the femur. The abscess was drained, and culture of the pus yielded a beta hemolytic streptococcus and an anaerobic coccus. For a time the patient improved, but after a short time she became febrile again and on May 4 streptomycin was started, 1,000,000 S units intramuscularly every six hours. Streptomycin had to be discontinued after twenty-one doses because of nausea and vomiting and pain at the sites of injection. Penicillin therapy was substituted. Two days later a new lot of streptomycin was obtained, and the drug was started again in doses of 1,000,000 S units every six hours. At this time, culture of material from the wound yielded Staph. aureus, diphtheroids, Pseudomonas aeruginosa, an alpha hemolytic streptococcus and an anaerobic coccus; all the aerobes were resistant to more than 256 units of streptomycin per cubic centimeter of culture medium. The resistance of the anaerobes to streptomycin was not determined. The drug was discontinued after four days because of the severe local irritation at the sites of injections, the resistance of the aerobes and the failure of the anaerobes to disappear. Although this patient received only a short course of treatment, streptomycin seemed to have no effect. The anaerobes persisted, and the wound became contaminated with resistant aerobes during therapy.

The other patient was a man of 70 years, who had a chronic ulcer over the internal malleolus of the left ankle which finally involved the joint. While the organisms recovered from the wound varied somewhat from time to time, Ps. aeruginosa, Bacteroides melaninogenicus and a gram-positive anaerobic coccus seemed to be constantly present. These organisms persisted throughout eighteen days of treatment, during which time the patient received 500,000 S units of streptomycin intramuscularly every six hours and 1,000,000 S units in 1,000 cc. of isotonic solution of sodium chloride locally over each twenty-four hour period.

Failure in these 2 cases does not indicate that streptomycin will be of no value in osteomyelitis caused by susceptible organisms. It does indicate, however, that it will probably fail when Bacteroides melaninogenicus and other anaerobic bacteria are present. Furthermore, it indicates that during treatment open wounds may become contaminated with other bacteria which either are resistant or acquire resistance rapidly.

Granulating Surfaces.—Four patients were studied who had sloughing or granulating wounds resulting from third degree burns or avulsion of skin. The drug was applied locally as a wet dressing in concentrations of 200 to 500 S units per cubic centimeter. All the patients did well in that the granulating areas became red and healthy and grafts took well. Interestingly, there was no significant change in the bacterial flora, most of the organisms which were present at the start of therapy still being present when it was discontinued. During the period of therapy, their resistance to streptomycin increased remarkably. It is difficult to evaluate this small group of patients. They might have done just as well with moist dressings of isotonic solution of sodium chloride.

Diabetic Gangrene.—In this group of 4 patients, there were 2 for whom streptomycin therapy was classed as failure. In 1 case, that of

a patient with an infected amputation stump and renal failure, streptomycin was started only a few days before death and obviously did not have a fair trial. The other failure occurred in a patient with an infected foot. Streptomycin was employed both as a local drip of 1,000 S units per cubic centimeter and as an intramuscular injection in doses of 500,000 S units every six hours. The infecting organisms were as follows:

	In Vitro Resistance to Streptomycin, Units per Cc.
Ps. aeruginosa	128
Gram-negative rod (unidentified)	96
A. aerogenes	56
Alpha hemolytic streptococci	80
Anaerobic gram-positive coccus	Not done

The serum level was 36 S units per cubic centimeter six hours after a dose on the second day of therapy. During four days of treatment, the foot became worse, so that amputation was finally done. Culture at this time yielded:

	In Vitro Resistance to Streptomycin, Units per Cc.
Ps. aeruginosa	256
Unidentified gram-negative rod	80
Alpha hemolytic streptococcus	56

The other 2 patients showed remarkable improvement of their infection under local streptomycin treatment. In 1 case, that of an infected amputation stump, the concentration of streptomycin employed locally was 200 S units per cubic centimeter, while in the other, a case of an infected foot, it was 2,000 S units per cubic centimeter.

It was not possible to correlate the bacteriologic observations with the clinical improvement.

Miscellaneous.—A number of patients were treated whose infections could not be classified in any of the preceding groups. Their diseases are as follows:

	No. of Patients
Miliary tuberculosis	1
Tuberculous meningitis	1
Acute pulmonary moniliasis	1
Chronic prostatitis	1
Urethral fistula	1
Friedländer's pneumonia	1
Chronic cholangitis	1

S. B., the patient with miliary tuberculosis, was admitted to the hospital on May 11, with no symptoms other than temperatures as high as 104 F., for three weeks prior to admission. Physical examination was entirely noncontributory, but roentgenologic examination revealed a fine mottling of both pulmonary fields suggestive of miliary tuberculosis. The temperature ranged from 100 to 104 F. By May 28 fine rales had appeared in both pulmonary fields. Administration of

streptomycin was started on May 25 in doses of 1,000,000 S units intramuscularly every six hours and was continued for one hundred and twelve doses. Serum levels were as follows:

	Hours After dose	Units
After 1,000,000 S units.....	2	26.5
	4	15.2
After 16,000,000 S units.....	2	31.0
	4	19.0
	6	16.8
After 48,000,000 S units.....	2	26.4
	5	13.6
After 77,000,000 S units.....	2	26.7
After 78,000,000 S units.....	1	32.7

During treatment there were no perceptible changes in the patient's course. Some time after treatment was stopped he died, and the diagnosis of miliary tuberculosis was established at autopsy.

The patient with tuberculous meningitis was a boy 4 years old, who was almost moribund when streptomycin therapy was initiated. He received 750,000 S units intramuscularly every six hours for a total of eight doses. He also received 10,000 S units intrathecally. Six hours after the first dose the serum concentration was 31.8 units per cubic centimeter; six hours after the third dose it was 171 units, and at the time of death, five and one-fourth hours after the last dose, it was over 300 units.

Streptomycin obviously did not have a fair trial in this case. Whether the high concentration of streptomycin contributed to his death is not known. The case does illustrate that streptomycin may accumulate in a critically ill patient and emphasizes the need for caution in the treatment of such patients.

The case of acute pulmonary moniliasis deserves little comment. The organism was completely resistant to streptomycin, its in vitro sensitivity being greater than 250 units per cubic centimeter. Treatment had no perceptible effect on the course of the disease.

No benefit was obtained in the case of chronic prostatitis. Although there was considerable variation in the bacteria which were recovered, probably due to contamination from the urethra, an alpha hemolytic streptococcus with a sensitivity of 4 to 16 units per cubic centimeter appeared to be the causative organism. Treatment consisted in administration of 500,000 S units intramuscularly every six hours. After twenty-five doses, drug fever developed and therapy had to be discontinued. Unfortunately, no serum levels were obtained, and it is possible that failure was due to an inadequate dose.

The patient with a urethral fistula had had a suprapubic cystotomy in 1931, for an unknown reason. He had remained well until October 1944, when a purulent urethral discharge developed. The cystotomy wound opened, and a perineal abscess formed. After the abscess was drained, a urethral fistula appeared.

The fistula failed to heal, the wounds were indolent and the urine was thick and foul. Culture of materials from the bladder yielded the following organisms:

	Resistance to Streptomycin, Units per Cc.
Staph. aureus	0.45
Beta hemolytic streptococcus	1.90
P. vulgaris	0.45
Ps. aeruginosa	14.30
Bacteroides melaninogenicus	Not done
Anaerobic diphtheroid	Not done
Anaerobic gram-negative bacillus	Not done

Treatment with streptomycin consisted in emptying the bladder, then in instilling 100 cc. of a solution containing 200 S units of streptomycin per cubic centimeter into the bladder every four to six hours. The patient retained the material for several hours by plugging the cystostomy opening, after which he voided. Four days of therapy was sufficient to cause pronounced improvement; cultures at this time yielded Proteus vulgaris, Staph. aureus, a diphtheroid and anaerobes which could not be isolated. Improvement continued, and both wounds healed promptly.

The case of chronic cholangitis deserves little comment, since the dose was too small to be effective. This patient was one of the first to be treated, and he received only 10,000 S units every two hours and then, after a few days, 50,000 S units every two hours. There was no effect on his course or on the bacterial flora of the drainage from the common bile duct. The organisms were sensitive to small concentrations of streptomycin, and failure is probably explained by the inadequate dose.

Although streptomycin failed in the patient with Friedländer's pneumonia, this case cannot be accepted as indicating in any way the place of streptomycin in the treatment of this condition. The patient, who was 58 years old, was admitted to the hospital primarily because of a cerebral vascular accident. During examination it was discovered that he had extensive pneumonia. Although Klebsiella pneumoniae was the predominant organism in the sputum, many other organisms were present in the sputum.

	Sensitivity to Streptomycin, Units per Cc.
K. pneumoniae	0.25
Alpha hemolytic streptococci	Not done
Staph. aureus	2
M. aurantiacus	1
Gram-negative bacilli	4
M. candidus	1
Esch. coli	5
Bacteroides melaninogenicus	Not done
Anaerobic gram-negative bacilli	Not done
Anaerobic diphtheroid	Not done
Anaerobic gram-positive coccus	Not done

The patient received 1,000,000 S units intramuscularly every six hours. Serum levels following the first dose were: 10.1 units per cubic centimeter at two hours; 11 at four hours and 7.3 at six hours. He died after receiving 7,000,000 S units.

Streptomycin was used prophylactically in an attempt to prevent peritonitis in 2 patients in whom the peritoneum was soiled during operative procedures. In 1 case, that of a patient with ulcerative colitis in whom the colon was torn, no infection occurred. In the other case, that of a patient with intestinal obstruction in whom the bowel was torn and extensive soiling occurred, infection did occur, but she recovered, the convalescence being far smoother than was anticipated. It is difficult to say how much benefit was obtained from therapy in these cases, but certainly the results indicate the need for further trial.

TOXIC SYMPTOMS

Streptomycin was administered to 56 patients, the cases of 4 not being included in this paper because of insufficient data. The discrepancy between the number of cases reported in the paper (55) and the figures just given is due to the inclusion of 3 patients under two categories. Of the 56 patients who received streptomycin, 12 exhibited definite toxic symptoms and 1 manifested symptoms which may have been due to streptomycin.

The toxic symptoms were fever, rash, weakness, myalgia, arthralgia, arthritis, nausea and vomiting. The 1 fatal case, in which symptoms may have been due to streptomycin (A. G.), was discussed in the bacteremia group. The toxic symptoms were usually severe enough to warrant cessation of therapy. Whether they were due to impurities which can be eliminated as the process of manufacture is improved or to streptomycin per se is not known. In addition to these toxic symptoms, most patients complained of considerable pain and persistent soreness at the sites of intramuscular injections. In many instances these areas exhibited induration, which persisted for several days.

COMMENT

The patients whose cases are presented in this paper were selected for treatment in order to test the value of streptomycin. Some patients were chosen because they had lesions which were probably hopeless, while others were treated because they had infections which, while not customarily fatal lesions, were those for which there was no satisfactory treatment. Still others were included in hopes that streptomycin might prove to be better than the current treatment. It is for these reasons that the cases are so varied. Although neither the total experience nor the number of cases in any one group is large, we believe that it is possible to draw certain conclusions from this experience.

First, it is fairly clear that streptomycin is capable of sterilizing the blood stream in short order provided the infecting organisms are susceptible to a serum concentration of the drug that can safely be maintained. If a larger experience proves this statement to be true, it

means that streptomycin will be a valuable agent in the rare cases of septicemia due to Esch. coli, A. aerogenes, Ps. aeruginosa and other gram-negative bacilli.

Second, streptomycin, since it is excreted in high concentrations in the urine, is able to sterilize urine that is infected with susceptible organisms. Used in conjunction with other agents, streptomycin should make it possible to cure more patients with mixed infections of the urinary tract than it has been possible to do in the past.

The apparent lack of response to therapy of the patients with peritonitis and infections of the soft tissues was disappointing. This is probably due to the fact that in most instances these were mixed infections, in which some of the organisms were resistant. The nonsporulating anaerobes seemed to be the chief offenders in this regard. In spite of the failure of streptomycin to render these lesions sterile, its use is still rational for the elimination of some of the organisms and should make it easier for the body to combat those which remain.

Streptomycin seems to follow the rules that hold for the sulfonamide drugs and penicillin in that it does not sterilize walled-off collections of pus or wounds harboring dead tissue and foreign bodies. Its use in such instances is not wise, because many bacteria seem to acquire resistance to streptomycin rapidly. It is wiser, therefore, by adequate surgical treatment to render the conditions as suitable for its action as possible before streptomycin therapy is initated.

Streptomycin therapy at present is accompanied with a high incidence of toxic symptoms. Whether these can be reduced as the process of manufacture is improved is not known.

SUMMARY

Fifty-six patients with various types of infection were treated with streptomycin. Manifestation of toxicity occurred in 12 of these patients.

In patients with bacteremia or septicemia, streptomycin sterilizes the blood stream promptly provided the organisms are susceptible to its action.

Streptomycin does not sterilize walled-off collections of pus, even though the organisms involved are susceptible to its action.

Owing to the high concentration in which streptomycin is excreted in the urine, it is a valuable agent for the treatment of infections of the urinary tract, provided the organisms are susceptible to its action.

The results of treatment of patients with peritonitis and various types of infections of the soft tissues were disappointing. Most of these infections were caused by a mixture of several kinds of bacteria, and failure in the majority of instances can be attributed to the presence of resistant organisms; the most prominent group of resistant organisms appeared to be the nonsporulating anaerobes.

Printed and Published in the United States of America

FELLOWSHIPS

April 18, 1942

Dear Doctor Buggs: It is a pleasure to inform you that you have been selected by the Committee on Fellowships of the Julius Rosenwald Fund to receive a grant of Two thousand two hundred dollars ($2,200) to assist you in carrying forward your studies in zoology and research in the embryology and physiology of marine life at the University of Chicago and at Woods Hole for a fifteen-month period. In the event that you are called into the armed forces before you can begin work on this project it will, of course, be impossible to hold the fellowship for you.

Will you please let us know at once whether or not you can accept this grant? An announcement of the Committee's selections will be made soon and it can include only those from whom acceptances have been received.

Sincerely yours,

WCH:MLU

WILLIAM C. HAYGOOD

Dr. Charles W. Buggs
Dillard University
New Orleans, Louisiana

SCHOLARSHIP

May 18, 1934

Dear Mr. Buggs: Mr. Arthur is at present associated with the Chicago YMCA abd is serving the Julius Rosenwald Fund as a consultant instead of in his former capacity as a regular member of the staff. For this reason I am acknowledging your letter of May 14 and have also told Mr. Arthur about it and have consulted with him as to its contents.

Needless to say the Fund will be glad to be of any assistance possible in calling to your attention opportunities for employment which may come to our notice. Your letter shows that you realize the situation with regard to academic appointments at the present time. Most universities, as you know, are not expanding their staffs and are replacing members of their faculties only when absolutely necessary.

Sincerely yours,

CRR:EWR

Mr. C. W. Buggs
205 Millard Hall
University of Minnesota
Minneapolis, Minnesota

MAY 22 1934

UNIVERSITY OF MINNESOTA
MINNEAPOLIS

SCHOLARSHIP

OFFICE OF THE REGISTRAR

January 15, 1934.

Mr. George R. Arthur,
Associate for Negro Welfare,
Julius Rosenwald Fund,
4901 Ellis Avenue,
Chicago, Illinois.

Dear Mr. Arthur:

Replying to your inquiry pertaining to Mr. Charles Wesley Buggs, our records show that he has not as yet completed all the requirements for his Doctorate. His course work in his major has been nearly completed, and he has passed the language tests and his preliminary examinations.

Very truly yours,

R. M. West,
Registrar.

RMW:O

JAN 17 1934

SCHOLARSHIP

June 20, 1933

My dear Mr. Buggs: We already knew about the final decision of Dr. Adams with reference to your coming to the Howard University Medical School this year. With this matter out of the way it now seems that you should continue on at the University of Minnesota with the hope of securing your Doctorate surely by December, if not earlier. I have explained the situation to Mr. Embree and he agreed that the grant of $200 made you when we thought you were going to Howard should still stand on our books. We should like to make payments in two instalments of $100 each whenever you so desire them.

Very truly yours,

GRA:VH

Mr. Charles W. Buggs
809 Aldrich Avenue North
Minneapolis, Minnesota

GEORGE R. ARMING

JUN 23 1933

HOWARD UNIVERSITY
WASHINGTON, D.C.

SCHOOL OF MEDICINE
OFFICE OF THE DEAN

Mr. George R. Arthur,
Julius Rosenwald Fund,
4901 Ellis Avenue,
Chicago, Illinois.

Dear Mr. Arthur:

In reply to your letter of June 1, 1933, I wish to say that Mr. Charles Wesley Buggs is one among three promising applicants for a position as Instructor in our Department of Bacteriology, Preventive Medicine and Public Health.

We have had word from Mr. Buggs stating that if he comes to teach at Howard he will be permitted to transfer his research equipment here in order that he might complete work upon his problem.

We hope to make a selection within the next two or three days, and we shall be pleased to let you know whether or not Mr. Buggs was selected.

Very truly yours,

Numa P. G. Adams

Numa P. G. Adams,
Dean.

JUN 23 1933

HW

SCHOLARSHIP

June 1, 1933

My dear Dr. Adams: Two months ago the Julius Rosenwald Fund made a small additional grant to Mr. Charles Wesley Buggs of the University of Minnesota in order that he might stay on at the University throughout the summer and secure his Ph. D. Degree in the field of Bacteriology. The additional money was granted because of the conversation we had with Mr. Buggs during our trip to the University wherein he stated that correspondence had passed between you and him with reference to a possible instructorship in the Medical School of Howard University this fall. Before sending the money to Mr. Buggs we should like very much to ask you if such an instructorship has been offered him and whether or not he has accepted the position. If such is the case we should be only too glad to help carry him through the summer. An immediate reply to this letter will be greatly appreciated.

Very truly yours,

GRA:VH

GEORGE R. ARTHUR

Dr. Numa Adams
Dean, Medical School
Howard University
Washington, D. C.

JUN 2 1933

UNIVERSITY OF MINNESOTA
THE MEDICAL SCHOOL
MINNEAPOLIS

DEPARTMENT OF
BACTERIOLOGY AND IMMUNOLOGY

May 5, 1933

Mr. George R. Arthur
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

Dear Mr. Arthur:

I wish to express my thanks to you for your appeal to Mr. Embree in my behalf, and to Mr. Embree for making the additional grant to me possible.

Because of a recent honor which has come to me in the nature of the Shevlin Fellowship in Medicine, I shall have to change my plans somewhat. The Howard "probable offer" has never materialized. I received a letter from Dr. Adams April 11 in which he informed me that the trustees of Howard University were meeting on that date, and he could not further commit the University until after the board meeting. I have not heard from him since.

Although my research is progressing nicely, it would be impossible to make a real contribution to the field in which I am interested by August. That is, I could get together enough data that would probably get me "by" and out of the University by August, but I am not absolutely sure about even this. I have five separate studies to make and at present I am just completing the first one. I must be thorough in this work because the field is so controversial. Also, from your letter of January 5 you will learn that I have been engaged in this investigation less than four months. On January 5, you sent a check for $20, with which to purchase the present apparatus I am using.

I have approached Dr. Larson with reference to my relationship with the Julius Rosenwald Fund and the Shevlin Fellowship, fearing that your support during the summer would be withdrawn if it were not my intention to finish my requirements and receive the Ph.D. degree by August. Dr. Larson indicated that he would communicate with you and explain the situation as it now stands. I trust his appeal will be fruitful.

I might add that Mrs. Buggs will enter the University Hospital next week for two separate operations.

Yours very truly,

C. W. Buggs

C. W. Buggs

CWB:H

Dr. Larson will be in Washington next week and has indicated his intention of visiting the medical school of Howard.

UNIVERSITY OF MINNESOTA
THE MEDICAL SCHOOL
MINNEAPOLIS

SCHOLARSHIP

Gra 24 | 24

DEPARTMENT OF
BACTERIOLOGY AND IMMUNOLOGY

April 22, 1933

Mr. George R. Arthur
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

Dear Mr. Arthur:

No doubt you have received a letter from Dr. Larson as per your request of March 31. Personally, there is no question at all as to the possibility of finishing in June. It will require at least four months to obtain sufficient data with which to construct a representative thesis.

Due to the fact that Mrs. Buggs will not be working after May, our income will be cut by one-third. In addition, we will have an increase in expenses, as several privileges we enjoyed at the Wheatley House will be discontinued when Mrs. Buggs ends her employment. For this reason, I should place the minimum amount of money at $225.00, that is, a continuation of my present grant for three more months.

I have made quite a few additions to my cataphoresis outfit and the work is now progressing nicely.

Yours very truly,

C. W. Buggs.

C. W. Buggs.

JUN 12 1933

CWB:H

SCHOLARSHIP

March 31, 1933

My dear Mr. Buggs: In answer to your letter of March 26, I do not know of any other source from which you might be able to secure funds to enable you to continue on at the University of Minnesota this summer in order to secure your Ph. D. Degree. I am willing, however, to present the matter to Mr. Edwin R. Embree, President of the Fund, as soon as he returns to this country about April 24th. Please give me the minimum amount of money you will need for the summer. I can make no promise as to the outcome of my appeal to Mr. Embree in view of the decision of our Board last year to make no new commitments. I do feel, however, that your case is exceptional and I wonder if you would be willing to have your dean write us, backing up your request for additional funds and stating that you will need to stay during the summer in order to secure your degree.

Very truly yours,

GRA:VH

Mr. Charles H. Buggs
809 Aldrich Avenue North
Minneapolis, Minn.

GEORGE R. ARTHUR

UNIVERSITY OF MINNESOTA
THE MEDICAL SCHOOL
MINNEAPOLIS

DEPARTMENT OF BACTERIOLOGY
AND IMMUNOLOGY

March 26, 1933.

Mr. George R. Arthur
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois.

Dear Mr. Arthur:

I wish to acknowledge the receipt of your letter under date of March 24. Thank you very kindly for your opinion concerning the offer from Howard University. Although the salary is extremely low (even lower than the salary I received before I obtained my Master's degree) I shall accept it.

I received a letter from Mr. Hill also. Mr. Davis was out of the city at the time of the arrival of my letter. Mr. Hill stated to me essentially the same thing he wrote you. In my reply I told him that I was, or rather would be without funds this summer and saw no way of completing my studies for the Ph. D. degree unless I obtained aid. I asked if it would be possible to obtain a grant sufficient to carry me through the two summer sessions. Do you know of any other source I could call upon if such became necessary? I would like to have my degree before going to Howard.

My work at present is progressing rather slowly. I am beginning to realize that the completion of my present studies will require all of twelve months if not more. I am therefore going to content myself with a limited investigation. This will be absolutely necessary if I expect to finish in August.

Mrs. Buggs joins me in best wishes to you.

Yours very truly,

C. W. Buggs.

CROSS REFERENCE RECORD

FIRM NAME OR SUBJECT SCHOLARSHIP BUGGS CHARLES W **FILE NO.**

DATE	REMARKS
3/13/33	Excerpt from letter: "Since Mr. Buggs will get his Ph.D. degree in June, I do not believe that the G.E.B. would be willing to give him a fellowship."

SEE GENERAL EDUCATION BOARD **FILE NO.**

DATE

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YAWMAN AND ERBE MFG. CO.
ROCHESTER, N.Y.

FORM NO. 099CR

SCHOLARSHIP

March 10, 1933

My dear Mr. Hill: I was at the University of Minnesota and talked to one of our men to whom we have given a fellowship grant for the last two years. He will secure his Ph. D. Degree in the field of bacteriology this June. You no doubt know that we have no outstanding bacteriologist - not one. Mr. Buggs from all we can learn has made a tremendously good record at the University doing some original research which has upset some theories of the various professors as well as the calculations of certain instruments used in his studies of cataphoresic experiments with bacteria.

The attached letter from Dr. W. P. Larson, head of the Department of Bacteriology, will explain the matter in detail. We have given Mr. Buggs $600 for the academic year 1931-1932 and $900 for the year 1932-1933. If what the professors at the University of Minnesota say is true, another year of research at the University will enable him to finish and get into print some very valuable and original theories worked out by him concerning the experiment already mentioned. I suggested that he write Mr. Jackson Davis or Mr. Favrot relative to a grant in order to have him stay on at the University next year and get his material ready for publication. Henry Allen Moe who is Secretary of the Guggenheim Foundation and a member of our Committee on Fellowship Awards, interviewed Mr. Buggs for us and stated that he thought him extraordinarily good in his field.

Please return Dr. Larson's letter.

Very truly yours,

GRA:VH

MAR 13 1933

Mr. Walter Hill
General Education Board
Richmond, Virginia

SCHOLARSHIP

March 10, 1933

My dear Mr. Buggs: The letter from Dr. Larson relative to recommendations for further assistance to you was received yesterday. We are sending it to Mr. Walter Hill of the General Education Board with offices in Richmond, Virginia. My suggestion would be for you to write Mr. Jackson Davis, stating your purpose and the need for another year's work, the confidence your professors have in you, and outlining a brief summary of your experiment. I would do this immediately, Mr. Buggs, if I were you.

Please give my respects to Mrs. Buggs, Mrs. Moses, and Mrs. Brown.

Very truly yours,

GRA:VH

GEORGE R. ARTHUR

Mr. Charles W. Buggs
~~809 Aldrich Avenue, North~~
Minneapolis, Minnesota

MAR 13 1933

SCHOLARSHIP

March 10, 1933

My dear Dr. Larson: Thank you for your letter of March sixth relative to Mr. Charles W. Buggs. As I stated before I am sure the Julius Rosenwald Fund will be unable to help Mr. Buggs with a fellowship grant. I am, however, sending your letter to Mr. Walter Hill of the General Education Board and am writing Mr. Buggs to apply to that organization for a fellowship grant.

Very truly yours,

GRA:VH

Dr. W. P. Larson
Department of Bacteriology
University of Minnesota
Minneapolis, Minnesota

GEORGE R. ARTHUR

MAR 13 1933

UNIVERSITY OF MINNESOTA
THE MEDICAL SCHOOL
MINNEAPOLIS

DEPARTMENT OF BACTERIOLOGY
AND IMMUNOLOGY

March 6, 1933.

Mr. George R. Arthur
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois.

Dear Mr. Arthur:

Before coming to the business at hand I wish to again express my appreciation for the interest evidenced in my work and your indication to do what is possible toward having my present fellowship extended. I greatly enjoyed having you look over my work and shall look forward to many other such visits from you.

I received a letter from Dr. Adams under date of February 27. I am sending his letter and my reply for your consideration inasmuch as I would like some advice. If I could obtain another fellowship I would prefer to remain here another year- providing the position (if there is an opening) was kept open for me. What is your reaction?

I am also enclosing the initial draft of the first few pages of my thesis. This may give you some conception of the nature of my work. The section on the theory of Smoluchowski will have to be rewritten entirely in view of our latest findings. As you will see, the whole thesis in now built around this theory of electroendosmosis and electrophoresis.

There are probably several practical applications of cataphoretic measurements. The method is being used by Dr. Harold A. Abramson of Physicians College, Columbia University, to study the properties of certain proteins. His most recent papers deal with the combining power of gelatin and egg albumin for acids and bases. The mechanism of cataphoretic mobility is also being employed to explain the acute inflammatory process. Abramson believes the migration of leucocytes to a point of infection to be due to a difference of potential set up between normal and injured tissue. A gradient of electrical energy is ~~thus~~ set up and the phagocytes migrate to the injured tissue which is positively charged (i.e., the positive pole of my apparatus). I should have stated in speaking of the combining power of proteins that Abramson believes cataphoretic studies to be very helpful in determining the orientation of the active groups in protein molecules. You will at once recognize the importance of these studies when you recall Langmuir's work on the orientation of polar and non-polar groups in mono-molecular layers of oils. The method was used by Falk of Chicago in 1925

UNIVERSITY OF MINNESOTA
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MINNEAPOLIS

DEPARTMENT OF BACTERIOLOGY
AND IMMUNOLOGY

in his study of respiratory diseases. His publications indicate that he was able to correlate the virulence of the four types of the Pneumococcus with their cataphoretic mobility. Virulent strains migrated at a greater velocity than did non-virulent strains or relatively avirulent ones. Type III. Pneumococcus was found to be more virulent for mice by ~~both~~ direct titration experiments than the other Types. Cataphoretic measurements showed that strains from Type III. migrated at a greater rate than the other Types. The same relationships were found to hold for the other cases.

In 1928 Jensen and Falk published their studies on the diphtheria bacillus. They showed that an inverse relationship existed between the virulence and the cataphoretic mobility. They hoped that this new method of determining the virulence of diphtheria bacilli would be substituted for the routine guinea-pig tests as both time and money would be saved. However, very few investigators have confirmed this work. Those who have published confirmations are open to criticism on one point or another. Personally I am of the opinion that none of the work has been done with rigid enough controls. No reference standard has been employed and hence the investigators have been unable to tell whether or not significant results were obtained.

Rosenow at the Mayo Clinic finds that Streptococci isolated from diseases of the central nervous system have characteristic migration rates distinct from the velocities shown by Streptococci isolated from diseases like chronic and acute infectious arthritis. He believes that the localizing potentialities of Streptococci may be predicted from their cataphoretic mobilities. I have only two statements to make with reference to Rosenow's work. In the first place very few bacteriologists or pathologists believe in his theory of elective localization. The other is that his results are too constant. Until I have investigated further the constancy of migration of such stable organisms as Staphylococcus aureus I will maintain an open mind.

My work at present is on the theory of cataphoretic measurements itself. As far as we have been able to determine Smoluchowski has failed to take into consideration the influence of the pressure gradient on the viscosity of the dispersions medium. Such a correction would explain many of the anomolous results obtained in attempting to plot Smoluchowski's curve. We will also introduce an entirely new method for obtaining the relationship between electroendosmotic and electrophoretic mobility, namely the integration

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THE MEDICAL SCHOOL
MINNEAPOLIS

DEPARTMENT OF BACTERIOLOGY
AND IMMUNOLOGY

of von Smoluchowski's curve. That certainly would be a good joke on Smoluchowski. Of all persons he should have been the one to balance the flow of water in capillary tubes by the simple application of the calculus, but apparently he has never thought of it. The problem is one in hydrodynamics and H. Lamb has written a whole tretise on the subject. He also failed to integrate Smoluchowski's curve. As yet I haven't plotted enough of the curves to draw any definite conclusions. I can say, however, that it appears as if integration is the only means by which we can determine the absolute velocity of a particle and hence its surface charge. After working out my technique I would like to apply it to a study of the diphtheria bacillus and the Pneumococcus.

If there is anything I have omitted in this brief survey of cataphoretic measurements or any amplification needed I will be only too glad to supply it if you will let me know.

Maggie wishes to be remembered.

Very truly yours,

C. W. Buggs.

UNIVERSITY OF MINNESOTA
THE MEDICAL SCHOOL
MINNEAPOLIS

DEPARTMENT OF BACTERIOLOGY
AND IMMUNOLOGY

SCHOLARSHIP

January 3, 1933

Mr. George R. Arthur
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

Dear Mr. Arthur:

My thesis problem is a rather involved affair and calls for expensive electrical units and delicate glass apparatus. My department, of course, has furnished everything. However, one unit, a glass apparatus costing $50.00 has proved worthless as far as obtaining quantitative data is concerned. I have wasted two months in vain attempts to"make it work", and have now reached the stage where the factor of time must be carefully considered in relation to my finishing here in June. I must have another cell, and rather than wasting time awaiting developments by our purchasing department (and the matter has not been taken up with them as yet) I would much rather purchase the cell myself. The probability is that unless the money paid for the previous cell is refunded by the manufacturer, I will be forced to obtain one the best way I can. At least my budget, as allowed by the department, has been reduced to less than $35.00, and when that is gone there won't be any more.

As is indicated by the inclosed letter from Dr. Abramson, I can have a cell made for $20.00, more or less. The cell made by Mr. Graham is a modification of the cell I now have, the specifications being those of Dr. Abramson. Incidentally, I may add that Dr. Abramson is the foremost American in the field in which I am now working. Would it be possible for me to obtain the cost of this apparatus and have the sum deducted from my last check? I would greatly appreciate this.

I should like to have omitted the details given in this letter, but considered that their incorporation was better than simply asking for an "advance".

Very truly yours,

C. W. Buggs.

C. W. Buggs

CWB:H

JAN 6 1933

7

CROSS REFERENCE RECORD

FIRM NAME OR SUBJECT SCHOLARSHIP - BUGGS **FILE NO.**

DATE	REMARKS
4-20-32	Comments on meeting of Committee of Awards and its consideration of Mr. Buggs application

SEE GUGGENHEIM JOHN SIMON MEMORIAL FOUNDATION **FILE NO.**

DATE

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ROCHESTER, N.Y.

FORM NO. 099CR

JOHN SIMON GUGGENHEIM MEMORIAL FOUNDATION
551 FIFTH AVENUE
NEW YORK

OFFICE OF THE SECRETARY

April 8, 1932.

CABLE ADDRESS: GUGMEMORA

SCHOLARSHIP

Buggs. E R

	ERE	M	ERE	O
	GRA		GRA	
	ERE		O	

Mr. Edwin R. Embree
Julius Rosenwald Fund
4901 Ellis Avenue
Chicago, Illinois

Dear Mr. Embree:

After the meeting Saturday, I took a train for St. Paul to visit my mother; and while there saw Mr. Buggs and Professor Green with a view to clearing up the questions that were raised with reference to Mr. Buggs. I report this:

Mr. Buggs does not want to go to the Pasteur Institute, nor does Professor Green or any other of Buggs' advisors think he ought to go to Paris at this stage of his career. Buggs wants to stay at the University of Minnesota next year and get his Ph.D. degree, which he can get there by June 1933; but which he could not get if he goes to Paris.

Further, if he goes to Paris, to enable him to follow the work on which he is now engaged, he would have to bring most of his material with him. They haven't got it at Paris, at least not enough or of the right kind.

Hence it is quite clear that Buggs ought to remain at Minnesota next year.

He came to my mother's home and I had a long talk with him. I think he is a very good bet for the Fund. He will have his Ph.D. at 26, which is rare for a negro --or for a white man either. Professor Green, to whom I talked for a long time about Buggs, has no doubt at all that he's a comer. Green says there's no doubt at all that next year Buggs can finish at least a satisfactory Ph.D. thesis following the lines on which he is now working. Green thinks that Buggs' thesis will be a first-rate work and he wants very much to have Buggs do it at Minnesota.

I suggest that if possible you allow Buggs $100. a month. This year he has $50. a month from the Rosenwald Fund, and Mrs. Buggs earned $25. There will be a baby during the year, which will take away Mrs. Buggs' earning capacity and increase expenses. Professor Green told me that he and others have had to give Buggs various sums of money during the past

Do you agree on 100 a month for ten months or should it be for 12? And do you agree that Buggs should continue at Minnesota?

ERE

Mr. Embree-yes to both questions. Both Prof Green and Mr. Buggs have changed their minds about when Mr. Buggs should study next year. Both Mr applications and letter stated a preference for Pasteur Institute.

GA.

year to enable him to keep going, (which, of course, also shows how well they think of him). Buggs confirmed this.

I can add details to this report if you want them.

My expense account is enclosed. Of course I am not charging you for my expenses beyond Chicago.

Sincerely yours,

Henry Allen Moe

M:G
Enclosure

UNIVERSITY OF MINNESOTA
THE MEDICAL SCHOOL
MINNEAPOLIS

218 Millard Hall
March 22, 1932.

DEPARTMENT OF
BACTERIOLOGY AND IMMUNOLOGY

Mr. George R. Arthur
Julius Rosenwald Fund
Chicago, Illinois.

Dear Mr. Arthur:

Delay in answering your letter has been occasioned by the absence of my adviser, Dr. Green. As yet he has not returned, but I am quite sure that he will agree with the contents of this letter.

First, I have determined definitely from the Graduate School that I will be able to take a preliminary examination for the Ph. D. degree during the coming summer. Passing this examination will qualify me to begin research work bearing on a doctor's thesis. This work will be a continuation of my Master's thesis, A Study of Herpes Encephalitis, and it is my desire to continue this work at the Pasteur Institute, of which Dr. Levaditi is Director.

Second, Dr. Plotz did outline a tentative program of study for me. This consists, as you may recall, of special lectures in the field of virus diseases and related subjects, and would be given by specialists in the respective fields. The program also called for work in the various laboratories of the Institute. Not being new to the subject of virus encephalitis, I would have excellant opportunities of acquiring the expert knowledge of Dr. Levaditi and his colleagues on my thesis subject.

Finally, I will state the situation as follows: My application to the Rosenwald Fund is for a grant to enable me to finish a course of study for the Ph. D. degree in bacteriology. I will soon finish requirements such as will allow me to complete the work in absentia. My thesis subject will deal with some phase of virus encephalitis and it is my desire to do this work at the Pasteur Institute where I will have the benefit of special lecture courses in the virus diseases in general and the assistance of Dr. Levaditi in particular.

I trust that this letter supplies you with the requested information.

Yours very truly,

C. W. Buggs.

C. W. Buggs.

SCHOLARSHIP

March 15, 1932

Dear Mr. Buggs: In a re-study of your application blank for a renewal of your fellowship grant, we note your particular desire to go to the Pasteur Institute next year. The question arises as to whether or not this choice is due to the fact that you have been invited to study there by Dr. Harry Plotz and Dr. R. G. Green, or whether it is due to the fact that you intend to pursue your present work in encephalitis throughout the entire course of your next year's work.

I do not find in any of your letters or in the letters from your professors a statement that your present encephalitic project will be the main one or whether it is just being used as one of your research subjects. We are aware that Professor Levaditi would be of great value to you if you intend to pursue your present study in encephalitis at the Institute. Otherwise I really do not feel that simply the prestige of having studied at the Institute would be worth the extra expense of financing a year's study there.

As the Fellowship Committee meets the first of April, we shall be glad to have an immediate reply.

Very truly yours,

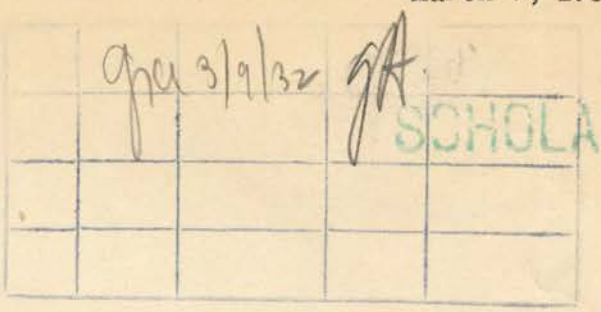
GEORGE R. ARTHUR

GRA:MLU

Mr. Charles Wesley Buggs
809 Aldrich Avenue, North
Minneapolis, Minnesota

MAY 6 1932

47 Camp Street
Providence, R. I.
March 7, 1932



Mr. George R. Arthur
Julius Rosenwald Fund
Chicago, Illinois

My dear Mr. Arthur,

I have found Mr. Charles W. Buggs a brilliant and deserving student. I feel that he should be encouraged and aided in his studies in bacteriology. Mr. Buggs should be able to contribute to pure bacteriology as well as to its applied medical aspects.

Sincerely yours,

S. Milton Nabrit

UNIVERSITY OF MINNESOTA
THE MEDICAL SCHOOL
MINNEAPOLIS

DEPARTMENT OF
BACTERIOLOGY AND IMMUNOLOGY

Mr. H. File with application. M

February 26, 1932

Mr. George R. Arthur
Rosenwald Fund
900 Homan Avenue, So.
Chicago, Illinois

Dear Mr. Arthur:

Some time ago Dr. Johnson visited this institution, and I asked him if there was any way in which I could be of assistance in furthering the development of Mr. C. W. Buggs, who is at present doing graduate work with me. Dr. Johnson suggested that I write to you.

I have found Mr. Buggs an exceptional individual, and I am very much interested in his development. I recognized from my contact with him in general class work that he had unusual ability as a student, and he has, with great ease, developed remarkable technical ability. During the past year I have had the opportunity to observe his capacity for carrying out investigative work. For his Master's problem, I assigned him certain studies on the virus of herpes encephalitis, and in doing this work he demonstrated that he does have the ability to do independent research. I feel that Mr. Buggs should be given all possible opportunities for developing his scientific talents, as I believe he will be a very useful individual.

If at any time you wish a detailed report of Mr. Buggs' activities here, I shall be most pleased to furnish it.

Very truly yours,

R. G. Green

R. G. Green

RGG:H

FISK UNIVERSITY
DEPARTMENT OF SOCIAL SCIENCE
NASHVILLE, TENNESSEE

CHARLES S. JOHNSON
DIRECTOR

Dpa 12/23 1/4/32

December 21, 1931

SCHOLARSHIP

Mr. George R. Arthur
Julius Rosenwald Fund
900 South Homan Ave.
Chicago, Illinois

My dear Mr. Arthur:

I am sending a copy of the letter from Charles Buggs of the University of Minnesota, and as a preliminary to application for the next logical phase of his fellowship, that of sustaining a fellowship at the Pasteur Institute where admission has already been secured. I am suggesting that he write to you for an application blank although this may not have been necessary. At any rate you can let him know the procedure for the next step.

Sincerely yours,

Charles S. Johnson

csj-n
encl

UNIVERSITY OF MINNESOTA

The Medical School

Minneapolis

218 Millard Hall

December 18, 1931

C O P Y

Dr. Charles S. Johnson
Fisk University
Nashville, Tennessee

My dear Dr. Johnson:

The fall quarter has just about come to an end, for formal classes, and I am now preparing for two weeks of intensive work. "Intensive" can hardly describe the work I have before me. I have at least a dozen things to do and only fourteen days in which to do them. I hardly know where to begin.

I don't think you know my program for this year. I am doing my entire minor (physical chemistry and biochemistry) this term, and if we are fortunate enough to go to France the doctor's degree will be rather easy to earn on my return. As a matter of fact, all I would have to do would be to put in "time". My main problem at the present time is to get away from chemistry long enough to study for my oral examination for the Master's degree. I should have taken it this quarter but just couldn't find time. And yet, I won't say that I couldn't find time. I think the truth is that I haven't made such a big effort, knowing that there was no rush, and that I had three whole quarters in which to take it. Guess I'll make a try during the winter quarter. Fortunately, my thesis was written during the summer.

My last letter to Dr. Plotz remains unanswered. However, no early reply was expected. Nevertheless, I would be glad to hear from him with reference to the Institute. You'll remember, of course, that both the Pasteur Institute and the sustaining fellowship are in the future. I am not pessimistic; just don't like the idea of counting one's chick before they arrive.

Soon after I received word from Mr. Arthur about the present grant I received congratulations on being the recipient of a fellowship to Europe. I don't seem to be able to make these people understand that I have not received a foreign fellowship. The net result has been to convey the idea that I am rather modest.

Dr. Green informed me this week that I had been chosen to work with him and Dr. Larson (Head of the Department) on human lethargic encephalitis. The findings will be published as a cooperative effort. I continue to get breaks.

I would appreciate hearing from you any developments, if any, that might have taken place since our last communication. If I remember correctly your board meets in February. I am hoping that my second request will be brought up at this time so that our plans may be completed. It would be rather nice, and I suppose quite necessary, to hear from Dr. Plotz before that time.

Trusting that everything is well with you and wishing you the best of the Season's Greetings, I am

Very sincerely yours,

C. W. Buggs

SCHOLARSHIP

809 Aldrich Ave.,N.
Minneapolis, Minn.
June 23, 1931.

Buggs-CW

Dr. Charles S. Johnson
Fisk University
Nashville, Tennessee.

Dear Dr. Johnson:

Inclosed are the various papers you requested and my letter to the Rosenwald Fund. I fear that my letter is rather lengthy and does not conform to the general form of request for a Fellowship, but I have simply tried to tell my story as clearly as possible, and to impress upon the Board my intense desire for further study and my great need of financial assistance.

I have said nothing about the amount of money for transportation to Europe, except to request that it be considered. Likewise I said nothing about expenses in Europe as I have not been albe to draw up even a tentative budget. I am leaving this up to your kindness.

There is also another matter which I left out of my letter. I stated my financial condition, but in asking for the $600.00 to attend school here I said nothing about granting a sum of money to take care of my debts. I don't know whether this is in order or not, but I would like to start out free of debts. I have a bill of $75.00 from Dr. J. W. Crump. This was incurred during the months he treated Mrs. Buggs for her injured shoulder. We have been unable to pay him regularly and would like to see him paid. I am also in debt to Miss Brown. I don't know exactly how much, but it covers broad for seven months. If an additional $200.00 could be secured to liquidate these debts it would be greatly appreciated, as $200.00 would make quite a big hole in six hundred.

In looking over my transcript you will observe that it is not complete. Grades for the spring quarter have not been reported as yet. At least mine have not been received in the office. I also wish to call your attention to the fact that two courses I took during the spring quarter have not been entered on the transcript, also the grades recorded "sat" and "in prog". That course is a three quarter course and no marks other than "satisfactory" and "in progress" are given until the entire course is completed.

Mr. R. G. Elzy has asked me to write Mr. A. L. Jackson in Chicago and let him know the nature of my work . He said that Mr. Jackson had quite a bit of influence with the internal organization of Provident Hospital and that perhaps he could be of help to me. I have written Mr. Jackson, stating that I was making application through you to the Rosenwald Fund for a Fellowship, and that I would be glad to let him know more about myself and the nature of my work here. I hope this communication to Mr. Jackson meets your approval.

I hope I have enclosed all the material you requested, and that my letter to the Board is suitable. Of course you can leave out that which is not suitable.

Wishing you much success in your endeavor in my behalf, I am

Yours very truly,

C. W. Buggs.

C. W. Buggs.

Institut Pasteur
25 Rue Dutot
March 5, 1931.

Dear Mr. Buggs,

I wish to reply to your letter of Feb. 23, which has just arrived. My friend Miss Elizabeth Walten has already written me about you, as well as to give me a letter from Mr. Johnson and another from Dr. Green.

To answer your questions briefly and to give you the actual facts, let me tell you the following. There is no actual position open at the Institute at present. When I spoke with Mr. Johnson I intended to convey the idea that I would be interested in helping some able Negro to obtain a good training at our Institute. I am still anxious to do it. Judging by what Mr. Johnson says and especially your recommendation from Dr. Green I should say that you answer the qualifications. I do believe with Dr. Green, however, that you should not consider coming over here until you have had a prior training at home and are ready to undertake research work here. I hence suggest that you continue your work in the U.S. for another year. It is exceedingly important that you speak and read Frence rather fluently. Unless you do you will lose a considerable amount of time here. You should also be able to remain two years. I feel that most people who come here for study do not remain long enough.

If you are able to fulfill these requirements, and provided I can arrange your work as I hope to, this would be my plan. You would begin working at the Pasteur Institute in a definite laboratory. Depending upon your progress you will either remain in one laboratory or visit and work in several at various times. During the winter of the first year you should follow the advanced courses in Bacteriology given at the Institute. This is exceedingly valuable and interesting. The lectures are given by specialists in each branch. During the second year you would continue your work at the Pasteur and then begin working at the Institute for Physico-chemistry where I also have a laboratory. I regard this as of great importance.

Will you please discuss this with Dr. Green and give me your reactions to the various thoughts raised here. When I receive your answer I shall consider your plans further.

Truly yours,

Harry Plotz.

Please attach photograph measuring not more than 2"x4"

SCHOLARSHIP

APPLICATION FOR FELLOWSHIP

JULIUS ROSENWALD FUND, CHICAGO, ILLINOIS

900 South Homan Avenue

Date January 26, 1932.

PERSONAL HISTORY

Name in full C. Charles Wesley Buggs.

Present address 809 Aldrich Ave. No. Minneapolis, Minn.

Permanent address

Place of birth Brunswick, Georgia Date of birth August 6, 1906

Single, married, widowed, divorced Married — 1927

Name and address of wife or husband Maggie L. Buggs. (Same)

Number of children — Age and sex —

Dependents 1 To what extent Fully (?) Relation Wife

Father's name John Wesley Address Brunswick, Ga. Occupation Physician

HEALTH OF APPLICANT

Weight 130 Height 5 ft 5½ in (feet / inches) Previous illnesses — — — (details and date)

Illnesses during past twelve months — — — —

Physical impairment—degree and how long existing —

Most recent complete physical examination—when and by whom December 22, 1931 Metropolitan examining physician.

Physician's recommendations Good Condition! Keep it up!

Have these been acted upon?

General health of family Good.

EDUCATION

Give a summary of your education in the following form:

	Name of Institution	Period of Study	Degrees, Diplomas, Certificates (give dates)
ACADEMIC:			
High School	St. Athanasius	1912 - 1924	Certificate, 1924
Normal			
College or University	Morehouse College	1924 - 1928	A.B. 1928
Graduate			
PROFESSIONAL:			
Music			
~~Art~~	University of Minnesota	1930 - 1929	M.S. Ph.D. ?
Technical			

ACCOMPLISHMENTS

Positions held (professional, teaching, scientific, administrative, business):

Name of Institution or Organization	Title of Position	Years of Tenure (give dates)	Under Direction of
State College Dover, Del.	Instructor in Science	1928 - 1929	Dr. R. S. Grossley
Douglass High School. Key West, Fla.	Instructor in Science	1929 - 1930	Prof. C. G. Hutchings.

REFERENCES

Submit a list of references from whom further confidential information may be obtained:

Name of Reference	Where and in what way does this person know you?	Address
Pres. S. H. Archer	Morehouse College	Atlanta, Ga.
Rev. J. Clyde Perry	High School	Brunswick, Ga.
Dean G. S. Ford	Graduate Scholastic Record	U. of Minn.
Dr. R. G. Green	Adviser in Research	U. of Minn.
Miss W. G. Brown	Domestic Relations and Character	Phyllis Wheatley House. Minneapolis, Minn.

Give a list of the scholarships or fellowships you have previously held or now hold:

Rosenwald Fellowship. Granted July, 1931.

Present position? — From — To — Salary? —

Do you seek further training for this or another position? What and where? Desire further training for position as teacher or bacteriologist to some hospital.

Have you positive assurance of a position after completion of further study? No.

If so, what is the position? — —

By whom is assurance given? — —

What course of study do you wish to take? Research in Bacteriology.

For what degree are you working? Ph. D.

What institution offers best opportunity for this study? Pasteur Institute et U. of Minn.

When does the course begin and when does it end? Arranged

Have your credits been accepted without condition? — —

Courses you propose to take:

Major Bacteriology.

Minor Pathology.

What financial assistance can you depend upon from present employer, school, family, or organization? —

None —

If you are a student and employed outside of school, how many hours per day do you work? — —

What are they? — —

Where employed? — — How much do you earn? — —

Will this continue? — How long? —

What is the total amount required for the proposed period of study? Twelve hundreds a year and traveling expenses.

How much can you provide? —

I am entirely without funds.

SUBJECTS STUDIED SINCE COMPLETION OF HIGH SCHOOL

Please group courses by subjects, such as English, Science, History, etc.

Name of Subject	Institution (school or college)	Number of Semesters	Year
Mathematics	Morehouse	Minor	1924 - 1928
Physics	"	Minor	"
Chemistry	"	Minor	"
Zoology	"	Major	"
Economics	"	2	"
Philosophy	"	2	"
Bible	"	2	"
English	"	4	"
History	"	2	"
Chemistry, Bio.	U. of Minn.		1930 (Fall) 1932
Physical Chemistry	"		"
Parasitology	"		"
Bacteriology	"		"
Immunology	"		"
Biometry	"		"

(OVER)

In addition to filling out the application blank, we are asking that you write an essay of not more than five hundred words, stating the major problem in your field, as you see it, and your reason for believing that additional training will enable you to help solve that problem, or, at least to make a contribution as a result of a wider experience. (Please use pages 5 and 6 for this essay.)

My desire is to obtain further training in the field of Bacteriology, a field that offers many opportunities to the man who is seeking to render a much needed service in Negro Colleges and Hospitals.

Bacteria play a very important role in man's scheme of living. His living would be absolutely impossible were it not for their various activities. Yet, the vast majority of people look upon bacteria only as disease producing microorganisms. Only a few of our Colleges offer bacteriology, and these, in most cases, give the course in its most elementary form.

Here at the University of Minnesota I have had the privilege and pleasure of studying under men who are recognized Authorities in their respective fields. I have been given opportunities of research that I honestly believe could have been obtained in no other University in America.

And now comes an opportunity for study in Europe at the Pasteur Institute. With the training given by this Institute I would be quite prepared to accept a position in some hospital, Medical College, or Arts College and would be qualified to teach, direct research work, and

disseminate bacteriological and Chemical knowledge. I feel that in my humble way I would be able to render at least a small fraction of the service and labor needed in this field.

Bacteriology

JULIUS ROSENWALD FUND
4901 Ellis Avenue
Chicago, Illinois

SCHOLARSHIP

4

The Julius Rosenwald Fund is making a review of the Negro fellowships which it has granted during the past seven years. Since an appraisal of our activity thus far in this field will naturally have some effect on future policy, it is requested that all persons who have received fellowship grants from the Fund cooperate by filling in carefully the brief information asked for on the following blank and returning the information promptly to the Fund.

Name BUGGS, Charles Wesley

Position at time grant was made Graduate student at U of Minnesota.

Specific purpose of the fellowship study To earn the Master of Science and Doctor of Philosophy degrees.

Subject studied under the fellowship (or special work accomplished) Major, Bacteriology; Minor, Biochemistry.

Institution at which fellowship study was carried on (or, if no specific institution was attended, state nature and place of the work carried out under the grant)

University of Minnesota, Minneapolis, Minnesota.

Present position or occupation Assistant Professor of Biology, Dillard University, New Orleans, La.

Your opinion of benefits received from the fellowship The grants from the Julius Rosenwald Fund made it possible for me to remain at the University, for without the grants I doubt that I would have been able to make it financially. The grants also brought that peace of mind, devoid of the major problems of financing one's education, that is so essential for representative work.

Other reports or comments may be written on the back of this sheet

JULIUS ROSENWALD FUND
900 South Homan Avenue
Chicago.

CONFIDENTIAL

YEAR 1931-1932
~~1932-1933~~

Name Charles Wesley Buggs
Address University of Minnesota
Present Address 809 Aldrich Avenue, North, Minneapolis
Occupation Student (graduate) in field of Bacteriology
Plan.

Aid to secure further training in Bacteriology before going to Pasteur Institute, Paris

Comments Thinks independently, has inititative, excellent sense of organization, rare technical ability
A. B. Morehouse College

Applicant's References Dean S. G. Ford, University of Minnesota
~~Dr. R. S. Green~~ "
President S. H. Archer, Morehouse College
Dr. Charles S. Johnson

Other References

Action of Standing Committee June 26, 1932 - $600
April 2, 1932 - $900

Pitt. Courier 6-29-35

BIOLOGIST

With a wide reputation as one of the most brilliant of the younger scientists, Dr. Charles Wesley Buggs was recently appointed to be in charge of the Biology department of the new Dillard University, which is to open in New Orleans in September. Dr. Buggs made an extraordinary record at the University of Minnesota, where he was elected to Sigma Xi, National Honorary Scientific Society. For two years he held the Shevlin Fellowship at Minnesota for original research. For the past year, he has been associate professor of Biology at Bishop College, Marshall, Tex.
(ANP Photo.)

9-26-36

GIVEN GRANT

DR. CHAS. WESLEY BUGG

Sigma Xi, national honorary scientific society, has made an award to Dr. Bugge, assistant professor of biology at Dillard University, to aid him in carrying on research in problems dealing with the biochemistry and physiology of medusae.

Offer letter

SCHOLARSHIP

May 3, 1933

My dear Mr. Buggs: In a conference with Edwin R. Embree, President of the Julius Rosenwald Fund, yesterday we discussed the question of an additional grant which will enable you to obtain sufficient data for your Doctor's dissertation. We are pleased to advise you that the Fund has made you another grant of $200. We hope you will be able to supplement this amount in order to carry you through the summer months. It is very seldom that additional grants are made by the Fund, but after hearing about the splendid work you have done at the University of Minnesota from Dr. Larson and the heroic efforts on the part of Mrs. Buggs, Mr. Embree felt that the Fund should stand behind you for at least another summer with the hope that after you receive your Ph. D. Degree you will secure you immediate work at Howard University or elsewhere.

We hope you will be able to secure all of the money you need not only to finish your university work but to pay your moving expenses to Howard University, should you secure a position there. If you think it worth while Mr. Embree would be willing to write Dr. Adams, Head of the Medical School at Howard, if you have any difficulty closing the agreement with him.

JUN 12 1933

Very truly yours,

GRA:VH

Mr. Charles W. Buggs
809 Aldrich Avenue North
Minneapolis, Minnesota

SCHOLARSHIP

ERE

GRA

GRA

April 29, 1932

Dear Mr. Buggs: At a meeting of the Committee on Awards of the Julius Rosenwald Fund held some days ago, your application was considered. We are all much impressed with the record of your work. We should like, if possible, to continue to help in your studies.

Unfortunately we have had to cut our fellowship budget to only a fraction of what it was in former years. We are, therefore, unable to make grants of any large amounts. It has occurred to us that if you continue your work at the University of Minnesota, as I understand you propose to do, your expenses might not be very high. We should be willing to make a grant of $75 a month for a twelve month period, that is $900 for the year beginning July 1, 1932. I am afraid that this is the most that we can do, and I think it only fair to say now that there is no likelihood whatever of a renewal of this grant beyond the coming year. If this assistance will enable you to continue your studies effectively, we shall count it an honor to be able to cooperate in this manner.

Very truly yours,

ERE:MLD

EDWIN R. EMBREE

Mr. Charles Wesley Buggs
809 Aldrich Avenue, North
Minneapolis

SCHOLARSHIP

ACCOUNT Scholarships & Fellowships APPROPRIATION No. 3031-12

NAME OF STUDENT Mr. Charles W. Buggs

ADDRESS 809 Aldrich Avenue, No.
Minneapolis, Minnesota

INSTITUTION University of Minnesota

RECOMMENDED BY

STATEMENT OF OFFER

ERE to Mr. Buggs, 7/1/31:

"I have the honor to inform you that at a meeting of the Committee on Fellowships of the Julius Rosenwald Fund, you were awarded a grant of $600.00 to study bacteriology during the year 1931-32."

AMOUNT OF OFFER $600.00 PAYMENT DATES July 9, 1931 - $100.00

CHECKS PAYABLE TO Self $50.00 a month beginning September 1st

TIME PERIOD OF OFFER One year Final payment June 1, 1932.

APPROVED BY GRA. AUTHORIZED BY EBE

PAYMENTS

DATE	EXPLANATION	AMOUNT	DATE	EXPLANATION	AMOUNT

ACCOUNT ~~Scholarships and Fellowships~~ APPROPRIATION No. 3132-13

NAME OF STUDENT ~~Charles Wesley Bugge~~

ADDRESS 839 Aldrich Avenue, North
Minneapolis, Minnesota

INSTITUTION

RECOMMENDED BY

STATEMENT OF OFFER

FRE to Mr. Bugge 4/29/32

" - - ~~We should be willing~~ to make a grant of ~~$75~~ a ~~month~~ for ~~a twelve month period~~, that is $900 for the year beginning July 1, 1932".

AMOUNT OF OFFER ~~$900~~

CHECKS PAYABLE TO ~~Self~~

TIME PERIOD OF OFFER ~~One Year~~

APPROVED BY

PAYMENT DATES

~~June 1~~	~~$75~~	Oct. 1	$75	March 1	$75
July 1	75	Nov. 1	75	April 1	75
Aug. 1	75	Dec. 1	75	May 1	75
Sept. 1	75	Jan. 1	75	June 1	75
		Feb. 1	75		

AUTHORIZED BY

PAYMENTS

DATE	EXPLANATION	AMOUNT	DATE	EXPLANATION	AMOUNT

ACCOUNT ~~Scholarships and Fellowships~~ APPROPRIATION No. 3132-13

SCHOLARSHIP

NAME OF STUDENT ~~Charles Wesley Bugge~~

ADDRESS ~~809 Aldrich Avenue North~~
~~Minneapolis, Minnesota~~

INSTITUTION ~~University of Minnesota~~

RECOMMENDED BY

STATEMENT OF OFFER

~~5/5/33 GRA to Mr. Bugge~~
~~"--- We are pleased to advise you that the Fund has made you another grant of $200. We hope you will be able to supplement this amount in order to carry you through the summer."~~

AMOUNT OF OFFER ~~$200~~ PAYMENT DATES

CHECKS PAYABLE TO ~~Self~~

TIME PERIOD OF OFFER ~~Summer~~

APPROVED BY ERL AUTHORIZED BY GRA

PAYMENTS

DATE	EXPLANATION	AMOUNT	DATE	EXPLANATION	AMOUNT
	Final payment - 8/14/33				

JUN 26 1933

UNIVERSITY OF MINNESOTA
THE MEDICAL SCHOOL
MINNEAPOLIS

DEPARTMENT OF
BACTERIOLOGY AND IMMUNOLOGY

June 20, 1931.

Fellowship Board of Rosenwald Fund,
New York City, N.Y.

Gentlemen:

My recommendation of further advanced education for Mr. C.W. Buggs is based upon a full year's work in this Depart - ment, during which time I have carefully considered his possibilities.

In class work he has demonstrated that he is a good student. During the past nine months he has been doing advanced work on a comparative study of herpes encephalitis and epizootic encephalitis of foxes, and has shown rare technical ability. In this work I have found that he thinks independently and has initiative. I have required of him considerable library work and this he has done with completeness and excellent organization.

Mr. Buggs has unusual technical ability coupled with the qualities of a good student. He is worthy of careful training and should become extremely useful as a medical investigator, or in hospital technology. My advice to him has been to secure, if possible, another year of advanced study in the United States, followed by two years abroad, preferably at the Pasteur Institute. He needs another year at an American university to fill out his fundamentals. Two years at the Pasteur Institute would give him advanced technical training which he is capable of absorbing.

Yours very truly,

R. G. Green.

R. G. Green.

RGG:L

FELLOWSHIPS

ACCOUNT Negro Fellowships APPROPRIATION No. 417

NAME OF STUDENT Charles W. Buggs

ADDRESS

Institution attending: University of Chicago and Woods Hole

INSTITUTIONAL Position: Professor of Biology, Dillard University

Specific Field: Biology

~~RECOMMENDED BY~~

STATEMENT OF OFFER

WCH to Doctor Buggs - 4/18/42:

"It is a pleasure to inform you that you have been selected by the Committee on Fellowships of the Julius Rosenwald Fund to receive a grant of Two thousand two hundred dollars ($2,200) to assist you in carrying forward your studies in zoology and research in the embryology and physiology of marine life at the University of Chicago and at Woods Hole for a fifteen-month period. In the event that you are called into the armed forces before you can begin work on this project, it will, of course, be impossible to hold the fellowship for you."

AMOUNT OF OFFER $2,200 PAYMENT DATES

CHECKS PAYABLE TO Charles W. Buggs

TIME PERIOD OF OFFER Fifteen-month period

APPROVED BY AUTHORIZED BY

PAYMENTS

DATE	EXPLANATION	AMOUNT	DATE	EXPLANATION	AMOUNT

CROSS REFERENCE RECORD

FIRM NAME OR SUBJECT FELLOWSHIPS BUGGS CHARLES W **FILE NO.**

DATE	REMARKS
	Dr. Buggs was previously granted a fellowship in 1931-33. This material is in separate folder in granted paid-up file.

SEE **FILE NO.**

DATE

SIGNED

FILE CROSS REFERENCE RECORD UNDER NAME OR SUBJECT LISTED AT TOP OF THIS SHEET, AND IN PROPER DATE ORDER.
THE PAPERS REFERRED TO SHOULD BE FILED UNDER NAME OR SUBJECT LISTED UNDER "SEE"

YAWMAN AND ERBE MFG. CO.
ROCHESTER, N. Y.
FORM NO. 099CR

SCHOLARSHIP

July 1, 1931

My dear Mr. Buggs: I have the honor to inform you that at a meeting of the Committee on Fellowships of the Julius Rosenwald Fund, you were awarded a grant of $900 to study bacteriology during the year 1931-1932.

It is our understanding that you plan to continue your study at the University of Minnesota.

Further correspondence concerning your work, the procedure in payments on the fellowship, and other details should be carried on with Mr. George R. Arthur of this office.

The Trustees and Officers of the Fund take much satisfaction in being able to cooperate with you in your plans for further study.

Very truly yours,

EDWIN R. EMBREE

ERE:VH

Mr. Charles Wesley Buggs
809 Aldrich Avenue, N.
Minneapolis, Minnesota