ANTERIOR POLIOMYELITIS

THREE LECTURES GIVEN TO COLUMBUS POLIO GROUP

VJERICKSON

POLIOMYELITIS THROUGH THE AGES

3700BC THROUGH ROOSEVELT'S ACUTE PHASE

Poliomyelitis is a disease of antiquity, but it did not attract the attention of the physicians as a disease entity before the end of the 19th century. History reveals that the disease was widespread--but in endemic proportions. Geographically, clinical descriptions of the disease came from England, Italy and India. Up to this time the disease was considered ubiquitous and due to teething, foul bowel and possibly fever--also, all of this time it was not considered contagious; not a medical problem of any magnitude; in fact, there is no known account of a large outbreak before 1865. In 1887, we have the first recorded epidemic in Sweden, because it manifested the paralysis in children as well as infants--it was called Infantile Paralysis. History does reveal a mild epidemic in England in 1796, in Italy in 1813, and India in 1823; all declaring the disease of little importance and just a child's disease due to teething. In 1887, Sweden had an epidemic and this one was of importance because this was the first documented epidemic, and a first step was made to define Poliomyelitis, the first step toward knowledge was begun.

Today the disease is known as an infectious disease caused by entro-virus numbers 1, 2, and 3; spread by fecal-oral route and by person to person. The spread is radically in all directions in each community with the infection in three groups: (1). 80-90% of the population is without symptoms. (2). 4-5% show symptoms without paralysis. (3). 4-5% develop paralysis. It also spreads

as countries develop in population and improved sanitation.

At about 1900 the affected age group broke out of the 1-5 years and began creeping upward.

The big question remains today--why do so many have the symptoms and so few develop paralysis? The causative factors appear to be trauma, fatigue and infections.

The earliest noting of Poliomyelitis come in the following years:

3700BC--Skeletons found with boney deformities typical of Poliomyelitis.

1530-1350BC--Egypt, stele found in crypt drawings. See Figure 1.

460BC--Hipprocrates; quotes from his notes: "In Thasus, a little before and during the season of acturus, (during the dog days) especially after a hot summer with great droughts--In this state of things paraplegia set in and attacked many--some died speedily: otherwise the disease prevailed in a somewhat epidemical form, but persons remained free of other diseases", and in discussing surgery of the foot Hipprocrates says, "Most cases of club foot are remediable unless the declination be very great, as when the affection occurs at an advanced period of youth and before the deforming of the bones is very great, and before any great wasting of the leg". Hipprocrates was born in 460BC and died at a great age between 375 and 351BC making him about 80-90 years old.

150AD--Galen: Five centuries after Hipprocrates--in 138-201 AD, this physician remarked there was a congenital club foot as well as an acquired club foot, and the translator, E.R. Long-a History of

Pathology states--It seems reasonable to suspect some of the latter cases were due to paralytic Poliomyelitis.

1796AD--The first description of a disease due to teething--Infantile Paralysis. Sir Walter Scott describes this in his autobiography. "I showed every sign of health and strength until I was about 18 months old. One night (I have been told); I showed great reluctance to be caught and put to bed; after being chased about the room, was apprehended and consigned to my dormitory with some difficulty. It was the last time I was to show such personal agility. In the morning I was discovered to be affected with the fever which often accompanies the cutting of large teeth. It held me three days, on the fourth, when they went to bathe me as usual, they discovered that I had lost the power of my right leg. My grandfather, an excellent anatomist as well as a physician; the great worthy Alexander Wood, and many others of the most respectable faculty, were consulted, there appeared to be no dislocation or sprain; blisters and other topical remedies were applied in vain. When efforts of regular physicians had been exhausted without the slightest success, my anxious parents, during the course of many years, eagerly grasped at any prospect of cure which was held out by the promises of empirics, or ancient ladies or gentlemen who conceived themselves entitled to recommend various remedies; some of which were of a nature sufficiently singular. The impatient child soon struggled with his infirmity and began by degrees to stand, to walk, and to run. Although the affected limb was shrunk and contracted, my general health was of more importance, and much strengthened by being frequently in the open air. In a word, I

who had in a city probably been condemned to a helpless and a hopeless descrepitude, was now healthy, high spirited, and my lameness apart, a sturdy child."NOTE: That in the 18th Century there was still no linking the fever to paralysis: nor was there a separation from the teething to the paralysis. Sir Walter Scott's not so well known 'lameness' was from polio--at least it is reasonable to suspect that it was polio, and as such is the earliest case on record for the British Isles. He was born in Edinburgh in 1771 and it is recorded that an attack of fever in infancy left him lame.

1813--Italy--Due to teething

1823--India--Due to teething

1887-- Sweden--In 1888 Dr. J. Rissler was the first doctor to state that Poliomyelitis was extraneural--i.e., the lesions were outside the nerves and widespread throughout the body, but fortunately, unlike the central nervous system, did no damage to the patient as was known then--this stimulated pathologists. He had noted in autopsies that the spleen, lymphoid follicles in the intestines and adjacent lymph nodes were all enlarged--now the medical family learned that Poliomyelitis was primarily a systemic infection, and he also was the first to describe the phagocytosis (the process of engulfing the dead cells or particles)of living cells. Unfortunately, 50 years was to pass before pathologists realized the importance and a new science of virology emerged--another important step up the ladder of knowledge.

1894--The first known epidemic in the United States: In the summer of 1894, in a secluded and picturesque valley at the foothills of Vermont, a little settlement of Otter Creek--population a few thousand farmers and lumbermen became the victim of a vicious attack of Infantile Paralysis when several hundred children suddenly became ill with fever and subsequent paralysis of the arms and legs. The epidemic did not attack the adults! It also did not attract public attention. The local physician, Dr. Gaverly, cared for all of these patients and this local physician finally stimulated researchers to find the answer in the field of bacteria. Why? Because this isolated valley had a clear stream running through the town and their drinking water came from there--this stream was also their sewerage system, and the only common denominator--other than teething of the patients. However, some of the victims were past the age and in fact the ages now ranged from 1-5 years.

1906, 1911, 1916: Small epidemics throughout New York, Alabama and others. During these years the age of onset crept upward, and the symptoms were recorded as fever, sore throat, diarrhea with 1-2 days of illness, then feeling fairly well--about the 5-6th day the virus invades the spinal cord. Dr. Draper's dromedary diagram: Circa-1912.

1-3 DAYS OF FEVER SYMPTOMS		5-7 DAYS-PARALYTIC SYMPTOMS
GASTRO-INTESTINAL TONSILITIS UPPER RESPIRATORY MALAISE WITH TENDERNESS	REMISSION OF SYMPTOMS	UPPER MOTOR NEURON (ENCEPHALIC FORM) LOWER MOTOR NEURON (BULBO-SPINAL FORM) PROFOUND STUPOR (SUDDEN DEATH)
SYSTEMIC PHASE (NON-PARALYTIC)	50-80% if total incidence of the disease stays here.	CNS SYMPTOMS PHASE (2nd HUMP WITH SUDDEN ONSET).

One incident that had some effect on the question of isolating polio children or not was the experience in New York (1916):

On Governor's Island, a military post, there were 90 children living--the living conditions were nearly ideal--sanitation excellent. At the beginning of the epidemic in July a rigid quaranteen was established which excluded all children visiting the island, and prevented any of the residents from leaving. Not one case of Infantile Paralysis developed among this group of children. At Barren Island in Jamaica Bay, the opposite, or extreme, in social level where 350 children were living--it was the so-called cesspool of the city--all the city refuse came here, rats, flies, mosquitoes were everywhere. No water supply, sewerage was non-existent and garbage not collected. Isolation was not enforced on Barren Island--there was no need to do so. No one wanted to come. Effective isolation was practiced accidentally for social and geographic reasons--despite all the poverty and filth no case of Infantile Paralysis occurred.

1921-Franklin Roosevelt develops Polio.

From the 18th and 19th centuries there were three particularly important men and one woman who were instrumental in bringing information to the rest of the medical field about Polio.

Jacob Heine--An Orthopedist, who first described the problems that result from the disease's effect on the muscle and resulting assymetry of body mechanics.

Oscar Medin--Also described the mechanical problems which resulted from the effect on muscles. But he also was the first to state that the disease was the result of an infection and recorded the symptoms manifested: fever and malaise. He stated the site of

the lesion as being in the spinal cord, and described the bi-phasic progression from symptoms to paralysis.

Ivar Wickman--A student of Medin, and who helped with the Swedish epidemic; developed two theories about the disease: (1) That polio was passed from person to person, and (2) He demonstrated that many cases of polio did not result in paralysis.

Mary Putman Jacobi--The first to describe the idea that the spectacular paralysis and deformity were due to a tiny microscopic destructive lesion within the grey matter of the spinal cord. She also hinted that the disease as being infectious, and that exposure to cold was a cause and the prevailing idea of teething and foul bowel began fading as an explanation. She was a meticulous recorder and described the prodronal symptoms (the duration of fever and the usual distribution of the paralysis). She was the first physician to bring to physicians the meticulous studies of neuropathology of Polio, and to write a real scholarly and exhaustive testbook article - on Infantile Paralysis indicating that there was more to the concept of the disease than a clinical description of the resulting paralysis.

From the above persons the empirical knowledge of Poliomyelitis began and additional steps were in place: also the medical profession began to take notice of this, which up to the 19th century was considered just a baffling disease.

Karl Landsteiner--Another pioneer should be added to the above-- the Nobel Prize Winner for the researching and typing of blood groups made the earliest attempts to isolate the 'germ' of Polio. He collected fresh autopsy material and attempted to grow the 'germ'. Many failures resulted, and even when there appeared to be growth it was difficult to prove that it was in fact polio, because when injected

into laboratory animals nothing happened, but in 1908, Dr. Landsteiner made the first successful transmission into a lab animal--he took the spinal cords of polio children, ground them in a solution of salt and injected this into several monkeys, who, all within several days were hauling themselves around their cages, whimpering, and their paralysis continued until their breathing became labored and they died. They were the first martyrs to this baffling disease. Dr. Landsteiner joins the others previously mentioned as the beginning architects in the building of the stair steps to successful conquering polio. Their knowledge laid the groundwork! Man could now give his disease to his nearest biological relative. A boom for science, a tragedy for the monkeys!

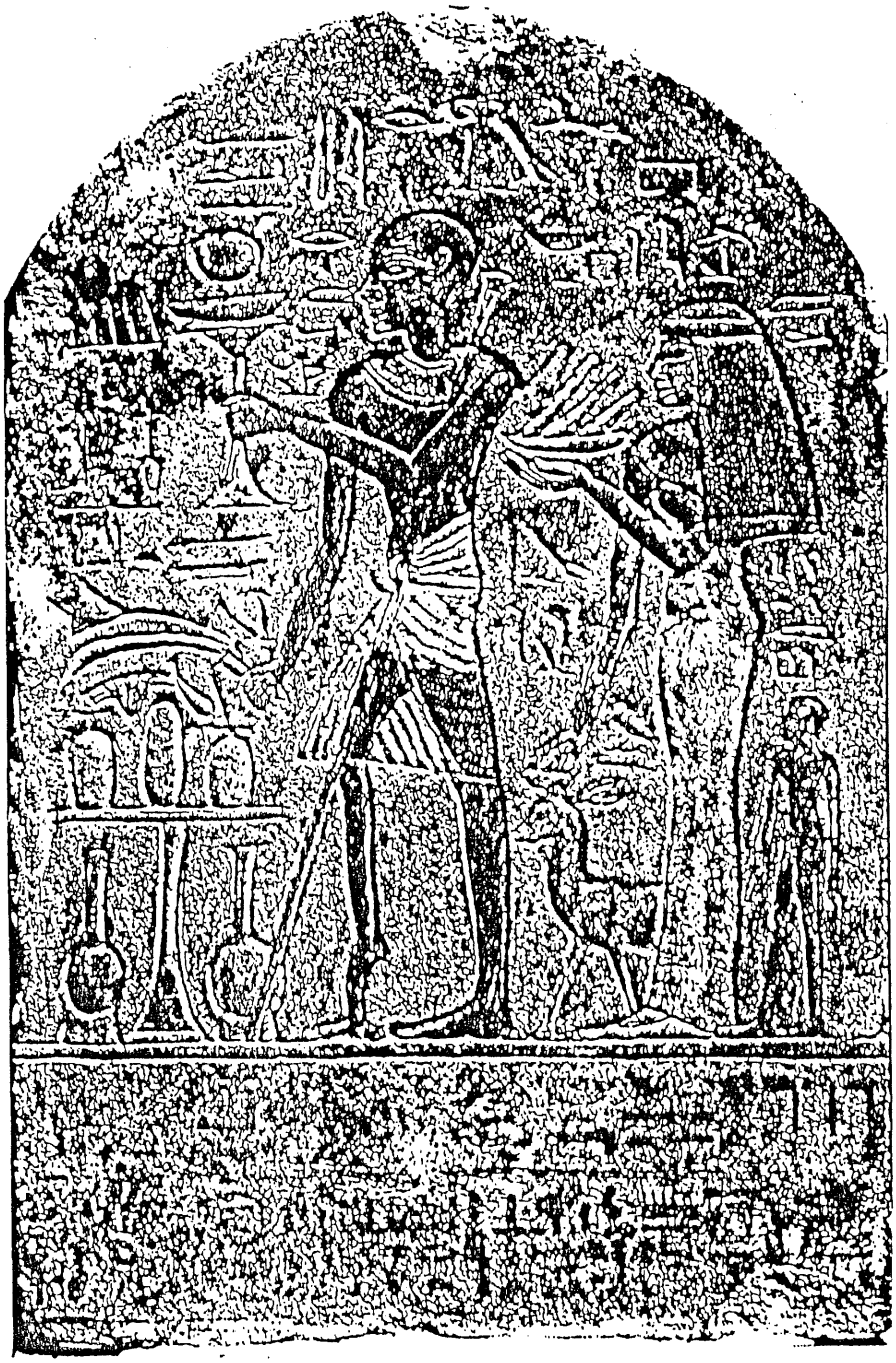
Dr. Sam Flexner--an American, was the first to be able to pass polio from one monkey to another in tandem without losing its virulence, and another step was added. This permitted laboratory animals to be used instead of human donors, speeding the process of research. Flexner also remembered that Dr. Ivar Ivanosky, in 1892, demonstrated that there were diseases producing agents so small that they passed through the earthenware filters used at that time. These were known as infilterable viruses. So, Dr. Flexner made a soup of the spinal cords, filtered this emulsion and took the slightly clouded liquid that passed through the filters and innoculated this into the monkeys. Guess what happened--they developed polio! We now had proof that the polio virus was so small that it passed through the best known filters and could not be seen by the most powerful microscopes of the time. We are now at a time when Landsteiner and Flexner's work received broader reporting to the public, and other medical pioneers all over the world increased in the research of this ubiquitous disease.

In 1911, a Swedish doctor by the name of Kling became interested in where the virus came from, what happened to this virus in the bodies of the victims and how it entered and left. Washings from the mouth, nose and intestines were carefully innoculated into the monkeys, and he was rewarded with success; in fact, the simple means of putting a cotton plug into the nostril a few hours of an infected animal and he was able to transmit the solution squeezed from the nasal plug into a healthy animal. In a few days the healthy animal became ill, the same was done with intestinal washings from a person ill with polio; however, this method was more effectatious than the nasal washings--Why? they did not know, but it did reaffirm that polio could be transmitted by intimate contact--person to person. Another puzzle created--why did children have this mysterious appearance of the virus when they did not have contact with a polio victim? Could a third innocent person, totally unaffected, yet be capable of spreading the infection to others? Again, enter Dr. Flexner--one day he was called to see a four year old polio. This time Flexner seemed not to be interested in the patient; instead, he carefully examined the parents of the patient. They appeared to be well, healthy and vigorous, without any sign of illness. He collected nose and throat washings, injected the material into several monkeys and in a few days the little animals became ill and shortly died. There was no doubting this evidence. Now the role of the 'healthy carrier' had been established and now another step up the building blocks to conquering polio. Between 1911 and 1921 (getting closer to home) and move over Shylock Holmes--medical detectives now had another whole new class of clues to track down. This time the news attracted the attention of the unflagging curiosity within each scientist! Even with this new information there was no unified

attack, no separation of basic problems. Each scientist investigated those phases that interested him; for instance, Dr. Mac Theiler, who worked for the International Health Division of the Rockerfeller Institute had been studying rats, and his lab assistant found one which was listless. Instead of destroying the animal he brought the rat to Dr. Theiler who recognized the symptoms and administering ether, he disected the animal--made an emulsion of the spinal cord and injected this into several white rats. Nothing happened for a few days and then it happened. Polio had now entered another animal. We are now at a time when a disease with human symptoms naturally attack mice. Another step up the ladder.

In 1921, Franklin D. Roosevelt, after his defeat for Vice-President, joined his family at their summer home in Campobello, New Brunswick. He left New York aboard 'Sabalo', a yacht belonging to a friend. On the trip a heavy storm overtook them and Roosevelt, a water enthusiast, volunteered and took the wheel for many hours. He arrived at Campobello in great spirits, but his appearance was one of fatigue and bedraggled. The next day Roosevelt and some of the family went sailing. In the late afternoon they noted a fire on the shore. Sailing to the location they pitched in to fight the blaze. After several hours of firefighting the father went swimming with his sons in the icy waters of the Bay of Fundy. The cold water refreshed him and he returned to camp. Here he sat for some time in his wet bathing suit answering the day's mail. When dinner time came he felt chilly. Thinking he had a cold he did not eat, but went to bed to warm up. The next day he felt no better and had all the symptoms of a cold, a moderate temperature and a

peculiar feeling in his legs. The doctor who was called was puzzled by the disease and indicated rest. The next day Roosevelt was no better and his legs no longer supported him. The local doctor called a specialist; Dr. Keen, of Philadelphia (who incidentally was summering in Bar Harbor). He was suspicious that his patient had Infantile Paralysis, but the lack of any other case in the vicinity made him doubtful. Dr. Keen called in Dr. Robert Lovett of Boston, who at that time was the leading authority of Infantile Paralysis. In a few days Dr. Lovett arrived and confirmed Dr. Keen's suspicions. Franklin Roosevelt had Infantile Paralysis. It was August, 1921 and he was 39 years old.



Egyptian stele, dating from the eighteenth dynasty (1580–1350 B.C.) now in the Carlsberg Glyptothek, Copenhagen. Kindness of the National Foundation for Infantile Paralysis.

Fig. 1

POLIO THROUGH THE AGES

THE ROOSEVELT YEARS: 1921 THROUGH AUGUST, 1955.

When Roosevelt developed polio in August, 1921, there were few cases, 1920 having been the 'light epidemic year', and as far as can be determined none of his friends or children had even the systemic phase. By September his legs were completely paralyzed and he moved to a New York hospital. The trip from Campobello was arduous. He was carried on a stretcher in the bottom of a launch to Eastport, Maine, where a special railroad car received him. He was met in New York by an ambulance where he was taken (still on the stretcher) to the Presbyterian Hospital and he was placed under the care of Dr. George Draper, and he remained there until Christmas. When he left at Christmas time he was in good health, good spirits; but what was called 'a helpless cripple chained to his wheelchair or bed'. At this time he was unable to use crutches. His mother was convinced he should give up his business and politics; and in fact, prepared Hyde Park for her 'crippled son', but he had no such intentions. With the help of a friend, Louis Howe, who was also his secretary, he returned to his office and during this time his legs were placed in plaster casts and with gradually chipping away behind the knees his legs were stretched out, a painful procedure. It is amazing to learn that there is no record of his having become bitter or discouraged.

In the summer of '22 he began the arduous task of learning to walk with crutches, and since he was tall and heavily built, it was

with great difficulty that he began to learn the art of swinging his large body between wooden crutches. With this exercise his vitality and energy increased and his general health improved markedly--today the health field calls this cardio-vascular exercise. For three years he fought to master the use of his legs without success. By 1924 he stopped his insurance business and entered law with Basil O'Connor in the Equitable Building at 120 Broadway, N.Y.. Sometime later this was to become the address of the Georgia Warm Springs Foundation, also, as an aside, this company was to handle all the employees pension funds (Equitable that is).

In the U.S. during the 20's and 30's when aid for a research project was needed the grants were available from private sources and from the Rockerfeller Foundation or the National Research Council, but the funds were made only on a yearly basis and the total very small.

In 1924 his good friend, George Foster Peabody, told Roosevelt about a young man with 'polio' who had received some benefit from swimming in a pool at the summer resort in Warm Springs, Georgia. In fact; this young man who came unable to walk, three years later was walking with crutches. Now, Mr. Peabody, who owned the resort, encouraged Roosevelt to come. He did in the fall of 1924, and found the buildings in some disrepair, but the countryside was beautiful and the grounds scenic, the pool of natural warm water (about 89 degrees F.). He stayed 6 weeks enjoying both the pool and balmy Georgia air, and he made more physical progress than during the previous three years. Because he had reentered politics again the reporters who followed him to Warm Springs found him swimming and enjoying the

company of other polios. Of course, this was good copy, and one of them wrote a feature article which was syndicated--the article was called "Swimming Back to Health". As a result of this article when he returned the next spring he found 10 polios who had read the article--a common bond soon developed. There was no medical advisor at the resort so the local doctor and Roosevelt worked out a series of underwater exercises--all showed improvement and were in fact "Swimming Back to Health".

By 1926 the National Convention of Orthopedists met in Atlanta and Roosevelt attended the meeting asking that they investigate the medical possibilities at Meriwether Inn. A committee of three was sent to observe the hydrotherapy exercises carried on there. At this time Mr. Roosevelt asked Dr. Leroy Hubbard (Orthopedic Surgeon of the New York State Department of Health), and his nurse and physical therapist, Miss Helena T. Mahoney, to carry out the treatments. This year there were 22 patients and despite the fact that they were all badly crippled and so-called 'Old Polios', they all improved and the committee approved the establishment of a Hydro Therapeutic Center at Warm Springs. Roosevelt bought 1200 acres of the Meriwether Inn Resort from George Peabody in 1927, and later placed the title with the Georgia Warm Springs Foundation. During the next few years thousands of polios came from all over the United States, but unfortunately most of them were without funds and the Foundation began to run heavily in debt. Roosevelt poured about 2/3rds of his personal funds into the project, his friends began contributing, and after 4 years of struggling with his legs he was able to throw away the crutches and with the aid of heavy braces he walked using a

cane. He was estatic, and in the same year, 1928, he was drafted to become Governor of the State of New York. He continued coming to Warm Springs and in fact, built a house there which was to become known as the 'Little White House' and the aftercare of Poliomyelitis became synonymous with Warm Springs. But the investigating and research of the acute disease was not included in the program. However, support for the research in acute care came from a philanthropist, Mr. Jermiah Milbank, who knew little of polio, but did know the horror it caused. Over the next few years the International Committee for the Study of Infantile Paralysis awarded grants to support publication of an encyclopedic book of the most extensive information about polio that had ever been published in one volume--part of the book--45 pages the "Bibliography of Poliomyelitis"covering the period from the late 18th century until 1932. Dr. Morris Fishbein brought the book up to date in 1949.

It should be noted the epidemics were increasing in numbers of persons attacked in the years of 1927 until 1932. Now the appeal of Poliomyelitis aroused a universal compassionate response. It had become a national affliction and the picture of a brave but paralysed child sadly attempting to walk was irresistible and this poster child was the flag stand of many a fund raising campaign.

In 1933 Franklin Roosevelt had taken office as the President of the United States; his national projection was one of struggling to surmount his disability. By sheer will power he also became the national symbol of hope and courage and his election gave a gigantic

boost to the cause of Poliomyelitis. Fund raisers were quick to take advantage so they chose to have on the 30th of January (his birthday) a birthday ball, the first being in 1934 and from then on to 1938 the birthday balls became the principal means of raising money to fight Infantile Paralysis. In 1934 and 1935 special advisory and medical scientific committees were formed to make grants for medical investigation. The first 16 grants totaled $241,000.00. In 1938 the birthday balls were replaced by the National Foundation for Infantile Paralysis. Basil O'Connor became its President, and the process of transforming the public picture of polio from a predominantly medical and public image to one that had more sentimental and psychological appeal. Within 10 years the most intensive and comprehensive attack on a single disease was launched by a private agency anywhere in the world. Now the organization had been diagramed to include the 3,070 counties of the United States with its own representative with 50% of the sums collected in each county to help each chapter with the hospitalization and care of its patients. From these chapters the other 50% went to the National Foundation and the whole field of medicine benefited. Then began the complaints that advertising was becoming the primary goal, but this also helped increase donations which increased the research. The propaganda from the National Foundation created an image that research was a holy goal. Polio must be conquered and contributions must support research (one could not exist without the other). Incidentally, this managerial concept is now copied by many other Foundations. Over 34 years the National Foundation collected 630 million dollars, or about 25 Million a year. Broken down--59% was spent on a type

of medicare program, 8% to educational programs, 11% or 69 Million for research, 13% went to advertising, and last;expenses and promotional schemes.

The two most noted persons of the period were of course, Franklin Roosevelt and Basil O'Connor, these two with Dr. Thomas Rivers (who incidentially was Georgia born). Rivers soon realized Roosevelt and O'Connor were out to 'conquer' polio using psycho-social methods. His job with the National Foundation was to create a bulwark of solid scientific research to bring the two methologies in juxtaposition and Rivers set up the scientific research unit of the Foundation. The questions he proposed are as follows:

1. Is the disease a clear defined entity, or translated, is there more than one form of virus?
2. Is the pathology of the disease in humans clearly worked out? No, much more was then known of monkey pathology.
3. Is the portal of entry known for humans?
4. Is there axional transmission?
5. Is chemical blockage possible?
6. Basic research to alter the virus with the hope of making a vaccine.
7. What relation is Polio to constitutional types?
8. Nature of the virus, i.e., Tobacco Moasic Virus, and methods of consistency and separation of virus--See Fig.2.
9. Setting up a traveling fellowship.
10. Chemotherapy of the acute phase.
11. Collection of strains of virus during epidemics.

The scientific research committee made the beginning of a master plan in the field of Poliovirus, and what was very important, the public was informed of its progress. From 1938 to 1950 was a period of much controversy--publicity vs. research, finances vs. benefactors, Sabin vs. Salk, in preparation of a polio vaccine. As far as the National Foundation was concerned many years had gone by with the goal of preventing Poliomyelitis; vigorously pursued since the discovery that it was a virus, with little success until the National Foundation entered the picture. One of the first successes of the NFIP was the sponsoring of a typing program which finally separated the polio virus into three groups. The scope of the National Foundation Scientific Research had made 298 grants to 74 institutions involving 114 groups of workers. This was the greatest scientific attack against any disease anywhere. Soon they supplied the public with professional information as to what to do 'when polio strikes', and provided professional education to physical therapists, orthopedic surgeons, pediatricians and other physicians about the use and development of the Drinker, Collins and Cuirias respirators as well as tracheotomies.

Enter Sister Kenny, a dynamic, very unrelenting Australian nurse whose experience with epidemics with patients lead her to proclaim doctors were treating patients as though this was the middle ages, and out of this controversy came the medical specialty physical medicine, physical therapy had begun during WWI and was

given a greater boost in WWII, but it took the epidemic at Hickory, North Carolina, to show the world the benefits of this subspecialty.

By 1948, psychiatry entered the picture as the epidemic totals rose at an alarming rate. Polio, of course, is a major insult to a developing personality--notably the child's ego--providing temptations to the child-the mother-the whole family. Its disabling effects provide an opportunity for the retention of the so called 'power stage', and a new medical field entered whose task was to set the stage so that polio interferes as little as possible with the emotional growing process.

After the initial innoculations with the Salk (killed virus) the dispute had settled around the use of the attenuated (live virus). In April and May of 1955, 4 Million doses of polio virus were administered to children without incident (exception is the Cutter disaster), and a sign of relief was heard when it was not the vaccine that caused the problems but the manufacturer's shortening the manufacturing process to take advantage of the money to be made.

However, with the vaccine available there was a monumental decrease in the incidence of polio world wide. In the United States there are about 8-10 acute cases a year. South America at the moment seems to have the greater number of cases and the World Health Organization is making a determined effort to resolve this.

All the years of 'crash' emphasis on polio was due to Franklin Roosevelt being a politician, a humanatarian and a polio who gave

to the Nation a hero's image to thousands and thousands of victims of the virus with an admonition 'go ahead. You can do it'.

The field trials of 1954 of the virus was completed and a public announcement of the sensational results (which were of great national interest) was made at Ann Arbor, Michigan, on April 12, 1955--ten years after Roosevelt's death. See Fig. 2 .

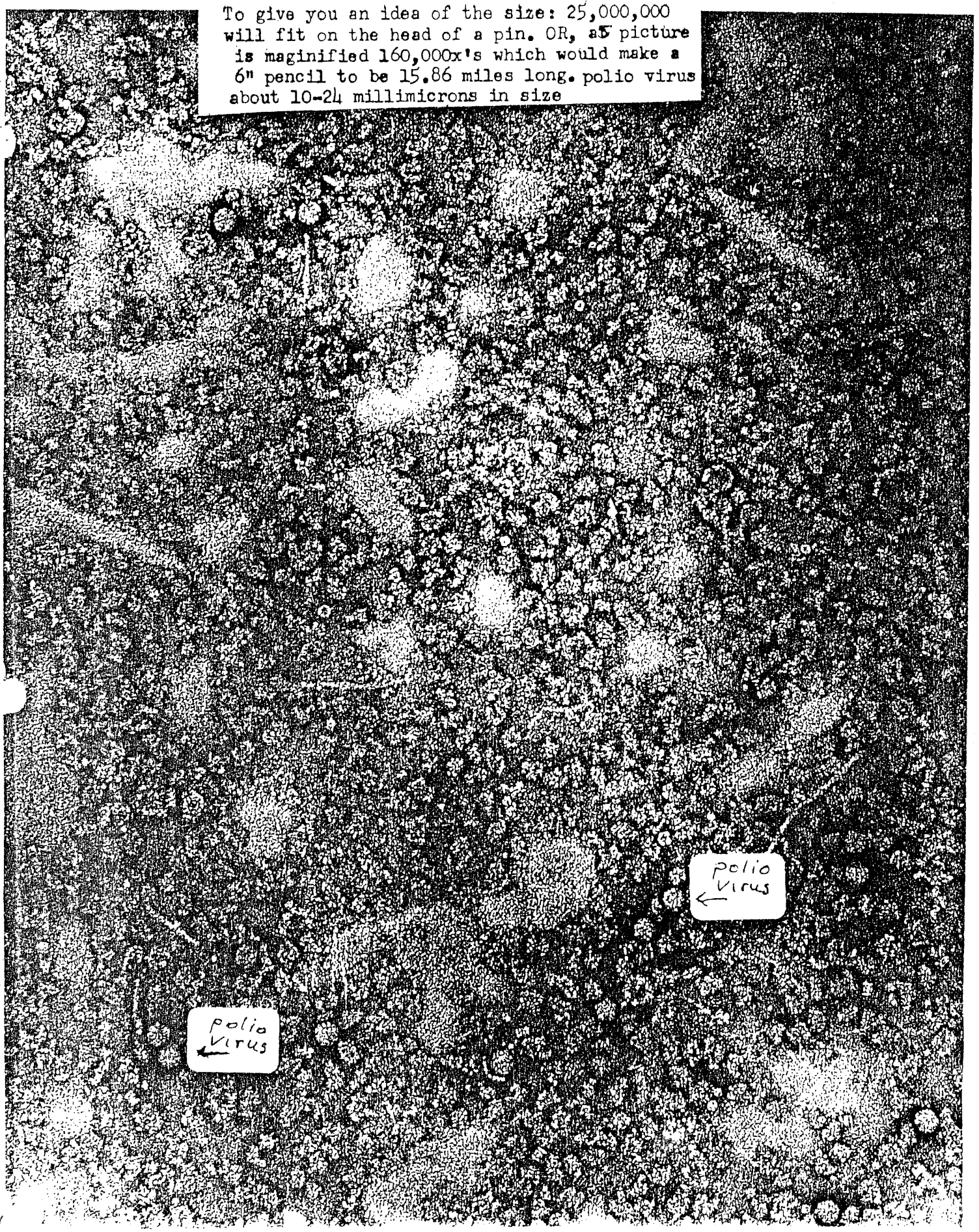

To give you an idea of the size: 25,000,000 will fit on the head of a pin. OR, a picture is maginified 160,000x's which would make a 6" pencil to be 15.86 miles long. polio virus about 10-24 millimicrons in size
Polio Virus
Polio Virus

Fig. 2

ENDEMIC

Ages 1-5 due to teething

3700BC	1530BC	400BC	150AD	1764AD	1813	1823
Egypt	Egypt	Hipprocrates	Galen	(Sir Walter Scott) only known case	Italy (8-10 casesknown) also some cases in Alabama and Lousiana	India

ENDEMIC

Ages creeping upward

1894	1906 1911	1916	1920	1921	1930 to 1935
Otter Creek 132 cases	no documentation	New York 27,000 cases 6,000 died	light epidemic	Franklin Roosevelt develops polio	epidemics increased yearly and the population of polio became equal /children/adults.

EPIDEMICS

AGES INCREASED AND THE EPIDEMICS INCREASED IN SEVERITY-YEARLY. RESEARCH BEGINS!

1935	1938	1950	1953	1954	1955
Bodin/Park 1. Formalin killed virus 2. Kolmer-attenuated virus in 1:4 emulsion with sodium ricinolate	vaccine being developed trials in 15 years.	Bodin/Salk/ Frances/ and Sabin on Typing Committee	Much struggling for being 1st--NFIP accused of playing PR and backed Salk	Vaccinr field trials with killed virus Cutter incident	Results of field trials 4/12/55

****note that there was an incident with the Sabin Vaccine but only with the Type III virus in 1961

POLIOMYELITIS THROUGH THE AGES

TYING IT ALL TOGETHER: THE FALLOUT

We have now learned in about 100 years that polio is a virus, a complete parasite, and feeds on a healthy cell. We now know that the healthiest individuals are the most vulnerable. We now know that polio is not a disease of infants--Infantile Paralysis, but correctly Anterior Poliomyelitis (Myelitis of the Anterior Horn of the spinal cord), or as is now widely known as 'Polio'. We now know that it is a complex virus and that it not only attacks the spinal cord-but the brain and higher nerve centers as well. We now know that fatigue and chilling produce a more severe infection and a more profound paralysis as well; unfortunately, a higher death rate. We also know that the virus has been brought to its knees, but not totally eradicated, and today, the Salk vaccine has been superceded by the Sabin. Finally, the struggle between killed and atenuated vaccine is no longer a political struggle.

Starting about 1926, the field of physical therapy became intrinsically involved with the disease. By the use of hydrotherapy, muscle function testing, empirical pooling of knowledge that the course of nerve impulses could be changed by judicious use of muscle reeducation (new pathways utilized) and the unimpaired pathways could be taught to take over duties unnatural to them; however, the treatment only relieved the symptoms and salvaged damaged muscles.

We also learned that many of the researchers failed because of the timing of the experiments; i.e. failing to recognize the 1-2 day systemic phase, and actually trying to stop the disease after it had become intrinsically a part of the nervous system--too late!

The patient was already sick; remember, Oscar Medin first described the bi-phasic course of this disease but it was not fully understood. Remember Karl Landsteiner, who first made the infilterable 'soup' containing the polio virus, and thus virology became a science. The thought that the polio virus might be multistrain was not investigated until much later when the vaccine was being researched.

We also know that the apex of the course in epidemics occurred in the late 40's and early 50's and encompassed the world. During this time the Armed Services, spread worldwide, became the target because G.I.s are a trapped audience much was accomplished when the Army Epidemicalogical Board created a separate unit called the Neurothropic Virus Disease Commission. The first outbreaks in the Armed Services came in the Middle East to the British 'Tommies' in Egypt. However, because of military censorship this was not reported until six years later. The dates were 1940-1941. The ages of the victims were from 20-40 years old and not a single child or infant was known to have been attacked. During the blackout of the epidemic seven strains of Poliovirus were isolated. By 1943 with the increased American troop buildup, the U.S. became alarmed. The U.S. Medical Reserve officers were now concerned that the polio of the Near East was a different type than that 'at home' and the symptoms of a severe backache was added to the other symptoms. By 1945 the same experience was noted in the Pacific Zone. Wherever American servicemen went the incidence of polio rose dramatically. Now polio became a military disease as well as a civilian one. but somehow different. See Fig. 3.

About this time a strange new location was noted for polio, where it had not been previously, Alaska, at Chesterfield Inlet, the theory of Poliomyelitis as being a temperate zone disease was

no longer a criteria. Another strange property of polio occurred when Dr. Kramer came to a children's home (where an outbreak of polio occurred) and saw a 1 year old child with a fever of 102 degrees, who subsequently, appeared well after one day. Three weeks after the child's one day fever subsided, Dr. Kramer took a stool specimen and innoculated a monkey, and the animal became ill and died of polio, an example of a healthy or abortive case of polio. The rest of the stool material was placed in a jar and kept in an ice box which Dr. Kramer promptly forgot until six months later when he was out of active virus. He found the old jar, concentrated the solution and innoculated a monkey. The animal showed all signs of paralysis. Sacrificing the monkey he studied the organs under the microscope and confirmed the diagnosis--Infantile Paralysis. A significant finding, never before had anyone realized that the virus could survive for six months in ice box temperatures. How many other peculiarities must be uncovered before they could hope to solve the riddle of polio? Another problem is that there are but a few instances where the virus was found in the blood of a polio victim--anti-bodies, but not the virus and the few that were recovered were incidentally to a sick patient before a diagnosis of polio had been made.

The three types of polio virus are:

I-BRUNHILDE, of which there are 161 strains and 82% of all patients have this type. It is the most paralytic.

II-LANSING, with 20 strains and 10% of all polio patients and least associated with paralysis.

III-LEON, with 15 strains and 7% of all patients have this type. This is the Bulbar type.

We also know that the Bulbar type is most prone in pregnant women and after a child has a tonsilectomy. What are the other non-specific factors: stress and fatigue are the two most important, but then we have strenuous exercise, as mentioned before tonsilectomy and adenoidectomy--both of these predispose the patient to severe Bulbar polio, and an infection of any antigens. Unfortunately, about 30 days following vaccination and immunizations polio is most likely to attack the subject.

In the 1950's Mayo Clinic in Rochester, Minnesota,began to recognize the weakness as reported by their patients as a false or true ALS. About the same time Dr. Robert L. Bennett, Medical Director of the Foundation at Warm Springs was cautioning patients "not to overdo it" because of the research being done by Dr. Clint Knowlton at Warm Springs. The principle of irreversible loss of muscle power due to overwork was a real and frightening possibility. All patients visiting Warm Springs were apprised of this so that long hours of continuing activity using the same muscles and muscle groups was discouraged and a change of activity recommended to give the overused muscle a rest. This seemed to work--for the next 20 years---until the middle 70's the routine checkup made by the patients was for equipment repair and replacement with a manual muscle test done routinely. About 1973 a change began--patients from other centers came complaining of aches and pains similar to the symptoms they had at onset,and when they consulted their hometown doctors were told this was due to several reasons: 1. They didn't get enough exercise; 2. They were overconcerned with the common aches and pains of daily living,in actual fact hypocondriacal;

3. They were aging and less able to cope with the stresses. All who came to Warm Springs at that time were counseled about the overwork principle and not to go to spas for resistive exercises, or get into hot tubs when in actual fact this fatigued them even more. We really did not have to tell the patients this because most of them had already discovered that they very rapidly worsened when they increased their exercises, especially the resistive exercises. See Fig. 4.

In the mid-Seventies this became critical and it was noted that all patients who returned had a marked drop in muscle power, some with pain and some without. At this time the patients were counseled to change their life styles so that any activity that left them weak or with muscle pain for more than several hours was to be cut down, and among the many activities that women were told to stop was vacuuming, lifting wet laundry, reaching for heavy utensils from top shelves, and those with back pain and early day fatiguing to rest at lunch time for an hour, lying down. Those with the greatest complaints were to return in six months or sooner if they desired. Fortunately, with some of those who did follow a reduced regimen their muscle tests showed an improvement. They were fortunate that the irreversible fatigue had not become a reality. In reviewing the muscle tests and documenting the changes that took place it was found that most patients had begun their loss of muscle power about 30 years following onset--this whether the patients were 30 years old at onset or 1 year old. There is a real reason for this time span. Remember that many, many patients developed polio in the 40's and 50's and were better cared for than in the previous years. Many with judicial muscle reeducation were able to live a

productive life and when the bodies warning signals began they ignored them until it was impossible to do so. They objected to using canes when they had walked unaided, they objected to using a wheelchair when they had walked with canes or crutches, and rejected bracing when none had been needed before. All of this until such a time as it was imperative. Those who had so valiantly 'whipped polio' and its after effects 30 years before now had an unexpected problem which soon led to an even greater one. When the doctors, they sought, left the patients with a feeling that they were in psychological and emotional turmoil and should obtain help from psychiatrists, but the polio patient is not one to take this without positive guidance and they sought help wherever they could. Unfortunately, at this time the medical schools were not teaching (except in a cursory fashion) about polio, and many a doctor had not seen a polio patient. Along with this is the fact that so few patients with an apparent unsolvable problem was not financially attractive, and the patients were left with a feeling of abandonment. Because of the polio personality they did not sit still but kept challenging the medical profession and now there are a few doctors who will act as consultants, but too few of them actually answer the patient's questions. Even the Social Security Administration would not admit that there was an entity called 'late effects of polio' until recently and this is due entirely to the polios themselves and their perservance. Now doctors are no longer passing the patients from one medical speciality to another, they are finally becoming concerned. Today the best physician to see is an Internist who will check your general health and maintain you at your optimum health, a physiatrist or a physical

medicine doctor who will review your musclo-skeletal level and refer you to an orthotist for such equipment as is indicated. Now, before everyone becomes confused, there are many, many polio patients who do not get the post polio syndrome--only about 25% do. If you have no problems do not make any where none exist--the aches and pains of growing older do occur in polios as well as the perfectly healthy persons. Those with the post polio syndrome have very classical symptoms; loss of muscle strength, rapid fatiguing cold intolerance, muscle twitching, depression because of the loss in the level of functioning that has been the norm for about 30 years, and lack of muscle recovery after prolonged activity: be it walking, housekeeping or typing, wheeling a wheelchair, to name a few. One item that bears noting are falls which result in fractures or immobilization which can mean shortened muscles, tightened ligaments and resulting atrophy of muscles which the polio patient certainly does not need any more of. (hate to end with a preposition but there it is). Those patients who are having the post polio syndrome should become a part of a self-help group, sharing ideas, concerns and exchange information.

What do we know about the PPS Syndrome:

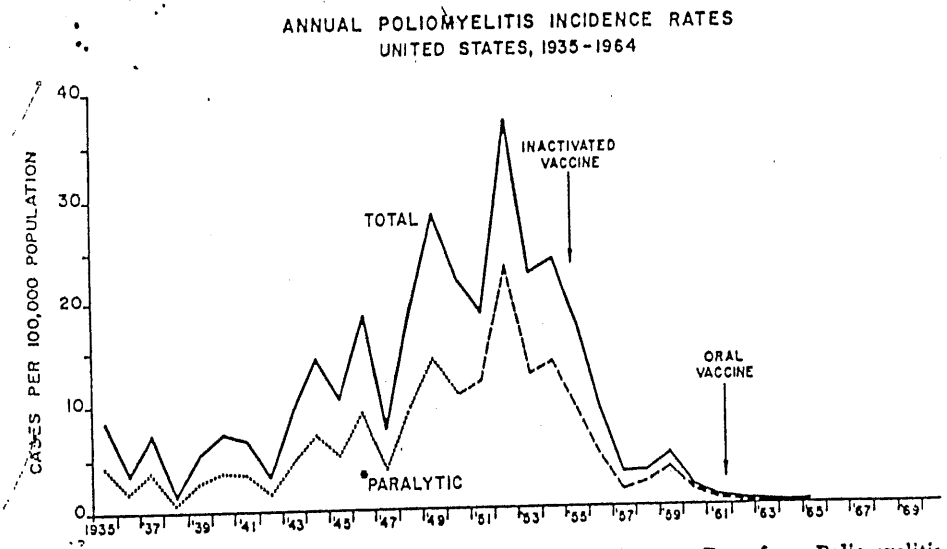
1. That malposition will change the alignment of bones and distort the use of muscles and ligaments across joints.
2. That the continuous activity; when a person might have 50% of muscle power--that person has to work twice as hard and long to function.
3. That the trauma of joints in prolonged use with the loss or lack of strutting across the joints causes what for the lack of a better term is traumatic arthritis (Osteoarthritis).

4. That those with trunkel involvement have a lack of rib expansion and therefore lessened cardio-vascular performance.
5. Those with involved lower extremities have a greater challenge to the heart to pump the blood upward since the muscles can no longer help.
6. Major distortion of the chest causes compression of the heart, lungs and stomach as well as intestine and kidney disfunction.
7. That arthritis and cardio-vascular problems are the major concerns and these must be monitored by physicians and the best person to do this is an Internist who will make the proper recommendations.

To end this section, I should like to challenge the medical profession and the polios themselves to find the answer to the following:

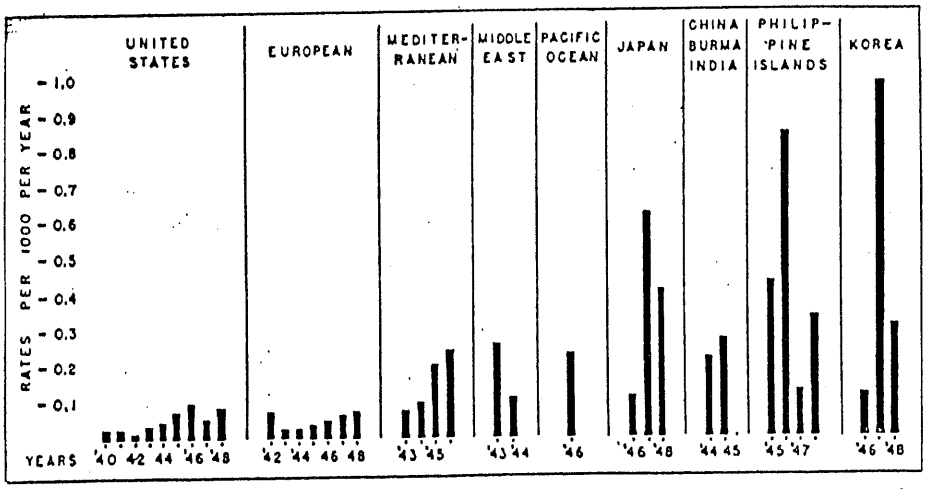
1. What happened at the beginning of the 20th century to change polio to the virulent virus that increasingly became more and more horrendous?
2. What is it that 25% of polio patients have that is different than the 75% who do not succumb to the post polio syndrome?
3. Since the aging process cannot explain away the one year old who develops polio and gets the PPS 30 years later, while the 30 year old at onset develops this about age 60--What has medicine done to investigate this?
4. That the predominance of research and medical tomes have been about the loss of nerves--which happens to all of us: Why not seek the answer in the loss of muscle fibers and the overuse principle: which happens to the polio patient but is not part of the aging process!

Your kindness in asking that I talk to you about a subject that continually holds my interest gratifies me and for this I thank you.



Thirty years of rates of poliomyelitis in the United States. Data from Poliomyelitis Surveillance Reports, U.S. Public Health Service, Atlanta, Ga.

Fig. 3



Annual rates (per 1,000) at which poliomyelitis was acquired by U.S. troops stationed in nine different geographical areas during various periods between 1940 and 1948 (from Paul, n. 18).

Fig. 4

REFERENCES

Berg, R. H. The Challenge of Polio.

Bosch. The Progression of Cripples.

Feldman, R. M. Uses of Strengthening Exercises in Post-Polio Sequelae.

Frick, N. M. Post-Polio Sequelae in Psychology of the Secondary Disability.

Galen. On the Natural Faculties.

Hippocrates. Writings.

Indian Journal of Public Health: Poliomyelitis Through the Ages.

Long, E. R. A History of Pathology.

Paul. History of Poliomyelitis.

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