— 1939 —

The Saranac Laboratory
for the
Study of Tuberculosis
OF THE EDWARD L. TRUDEAU FOUNDATION

REPORT OF THE DIRECTOR

AND

FINANCIAL REPORT

FOR THE YEAR ENDING SEPTEMBER 30, 1939

REPRINTS OF SCIENTIFIC PAPERS

The Saranac Lake Academy
of Medicine

THE SARANAC LABORATORY

THE fact that the Saranac Laboratory has always been a separate institution from the Research and Clinical Laboratory of the Trudeau Sanatorium is not generally understood. Both laboratories are sponsored by the Trudeau Foundation, but the Saranac Laboratory is located at 7 Church Street in the village of Saranac Lake and not at the Sanatorium.

The properties of the Saranac Laboratory consist of the original building, given to Dr. E. L. Trudeau by Mr. George C. Cooper in 1894 as a private research laboratory, together with the John Black wing, donated by Mr and Mrs. Frank B. Black in memory of their son. The addition contains the library and lecture room, erected in 1927 and 1928, and private research rooms constructed in 1935. There are also two animal houses

To avoid confusion, the Trudeau Foundation publishes separate reports of the Trudeau Sanatorium and Saranac Laboratory.

THE SARANAC LAKE ACADEMY OF MEDICINE

IN July, 1931, a group of physicians in Saranac Lake met in the John Black Room to discuss ways and means for supporting the diagnostic and research activities in the Saranac Laboratory during a period of diminishing income. They were of the unanimous opinion that this institution is essential to the continued existence of the village as a center for the scientific treatment and study of tuberculosis. As a concrete expression of this feeling, they constituted themselves the nucleus of a body to be known as the Saranac Lake Academy of Medicine Its object is "to foster interest in the pursuit of scientific medicine in Saranac Lake" through the agency of the Saranac Laboratory. Its members pledge themselves to support the activities of this institution in every possible way and to seek assistance from others for its operation The active members are physicians practicing in Saranac Lake, but associate, sustaining, and life memberships are also open to interested laymen.

The formation of the Academy created nothing new. The Laboratory, the Library, the diagnostic service, the scientific lectures and research have always been an integral part of the medical life of Saranac Lake, but by many they have been freely accepted as a natural heritage from the great founder of this health community By membership in the Academy of Medicine, or by contributions through it, anyone can feel that he has a part in keeping alive the Trudeau ideals for the furtherance of medical science.

THE SARANAC LABORATORY

DONALD E. CUMMINGS, B.S.

Assistant Director in Charge of Field Work

THE SARANAC LABORATORY FOR THE STUDY OF TUBERCULOSIS OF THE EDWARD L TRUDEAU FOUNDATION

LABORATORY STAFF

Leroy U. Gardner, M.D. ..... *Director*
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Thomas M. Durkan, M.E. ..... *Chemist and Engineer*
Louis Berkelhamer, B.S., M.S. ..... *Petrographer*
Douglas S. McCrum, B.S., (E.E.) ..... *Photographer and Assistant Engineer*
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Catherine M. Cummings ..... *Librarian and Secretary*
Roy Dayton ..... *Financial Secretary*
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Richard Walters ..... *Roentgenological Technician*
Joseph Goldstein ..... *Roentgenological Technician*
Melvin Berg ..... *Bacteriological Technician and Clerk*
Helen R. Smith ..... *Stenographer*

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REPORT OF THE DIRECTOR

of the Saranac Laboratory for the Study of Tuberculosis

1939

LEROY U. GARDNER, M.D.

ACTIVITIES in the Laboratory the past year have followed their usual trend No startling discoveries have been made but these rare occurrences in the study of chronic diseases are the good fortune of few investigators. Most of us must be satisfied to observe the successive manifestations of such diseases as they evolve in human beings and experimental animals. Our attempts to simplify nature's processes by creating highly artificial conditions sometimes lead us astray but at others they provide the means of forging a link in a chain of evidence.

The reprints of published papers bound with this report in no sense reflect the extent of experimental work in progress. Possibly our policy of publication is unsound. "Point papers," based upon individual tests, are rarely issued because we ourselves are not always certain of their significance and reports on industrial diseases are often misinterpreted or given unwarranted importance by non-medical readers. It has, therefore, been customary to defer publication until the completion of collateral experiments bearing on the same topic. This method permits evidence to be weighed and evaluated in the light of experience, but it may defeat itself by necessitating papers so long that few but specialists are interested in reading them.

The annual report of the Director is his vehicle to indicate the nature of the work of the Laboratory and to speculate upon its significance. The purpose is not to draw final conclusions, but to inform the sponsors of the work and others of its trends and of any apparent progress.

Experience with the action of asbestos dust still confirms the impression reported a year ago that grinding the fibres of this mineral to an extremely fine state of subdivision destroys or at least minimizes their capacity to irritate the lungs Nothing has been discovered that is incompatible with the theory that the irritating properties of the longer fibres is of a mechanical nature. A crucial test on which we had relied to prove the point has failed for reasons

beyond our control. On the premise of a report by another observer to the effect that dogs would develop asbestosis, we experimented upon this species of animal but found that no reaction had developed after a year's contact with asbestos fibre. The test for which such high hopes were entertained consisted in the introduction of large doses of asbestos fibre into both lungs by means of a bronchoscope, followed by collapse of one of them induced by stenosing the stem bronchus with silver nitrate. According to our theory of mechanical irritation the collapsed lung should move very little with respiration and hence the fibres within it would exert little influence. The reasons for the failure of the dog to respond to this dust are unknown, but the same is true of all other species tested with the exception of man and guinea pigs. The probable significance of the results has made it seem profitable to repeat the experiment on guinea pigs. If the technical difficulty of bronchoscopy in this small animal can be overcome we should be able to substantiate our belief in this theory.

A series of experiments by Messrs. Dworski and Delahant upon the nature of the injury produced by silica particles has yielded most interesting, though in some respects perplexing results. It will be recalled that the majority of observers believe that slow solution of silica particles in the tissues results in chemical injury of the tissues. This solubility hypothesis, at least in the simple form thus stated, is not consistent with all the experimental observations. Chief among the latter are, first, the lack of reactions suggestive of silicosis to repeated injections of soluble silica of any known form and, second, the fact that the tissues respond to injections of fine silica so rapidly that it is hard to conceive of solution having occurred.

The experiments to be cited deal with the second objection to the solubility hypothesis. In the living animal a specific response to very fine quartz particles, under 3 microns in diameter, occurs within a few minutes, the rate depending upon the site and manner of injection. Similar introduction of other minerals of the same particle size produces no such effects. On injecting enough quartz of this size into the blood stream, the animal almost immediately suffers profound shock and dies within a few minutes to one hour. Intraperitoneal injections of too much silica cause acute illness for several hours and even subcutaneous injections produce inflammatory reactions of characteristic appearance within as short a period as 15 minutes.

Such responses appear too rapidly for any solution to have occurred after contact with the tissues. In the test tube traces of soluble silica can only be discovered after 24 hours of contact between fine quartz particles and blood serum at the temperature of the body. Tests that have been performed seem

It has been indicated that the toxic action of quartz is limited to particles 3 microns or less in diameter. The same is apparently true in the production of the more chronic tissue reactions. While particles more than three times this size may be breathed into the lungs, it would appear that only those less than the critical size are biologically significant. This effect has always been attributed to the greater amount of surface presented by a given number of small than large bodies.

To learn more of the influence of this factor of surface area Mr. Dworski and Mr. Delahant prepared a series of suspensions of graded sized quartz particles. In making suspensions they varied the concentrations so that unit quantities of each would present equivalent amounts of quartz surface. When groups of animals were injected with each of these suspensions, it was found that no silicosis developed if the necessary surface area of quartz was supplied by particles greater than 3 microns in diameter.

Microscopic examination of the tissues disclosed that in the case of particles exceeding the 3 micron limit not more than 3 or 4 fragments had been ingested by any phagocyte and more often there would be only 1 per cell Below the critical size the number increased inversely with particle size. This evidence indicates quite clearly that surface area of the irritant only becomes important in relation to the interior of the cells. The quartz surface in contact with extra-cellular fluids apparently has little to do with the development of silicotic nodulation. This observation suggests that the immediate reactions to intravenous injections of quartz may be a non-revelant index of toxicity exerted upon tissues not concerned with the disease, silicosis

The intracellular injury, however, becomes important when it is recalled that these changes are essentially the same as those produced by tubercle bacilli resulting in the pathological forms commonly designated as "epithelioid cells." Among other characteristics such cells exhibit droplets of visible fat. The presence of this product of degeneration in the phagocytic cells of both tuberculosis and silicosis led Fallon to hypothesize that it was these non-specific fatty or lipoid substances, liberated in large amounts, that led to the formation of the nodules characteristic of each disease. For years it has been known that lipoids from the tubercle bacillus would produce nodules, but no one had thought of testing the action of lipoids from injured cells. Fallon injected the fatty substances extracted from silicotic tissue and produced nodules, but he had difficulty in freeing his material of all particulate silica. We are repeating his work, hoping to surmount this obstacle and demonstrate the validity of his hypothesis.

A word of caution should be added; no one should infer from these ex-

periments that silica dissolves in the cells and is liberated in the blood stream where it may poison other tissues. Apparently its effect is exerted only upon tissues in immediate contact with the quartz particles. Phagocytes are injured or die and connective tissues undergo a peculiar hyaline transformation that Mr. Baisden, working in this laboratory, showed to be analagous to that in tanned leather. In these processes practically all of the dissolved silica is absorbed. Analysis of the blood of all human beings reveals minute quantities of soluble silica, but in silicosis there is no excess. Likewise in the urine there are even larger amounts but it is probable that most of it is derived from vegetable foods and water.

Other experiments by Mr. Steenken, in which fine quartz was injected into the brains of guinea pigs to study its effect upon local susceptibility to tubercle bacilli, suggest an interesting contribution to cytology. The silica first produced small abscesses whose walls were composed of large phagocytic cells. After five months the nodules located in the meninges had been partially replaced by hyaline fibrous tissue but deep in the substance of the brain itself the lesions remained unchanged. In the latter location the ordinary connective tissue cell or fibroblast is lacking; in the meninges and in the walls of blood vessels such cells occur as in all other parts of the body. Since the silicone reaction only became fibrous in parts of the brain normally containing fibroblasts it would appear that this cell is essential to fibrosis. This conclusion would not be acceptable to cytologists of the Maximow school, who hold that the phagocytes are themselves transformed into fibroblasts.

New impetus to the study of the protective effects of calcined gypsum against quartz has been given by an observation that on intraperitoneal injection of a mixture of these two minerals, no silicosis developed in eight months time. Control animals given the same quantity of quartz alone showed silicone nodules on all the peritoneal tissues. We are now attacking the problem in other ways to verify the original observation and to discover whether the mechanism is the same as that in the case of aluminum hydroxide. In all previous experiments, limited to the inhalation method, it had been inferred that the protection from gypsum was due to atmospheric flocculation with the quartz and reduction in the amount of dust inhaled.

The only point to be mentioned on the experiments with aluminum as a protector substance is the apparent discovery of the cause of our previous failures with this mineral that proved so successful in the hands of the Canadian investigators. They used it in dry state and completely neutralized the action of inhaled quartz. We used it in saline suspension with quartz to perform injection tests and observed no evidence of protection. It has recently

to rule out the possibility that the reaction is due to soluble silica already present in the saline solution used to suspend the particles. If they are completely removed by centrifugation, delicate colorimetric tests reveal the presence of soluble silica, but injection of this fluid has no effect upon animals. In other words, the particles of quartz themselves induce the symptoms.

The only explanation now tenable is suggested by the observation that similar reactions are produced by injecting *small* doses (larger ones have different effects) of colloidal silicic acid. It is possible that during the prolonged immersion in water necessary to separate the quartz particles of the proper size there has been chemical reaction and that a thin film of colloidal silica covers the surface of each grain. Certainly it is hard to conceive that formation of such a film during the few minutes preceding the onset of symptoms that follow injection.

Further evidence that the injurious principle resides on the surface of the particle and not in the suspending fluid is indicated by the lack of toxicity of the blood of a guinea pig dying in silica shock. Transfusion of such blood into another animal causes no symptoms. And finally it has been shown that the injection of quartz grains whose surface has been coated with other substances like the hydroxides of aluminum or iron is likewise followed by no symptoms.

The nature of the injury resulting from the introduction of large numbers of fine quartz particles directly into the blood stream is unknown but it presumably affects some part of the circulatory system or its nervous control. The symptoms and pathological changes simulate those of surgical shock, practically all of the blood in the body being rapidly concentrated in the dilated vessels of the abdominal cavity and spleen. The blood no longer clots on removal from the vessels In contradistinction to surgical shock this condition does not respond favorably to injections of adrenalin. A feature that is most difficult to understand is the development of tolerance in animals that survive sublethal injections. After several such treatments they may be given three to four times the original dose with impunity.

The mechanisms responsible for these acute reactions to fine quartz and their possible significance in the chronic phases of silicosis are still a mystery. They may be merely indicative of a capacity to react to silica, for these acute effects are only observed in the species that readily develop fibrosis. The dog, for example, is an animal with an apparently high tolerance to silica although prolonged contacts with excessive quantities of fine quartz will ultimately produce nodulation Very large amounts of the same suspensions that promptly killed rabbits and guinea pigs may be injected into a dog's veins without apparent effect

been noted that if the suspensions are not heated for sterilization, as we had been doing, the associated aluminum completely protects animals against acute silica shock. We have now started to repeat our previously unsuccessful experiments, using unheated aluminum to see whether we can prevent the development of chronic tissue changes. Numerous other tests with the hydroxide of aluminum continue to demonstrate the value of this substance as an inhibitor of silica.

Aside from problems dealing with mineral dusts, a study is in progress upon the therapeutic value of a special compound of sulphanilamide. This powerful bacteriostatic agent had been combined with an oil on the theory that it would then be capable of solution in the wax-coated tubercle bacillus and destroy the organism. Mr. Stephen Phillips, Jr. generously offered funds to study the effects of the new compound (dodecanoyl-sulphanilamide) upon acute tuberculosis in silicotic guinea pigs and also upon very chronic infections of the same nature in guinea pigs previously immunized with Calmette's low virulent strain, BCG. We regret to state that the results thus far obtained offer little cause for encouragement; although some of the animals are still alive it now seems improbable that the drug has had any beneficial effect. Our experience confirms that of most other investigators who have used it to treat primary tuberculous infection in animals.

Diagnostic Work

The table which follows indicates the number and variety of diagnostic examinations made upon patients in Saranac Lake and its vicinity. In spite of a decrease in the total number of patients there were 945 more tests this year than last, indicating a greater tendency to use this service of the Laboratory. The fact that 76 sputa were submitted for pneumococcus typing, 47 more than in 1938, calls attention to the effectiveness of the publicity given this subject. The 24 referred autopsy specimens represent cases of suspected pneumoconiosis, submitted for confirmation of diagnosis. On most of them there was not only a histological but chemical and petrographic examination of the minerals recovered from the lungs.

Summary of Diagnostic Examinations

January 1, 1939 to December 31, 1939

Diphtheria Cultures	32	Feces: Smear, Culture and Parasites	40
Vincent's Angina	20	Milk, Bacterial Counts	27
Pneumonia Typing	76	Water; Bactenology	61
Undulant Fever	19	Water, Ortho-tolidine	365
Enteric Diseases	11	Urine, routine and special tests	1144
Gonorrhea, smears	11	Autogenous Vaccines	26
Blood		Surgical Pathological Specimens	200
White and Differential	640	Autopsies, Human	46
Red and Hemoglobin	514	Referred Autopsy Tissue	24
Matching and Typing	309	Animals Inoculated for diagnosis	62
Cultures	32	Ascheim-Zondek Pregnancy Test	20
Chemistry	307	Miscellaneous Examinations	276
Sedimentation	149	Supplementary Tests	777
Spinal Fluid, Urine and other material for tubercle bacilli	101		
Sputum for tubercle bacilli	1136	Total Examinations	6425

The only radical administrative change to be reported has occurred in the Field Division. Mr. Cummings, who has so successfully directed this activity for the past seven years, accepted an appointment as Associate Professor of Medicine in the University of Colorado in September. However, we consider ourselves fortunate that this new arrangement will still permit him to spend one-third of his time in the Laboratory Field Division. While we cannot but regret the change, preventive medicine will be the gainer for he now has the facilities of a university hospital located near large mining communities in which to expand his activities.

It will be necessary to employ an assistant engineer to help Mr. Cummings maintain his contacts in the field. A man with considerable experience has already been approached and it is anticipated that he may join the staff in the near future.

In June the Fourth Symposium on Silicosis was attended by about one hundred enthusiastic participants. This year the character of the program was varied by presentations of the experience in a wide variety of dusty

industries with and without silica hazards. The interchange of ideas served to emphasize the fact that while the essentials of the dust problem are the same everywhere there are minor variations that are real and that may be the cause of misunderstandings. It is a pleasure to express publicly our appreciation to the twenty-one guest speakers who presented the topics for discussion and whose presence made this five-day meeting such a success.

Mr. Kuechle, Vice-President and Claims Manager of the Employers Mutuals, has again undertaken the editing and publication of the report of the Symposium. His company has defrayed all expenses and has turned over the proceeds to the Laboratory as their contribution to research in industrial disease. In view of the fact that the past donations from the sale of previous symposia have amounted to $4,395, we have reason to be doubly grateful to both Mr. Kuechle and the Employers Mutuals.

Without the financial support of those whose names appear on other pages of this report none of these activities would have been possible. For their contributions, which amounted to $54,575 during the past year, the Director and his co-workers are deeply indebted. Of this total approximately $12,000 represents unrestricted donations which could be used for any research purpose. Industry contributed approximately $35,000 for the solution of its special problems. Income on endowment in trust of the Trudeau Foundation of $5,951 and unexpended appropriations of $17,134 received during the previous year brought the total amount available to $77,661.51. The apparent balance of $7,234 shown on September 30, 1939, the end of the fiscal year, represents overlapping contributions.

This report would be incomplete without an expression of the director's appreciation of the sympathetic support of his board of trustees and the loyal co-operation of his fellow workers. All have worked together harmoniously in the various activities of the institution.

It may not be amiss to review the development of the Laboratory's program of industrial research and to explore the possibilities for future usefulness. Twenty-two years have passed since Dr. Baldwin asked why the granite cutters in Barre were dying of tuberculosis when the marble cutters, working with the same tools, under similar conditions in Proctor, only a few miles away, had less tuberculosis than the general male population of the state of Vermont. To answer this question and others developing out of it has been our major objective since 1918. Physical facilities have been developed for this special kind of research and to the original staff of pathologists and bacteriologists we have added engineers, chemists and a physicist-petrographer. The scope of the work has gradually expanded from an academic interest in a

possible cause of altered susceptibility to tuberculosis to include the direct application of knowledge in preventive medicine. A consultation service has been offered industry to solve its problems of dust prevention and in collaboration with the Roentgen Laboratory at Trudeau, medical control of employee health has been fostered. The Field Division of the Laboratory has even organized and participated in a community campaign for the eradication of tuberculosis. Through its individual efforts and through contacts with other agencies, the Laboratory has attempted to disseminate information on these subjects to medical and lay groups that could apply this knowledge. The cost of these efforts has been supported by industry, insurance, and private philanthropy, whose contributions have amounted to thousands of dollars. It is not my purpose to attempt an evaluation of these activities but to explore the future possibilities of this organization, built with such a considerable expenditure of effort and money. I am naturally concerned to discover whether this private institution can continue to carry on activities that in so many places are functions of universities and governmental agencies.

The first and most practical question is whether such a program will continue to be valuable enough to attract the necessary financial support. Are there still enough unsolved problems in the field of industrial diseases of the chest to justify the cost of this expensive plant and staff? Is there now enough information about the diseases due to inhaled dust and their effect upon tuberculosis so that further research is unnecessary? If so, are there other irritants used in industry that increase susceptibility to tuberculosis and thus constitute a proper subject for our investigation? If work in this field is to continue would it be more profitable to narrow the range of our activities and devote more time to the solution of the fascinating research problems that have already been uncovered?

Before trying to answer these questions, let us look at the industrial situation. As far as the two known major dust diseases, silicosis and asbestosis, are concerned there probably is enough information today so that they could be either eradicated or at least reduced to negligible frequency. But to put this knowledge into practice requires constant expert supervision and considerable expenditure of money. This is now being done with eminent success in a number of our large industries because they can afford the trained personnel and the necessary protective equipment. The small manufacturer with limited capital, on the other hand, still needs help. If he thinks of medical advice at all, he must discover some physician who either knows or is willing to become acquainted with the hazards in the local plant and who will deal fairly with both employee and employer. For his engineering advice

the dust-conscious small manufacturer often turns to the makers of protective equipment, or, if he can afford it, he may engage an outside engineer to design apparatus to meet his special requirements.

But the essence of the control of a dust hazard is constant supervision: the reason it works in the large plant is the presence of physicians and engineers whose main duties are to keep both men and machines functioning properly. For success in the small plants, there must be other experts who, either as private practitioners or employees of the state, will spend their time in going from shop to shop, checking the health of the employees and the operation of the machinery. Today there are not enough experts to meet this demand. Those who are qualified are either employed by the large industries that can pay attractive salaries, or they are in the service of state or federal governments where, as inspectors, they guard agains infractions of industrial codes and, as investigators, they discover new dust hazards In some states the departments of industrial hygiene are doing much to minimize these hazards but with limited personnel they cannot supervise routine activities in individual plants The conclusion is inevitable that more experts must be trained.

Most modern dust control codes seek to prevent the formation of dust of all kinds with especially stringent restrictions for those that contain dangerous proportions of free silica or asbestos. This philosophy indicates that we shall always need expensive ventilation, exhaust systems and engineers to insure their proper operation. Antidotes against the action of the toxic quartz dust, whose effects are being studied in the Banting Institute and the Saranac Laboratory, must necessarily play a minor role in prevention. Perfection of practical methods for their use may somewhat reduce the cost of dust elimination because it may be possible to permit somewhat higher atmospheric concentrations. However, regardless of health hazards, industry is coming to realize that men do not work as effectively in atmospheres polluted with visible dust.

Fully as profitable as discovering agents to neutralize the action of silica would be the discovery of the factors that govern individual susceptibility. In the case of benign dusts, like those in the cement plants, there are certain men who seem to suffer no inconveniences and have spent their whole lives in an industry which in the past was notoriously dusty. Others apparently found it so disagreeable that they sought employment elsewhere after a few months. Where there is a silica hazard the fact that only about one-fourth of any exposed group develops silicosis leads to the suspicion that some individuals are immune or at least highly resistant. If only such individuals were selected

for employment in the silica industries the advantage would be obvious. An experimental study of this difficult problem is now in progress and if the results are at all encouraging it is hoped to extend the investigation to human subjects

Much more needs to be known of the subtle relationships between dust diseases and the superimposed tuberculosis that is responsible for most of the disability in silicotic subjects. Some new method of treatment is indicated for the very chronic forms of tuberculosis that commonly complicate silicosis because they do not respond favorably to ordinary sanatorium regimen.

While uncompleted studies are helping to define the conditions under which asbestosis develops, there is need for more information on the influence of this disease upon susceptibility to tuberculosis. Although such infection seems to be less frequent in employed workmen with asbestosis than in those with silicosis, tuberculosis is a common complication in those who die. There is still some question whether the association is a specific result of the dust reaction, as in the case of silicosis, or whether other factors are dominant

New forms of dust disease are constantly being reported now that x-ray examinations of the chest have become routine procedure in industry. Investigation of some of these has disclosed a silicosis masquerading under the name of another causative agent. In other cases the peculiar shadows in the films are apparently due to harmless collections of inhaled particles in the lungs that have no significant effects upon the function of these organs · In order to combat unjustified compensation claims based upon mere shadows in a film with no actual disability, every industry is forced to become familiar with the effects of its materials upon the lungs.

The widespread use of chest roentgenograms in industry has led to other abuses that can only be corrected by education. Many employers, faced with the possibility of future claims for compensation, refuse to hire individuals whose films show evidence of disease interpreted as tuberculosis. They need to be taught that this infection may heal completely and that in mature adults the scars of old disease in the top of the lungs are not likely to be the source of new disease. To refuse employment to such persons, who constitute about 5 percent of the population, will create a serious social problem. On the other hand, employees have learned to use x-ray films as the basis for compensation claims that often have no justification. They may feign disability after learning that their lungs show evidence of old scars, or when they actually suffer from active pulmonary tuberculosis they claim that inhaled dusts or fumes were responsible. While it has been quite well established that of the dusts, only free silica and possibly asbestos have any influence

upon associated tuberculosis, there is a real need for authoritative information on the effects of other industrial by-products. In spite of the experience with war gases and other irritating substances some physicians hold to their opinions that there must be pulmonary inflammation which in turn must influence co-existent tuberculous foci.

There also is a wide scope for research upon the effects of various fumes and gases upon the normal lungs. Many of them produce unpleasant reactions in the eyes, nose and throat but whether they cause chronic changes in the lungs and are responsible for all of the symptoms that have been alleged is questionable. If they actually do, every effort should be made to control them, but, on the other hand, industry should not be penalized for injuries that do not exist.

The subject of non-tuberculous pneumonia in industry is another that needs clarification. Opinion is changing on the role of dust in altering susceptibility to this disease; it is now believed that other factors are responsible for the high incidence of pneumonia in at least some of the dusty trades. An appended paper by Vorwald, Delahant and Dworski, reports the first of a series of experiments on this subject. Here it is shown that silicosis has had no influence upon susceptibility to one of the most virulent types of pneumococcus nor upon the character of the resultant disease.

From this summary of the situation in industry it would appear that there are still important problems to be solved. In scope they vary from those of general education and administration to detailed investigations of particular hazards and disease. Since these must be studied in plants or mines, in hospital wards and in experimental laboratories it would appear that there is still need for the specialized facilities of the Saranac Laboratory and associated departments at the Sanatorium.

The study of silicosis has now reached the stage where certain observations must be made on human subjects. The important problems of therapy for associated tuberculosis, of individual susceptibility and objective measurement of disability cannot be investigated on experimental animals alone. A program of clinical research is now receiving detailed consideration. Trudeau Sanatorium has already provided funds to establish a department of pulmonary physiology with the understanding that in subsequent years one half of the cost will be born by the University of Rochester as an active partner in this endeavor. Dr Wright, the physiologist, started his work in September. A group of clinicians specializing in pulmonary and cardiac diseases has been interested in the program and the necessary laboratory facilities will of course be available.

The primary objective would be the discovery of some satisfactory method of treating tuberculo-silicosis. This extremely chronic combination of occult tuberculosis and silicosis, which is being discovered all too frequently in industrial surveys, does not respond favorably to the ordinary sanatorium methods of treatment — at least the results have been unfavorable in cases treated after symptoms of the infection have appeared. We would hope to experiment upon a carefully selected group whose disease was discovered in its incipiency.

While these men were under observation it should be possible to obtain useful data bearing on the evaluation of disability and perhaps something could be learned about susceptibility by intensive study with all the available means. For the latter objective there would also have to be supplementary work on men with silicosis and no tuberculosis, and on others who had had long exposures to dust without contracting silicosis.

Since it has been estimated that there are several thousand cases of tuberculo-silicosis in the United States whose treatment is either inadequate or delayed until too late to expect favorable results, it behooves someone to attack this problem of therapy. Saranac Lake has adequate facilities for such an investigation, the background of experience in tuberculosis and silicosis and many contacts with industries where this disease is prevalent. With funds to provide full maintenance for a group of ten or twelve silicotic subjects for a period of perhaps two years, much could be learned. It is earnestly hoped that the money can be found to subsidize this project.

In the educational field a proposal has been made to establish a "registry" for cases of pulmonary disease due to dust, similar to those now functioning for the review of diagnoses of tumors. Under this plan pathological material together with the occupational history and, where possible, x-ray films of the deceased person's lungs would be sent to a committee for review. The Saranac Laboratory, which already renders such service on a limited scale, might hope to participate in return for the information that would be gained. Such a registry should be helpful to pathologists whose experience in this field is limited to an occasional case.

For financial support the institution now looks largely to industry, but its only guarantee of income from this source is the successful solution of problems that are troublesome and expensive in particular trades.

To realize its fullest possibilities the Laboratory should have a backlog of unrestricted income. It could then explore new fields by attacking abstract problems that might appear to have no immediate application. It could experiment with therapy for diseases already contracted. It could play a much larger

part in the training of the personnel needed to supervise preventive programs in the smaller plants. With the university affiliation, which may some day materialize, it could assist in undergraduate teaching. Industry can hardly be expected to supply all the funds for such general purposes, other groups who might also benefit could share the cost. In the past the insurance companies have been liberal contributors, in fact the annual grant of the Metropolitan Life Insurance Company and that of the Milbank Memorial Fund largely maintained the Laboratory for years before industrial contacts were established. More recently the respective associations of both the stock and the mutual companies have been substantial contributors. An intimation that their support cannot continue is cause for concern and we must seek new sources of unrestricted income.

There is work to be done and industrial development is constantly creating new problems. The Saranac Laboratory may reasonably hope to take part in their solution. Like most educational institutions it needs greater financial security.

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SARANAC LABORATORY FOR THE STUDY OF TUBERCULOSIS

RECEIPTS AND EXPENDITURES

Year ending September 30, 1939

Balance on hand October 1, 1938		$17,134.0
Receipts:		
From Trudeau Foundation	$5,951.88	
*Gifts and other receipts for maintenance of plant and work	54,575.67	
Total receipts for the year		60,527.5
Total of balance and receipts		77,661.5
Expenditures:		
For research and field surveys	58,464.74	
Travel and other expenses of workers	1,460.90	
Permanent equipment	1,651.53	
Fuel, light, insurance, animals, feed, supplies and other running expenses	8,840.85	
Total disbursed		70,418.02
Balance on hand September 30, 1939		7,243.5

*See following pages for list of contributors.

CONTRIBUTIONS

TO THE

SARANAC LABORATORY

From October 1, 1938 to September 30, 1939

NOTE. — Items in second column received after October 1st, 1939, to be credited in the 1940 financial report.

Adirondack Fund for the Tuberculous	1,000.00	249.99
Air Hygiene Foundation of America	6,275.00	500.00
Ass'n of Casualty & Surety Executives	2,500.00	
Dr. Edward R. Baldwin	50.00	
Colorado Fuel & Iron Company	2,000.00	1,000.00
Mrs. Bigelow Crocker	10.00	
Mrs. Charles L. Crocker	50.00	
Mr. Thomas M. Durkan	50.00	
Employers Mutuals Insurance Co., thru Mr. B. E. Kuechle, Proceeds from Sale of "Silicosis Symposium"	198.52	57.00
Dr. Leroy U. Gardner	155.00	375.00
General Hospital of Saranac Lake	916.74	250.02
Miss A. Louise Gilbert	10.00	
Inland Steel Company	3,854.16	875.03
Johns-Manville Corporation	5,000.00	1,250.00
Edna Perrin Labarrere: Bequest in Memory of Dr. Jacques Louis Labarrere	1,000.00	
Mr. Lawrence Macfarlane	100.00	
Miscellaneous Contributions	339.00	90.00
National Carbon Company	1,375.00	1,375.00
Owens-Corning Fiberglas Corporation	625.00	36.00
Penn-Dixie Cement Corporation	750.00	
Pickands, Mather & Company, for Lake Superior Iron Ore Association	15,000.00	2,916.00
Carried forward	41,258.42	8,974.04

Brought forward	41,258.42	8,974.04
Mr. Stephen Phillips	6,500.00	
Portland Cement Association . . .	2,747.00	
Mr. Arthur B. Purvis	250.00	
Republic Steel Corporation . . .	3,250.00	750.00
St. Joseph Lead Company	250.00	125.00
United States Gypsum Company . .	247.50	32.50
In Memory of Sydney Lunt Wood:		
Miss Sarah C. Armistead . . .	5.00	
Miss Susan Wood	50.00	
Mrs. S. L. Wood & Mr. John Wood	20.00	20.00
	54,577.92	
Less exchange on two Canadian cheques	2.25	
	54,575.67	9,901.54