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MEDICAL AND SURGICAL OFFICERS
FORTY-SIXTH MEMBERSHIP MEETING

FEBRUARY 23, 24 AND 25, 1966
SHERATON-PALACE HOTEL
SAN FRANCISCO, CALIFORNIA

ASSOCIATION OF
AMERICAN RAILROADS

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TABLE OF CONTENTS

	<u>Page</u>
Officers	5
Committee Personnel	5
Call to Order	9
Chairman's Message - E. C. Olson, M.D.	9
Address - William Jaekle	11
Address - Rodney R. Beard, M.D.	16
Panel Symposium - Cardiopulmonary Problems	27
Panel Symposium - Neuropsychiatric Problems	57
Address - Grant Morrow, M.D.	81
Report of Committee on Medical Standards	85
 Summary of Interim Meetings:	
Cardiovascular Surgery - Minneapolis, Minn.	91
Hearing - Denver, Colorado.	100
Vision - Chicago, Illinois	102
Panel Symposium - Noise	105
Address - J. A. Risendal	131
Report of Medical-Legal Committee	140
Report of Committee on Nominations	163
Panel Symposium - Return to Work of Employees With or Fol- lowing Major Disabilities	165

TABLE OF CONTENTS - Continued

	<u>Page</u>
on Trauma	180
on First Aid	183
s	186
.	188

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time, environment, contact with communicable diseases, degenerative and chronic diseases tends to reduce the life expectancy, it follows that the medical department is often regarded as a barrier, because it may suggest removal of these individuals from the good of all concerned.

In our social attitudes and customs exert a decided influence on the practice of medicine and particularly in its liability and legal aspects. Medical opinions and actions pertaining to disability are subject to a closer scrutiny and contention; the responsibility of the railroads for the health of its employees has also undergone considerable change. Aggravation of pre-existing functional conditions is compensable without particular regard to the original condition. Death occurring on the job is charged to the company without much regard for the natural course of the progress of degenerative diseases. The representative pleads to have an employee with a given disability removed from work will frequently blame the company for acceding to the employee's demand, any untoward result ensues. The courts take the social customs demand a verdict in favor of the employee. The railroads and particularly railroads are held increasingly responsible for the employee and his health and welfare.

What is the role of the medical department of the railroad? The prospective employee insofar as his physical attributes, build, strength, stamina and endurance must be ascertained by the medical examiner. His psychological make-up, maturity, maturity and suitability for the position sought must be fully weighed. Since one must assume that once employed, the individual may very likely make railroads his life work, it follows that any impairment are likely to handicap him in the future and which cannot be ascertained with some degree of certainty, should be a signal to the medical department to exercise its special capabilities of the individual to the needs of the company.

It can be seen that the medical group is in a position to exercise great influence in the selection of the personnel for the railroad and act as an effective barrier to the unqualified.

It performs another important function; namely that of protecting the health of the employee, the safety and welfare of the public, and fulfilling its obligation to the employee for efficient and safe performance. It can advise the employee that continued employment might endanger all concerned.

In spite of contentions to the contrary, it can and does furnish impartial opinions regarding the degree of disability suffered as a result of injury and the ability and safety of the employee to return to his job.

I am sure that the profession is keenly aware of its position in the social and economic scheme and its obligations to the employee, the public and the company. It does not want only or capriciously to deprive anyone of an opportunity to earn a living.

Serious thought and deliberation are given to any situation where a question is involved.

Our efforts to promote our relations with management, to carry out our aims and desires to be of the greatest possible assistance, to continually appraise our position, to keep abreast of the changes and progress in our profession, and to apply them judiciously in the conduct of our work, have been our earnest ambition. Our lines of communication may not always have been as open as they should have been, but we have been trying to expand our sphere of activity in the form of more frequent meetings and discussions on subjects of current interest and importance in railroad medicine to the end that those whom we serve will profit by it.

We are presenting at this our 1966 Annual Meeting a program of varied subjects such as panel symposia, reports of activities and suggestions of the standing committees, a discourse or two and an address by the Assistant Vice President of the Southern Pacific Company, Mr. William Jaekle.

I want to acknowledge our debt and gratitude to Dr. Vance Strange, Chief Surgeon of the Southern Pacific Company, for the time and effort he has expended in securing most of the participants in our panels together with our speakers.

It is now my pleasure to introduce to you Mr. William Jaekle, Assistant Vice President of Operations, Southern Pacific Company, who has graciously consented to address us on a timely subject.

Mr. Jaekle.

(Applause.)

ADDRESS: William Jaekle, Assistant Vice President Operations, Southern Pacific Company

Thank you, Dr. Olson. Medical and Surgical Officers of the Association of American Railroads: When Dr. Olson opened the

meeting, it reminded me of the new church which was recently built in Orinda. You remember Dr. Olson said, "Won't you please move up?"

Well, we have this new congregational church that was built supposedly with a capacity of about five hundred. When the congregation walked in the first Sunday to see it, well, lo and behold, there's only pews for about fifteen or twenty right at the very back. The people scrambled in those fifteen pews and sat there, and suddenly the pews moved ahead. Some came up out of the floor, and just kept moving right on up. So, of course, everybody that was in the back finally ended up in the front.

Our minister stood there, and he was always given thirty minutes to make a sermon. He was a little bit long that Sunday, so at the end of thirty-one minutes, the little yellow light came on, and pretty soon a red light came on, and he disappeared.

So I hope, Dr. Olson, if I overrun my fifteen minutes that you haven't got me wired for the escape hatch. (Laughter.)

You will note by your program that Mr. Lamprecht, Southern Pacific's Vice President of Operations, was scheduled to speak here. Yesterday morning, Mr. Russell, our Chairman, Mr. Biaggini, our President, decided they were going to make a tour of the Rock Island properties. This has been scheduled for two days subsequently, but they decided to set it up 48 hours, so Mr. Lamprecht turned around and said, "Bill, here are my notes."

So that is why I am substituting, and it's really a pleasure to be here.

I have Mr. Lamprecht's notes and I have done my best to work them over.

Mr. Lamprecht wrote briefly, "I appreciate the opportunity of welcoming you to San Francisco, Southern Pacific's headquarters city. I know you have very serious matters on your agenda, and I am confident your stay here will be fruitful from that standpoint."

Hopefully you and your ladies will also have at least some opportunity to see and enjoy some of the attractions of our city and some of the many points of interest that surround it. I understand it's been twelve years since you last came here for your meeting. Please make the most of this visit."

I am sure you will. We intend to change the weather a little bit for you tomorrow. It's going to be clear and shiny both Thursday and Friday. I got that on the basis of our weather man that fore-

asted today's clear weather. (Laughter.)

"On the basis of my own experience, both as an officer of Southern Pacific and of the Operating-Transportation Division of the AAR, I look upon you railroad physicians and surgeons as one of the hardest working, most dedicated groups in our industry.

"The medical profession and the railroad industry share almost a century of the closest cooperation. Even before the first trans-continental rail line was completed, and while the pioneer builders of the Central Pacific, Southern Pacific's predecessor, were still engaged in the monumental task of building the line over the Sierra Nevada Mountains, they had organized a medical department, the first of any railroad. And in 1868 they established their own hospital, probably the first industrial hospital anywhere in the world. Shortly thereafter establishment of medical departments became general throughout the railroad industry.

"In those early days when there were no other public health organizations, these railroad medical people took on a major pioneering responsibility in the whole field of public health service. Out of their close relationship with the railroads came many significant benefits extending to the whole of humanity.

"For example, research of our own medical staff was directly responsible for the eradication of typhus and typhoid fever. There has been a steady flow of new knowledge and new techniques from the continuing research activities in railroad hospitals throughout the country.

"There has also been a tradition from the start, and it has been general throughout the railroad industry, of choosing the outstanding physicians and surgeons for their medical staffs. These men, because of their high caliber, have been the nucleus around which medical societies have come into being, including the American College of Surgeons founded in 1913.

"As your profession and our industry have matured together, there has been a continuing mutual high regard and close collaboration toward the major objective of providing the best possible health protection for railroad workers.

"Much has been done by both parties to make our railroads a safer, healthier place to work.

"On your part, you have developed for us standards of employment which have done much to eliminate at the source many of those whose physical deficiencies would be hazardous both to themselves

and to their fellow workers. The requirement of including back X-rays has had extensive practical benefits in excluding many of those not qualified to meet the physical demands of our service and as a protection to us against false personal injury claims.

"Almost immediately, when a person becomes an employee, we start building up a substantial investment in his training and the various fringe benefits to which he becomes entitled. So, in addition to all humanitarian considerations, it is important that we keep him healthy and able to perform his duties efficiently, so that our growing investment need not be wasted. For this, of course, we look constantly to you.

"Statistics show there has been great progress in cutting down the average hospital stay. This is due partly to the lesser severity of injuries."

I can speak from rather personal experience, too. Dr. Strange, one of the Chief Surgeons, Operated on me a few weeks ago for a hernia and Vance and Dr. Newberg came in after about sixty hours and said, "It's time for you to go home."

So they bundled me up and sent me home. So at the Southern Pacific Hospital they have done quite a job in cutting down the average hospital stay.

"But, mostly, it is due to the advances in medical science and the treatment and handling of patients that you have brought into play.

"On our part, beyond our never-ending program to train our people to work safely, we continue to strive to improve that part of our technology which will promote the health and safety of our people on the job.

"The modern coupler has long since replaced the old link and pin which was so great a hazard to the hands and arms of switchmen of the old days. The fireman no longer perches precariously on top of the tender to take on fuel and water, thanks to the advent of the diesel, so that we have far fewer of the extremely disabling type of falling accident involving heel and spinal fractures. By the same token, the diesels with their dynamic braking have eliminated the need for brakemen to decorate the tops of moving freight cars to set up retainers. The diesels have also cut down on the hazards of slack action in long freight trains.

"The technical revolution which has transformed almost every detail of railroading in the past 15 years has, in fact, had a tremendous effect in improving the safety of railroad working condi-

tions. Radio communication between engine and caboose and between trains and way stations, centralized traffic control which cuts down the need for brakemen to throw switches by hand, hot box indicators which give the crew and the dispatcher an indication of overheated journals and lets them give prompt attention to avoid derailments, the intricate machines which take most of the sweat and physical strain out of maintenance of way, automatic classification yards--all these and almost every other modern development we have made have contributed in some way to cutting down the chances for accidents and injuries.

"On Southern Pacific our reportable injuries dropped 20%, from 8.66 per million man hours in 1961 to 6.93 in 1964, and 1965 will show a further improvement when the final figures are in. On this basis, together with the fewer man-hours it now takes to run a railroad, one might reasonably expect our bill for injury claims to follow the same declining pattern.

"Unfortunately, this has not been the case. The trend of injuries continues to be toward making fantastically high awards, sometimes where even the basic merits of the claim seem highly doubtful.

"So, instead of declining, our cost of settling claims has continued on a high plateau. Claims settlements for Class I railroads continue to run around \$100 million a year. For Southern Pacific alone these claims run around \$7.5 million, a fact with which I am intimately familiar, since the charge is against operating expense.

"Thus, while between us, I feel great progress has been made in the matter of reducing the instances and effects of personal injuries, we still face a very serious problem from a claims cost standpoint. In this situation, my own concern extends beyond the fundamental matter of keeping our people healthy to a consideration of keeping our railroad healthy, also.

"You have been most helpful in giving expert testimony and, of course, in the very important matter of getting the employee back into service as quickly as possible. You have made independent studies and you have worked very closely with general claims departments of the railroad to see how our experience in this field compares with the experience of other industries.

"Beyond this, you are looking ahead to the overcoming of new hazards that may arise to replace some of the old ones we have overcome, as our technology continues to change. The effects of exposure to detergents, gases and fumes, acids and solvents, irradiation, and so forth, are possibilities we have to consider and

prepare for. I note that one of the discussions you have scheduled for your meeting is a panel on noise, indicating the ever-expanding scope of subjects to which you are directing your attention.

"In closing, I wish to express my personal appreciation for all you have done and confess I cannot suggest what more you can do to help us solve our continuing problems of high claims costs. Nevertheless, because you are in a position to observe this problem so closely from our own vantage point, I do want to ask that you continue to be aware of it and to include it in your thinking as individuals and in your deliberations as a group. I can ask no more than that," Mr. Lamprecht wrote.

Personally, I have enjoyed substituting for Mr. Lamprecht, and I want to extend my very best wishes for a most successful meeting, Dr. Olson, and my best wishes to you all here. (Applause.)

CHAIRMAN OLSON: We are delighted to hear what Mr. Jaekle has just said. We are glad to know that railroads are so well acquainted with our problems, and I am sure that attitudes of this sort will be highly productive in our efforts.

We do thank you, Mr. Jaekle, very much.

We now have an address by Dr. Rodney R. Beard. You will note in your programs that he was designated in a certain manner, and this is in error. I wish to correct it by saying to you that he is the Professor of Preventive Medicine of the Stanford University School of Medicine, and he is going to talk to us this morning on the role of industrial hygiene in the railroad industry.

We are glad to welcome him. Dr. Beard. (Applause.)

ADDRESS: Rodney R. Beard, M.D., Professor of Preventive Medicine, Stanford University School of Medicine

Thank you, Dr. Olson.

I am very much honored to be speaking to you gentlemen this morning. It isn't often that I have the opportunity to talk to a group of people who have such a wealth of experience and background and knowledge on which to build a discussion.

I am the son of a railroad man, a train man for awhile. He had sense enough to get out of that fairly soon and become a station agent and a railroad telegrapher, and he served a long time with the Southern Pacific Company, having recurrent gallbladder problems, he was a patient of Dr. Coffey's and had several experiences with the Southern Pacific Hospital. They didn't get the patients out in

two and a half days back in the 1920's, however.

Dad warned me that he would disown me if I ever went to work for a railroad, so, with that kind of encouragement I got into medicine. But not very long after I completed my medical school training and some graduate work in the field of public health, I found myself back in the transportation business, because Pan American Airways had a little problem of diarrheal disease out on Wake Island, and they wanted someone to go and make a sanitary survey and find out what the problem was. It was very simple. They were drinking their sewage and the people in the station knew it perfectly well. They had told the people in the home office what was the matter but, you know, it takes a visiting expert to make the local boys look good and get their message across. I was such a success with this that I soon became a part-time permanent employee of the airline, and for the next ten years I had some of the pleasures that are familiar to you gentlemen with prima donna crew members, and with outlying stations where there are few doctors and no hospitals, and with problems of finding decent food and clean water for the crews and for the people who ride the line.

Despite this introduction to aviation, I still have remained a railroad buff, and travel by train when schedules permit, preferably in a caboose. But it would be false for me to claim firsthand knowledge of special health problems of the railroad operations. To be fair, there ought to be a co-author listed on the program, and this would be Mr. A. C. Archambault of the Southern Pacific Company, who has given me previously and recently a good deal of information about railroad operations.

Industrial hygiene is a field with considerable breadth of activity. One can define it very generally as the detection and control of industrial health hazards.

For purposes of detecting health hazards, in my early days in this field, I spent at least 10 per cent of my time observing men at work in the shops, in the offices and on the line. Direct personal observation of this kind just can't be bettered for giving a doctor an understanding of working conditions, the physical requirements, and the dangers which are met by his patients. The inquiring eye and nose will find out all sorts of strange things. Going through a shop you notice a strange but familiar odor and realize that it's carbon tetrachloride, and knowing the hazards of this material, you trace it down and find that it's being used for cleaning spark plugs, and here is a man soaking spark plugs in an open pan of carbon tet right under his nose. You are lucky if he isn't an alcoholic and if he can survive this kind of an exposure.

Then, in another place, going about with your eyes open, you see bags of chemicals labeled potassium nitrate, and stored close by are some glass containers of concentrated acid. This you might find in the neighborhood of a plating shop; it is convenient to have these things there. They are going to be used close by and where else would you store them?

This would be all right, except for the fact that you know what happens if you put concentrated acid on saltpeter. It will blow up. This is another of the things that just an open eye can detect.

I recall the thorny-handed brake repairman whose hands just looked miserable. His explanation of this was that the brakes had sharp edges and his hands got cut. "Well, couldn't he wear gloves?"

"No, he couldn't wear gloves because he had to rely on a sense of touch in order to carry out his operation properly."

Of course he couldn't feel anything with the heavy calluses that he had on his hands anyway, and he might have done much better to put on gloves, but it was not easy to convince him of that.

We find these bad things as we go around our work places. We talk with the people who are concerned, talk with the people on the job, and frequently we can find an acceptable way by which they can avoid injury and disease. This is observation, it's the detection of hazards. After this comes the invention of a solution which will be acceptable and which will provide protection. This is industrial hygiene. Any thoughtful, observant, well-trained physician can practice it. There are a few special points to be learned, particularly about the treatment of the problems which one discovers.

The first principle is to ask if the dangerous material cannot be replaced or the unsafe practice discontinued. It may not be easy to find something which will take the place of the material which is in use and which will do the job as well or nearly as well, but I'm also encouraged when I start doing this, because I remember the examples of success. We have succeeded in displacing carbon tetrachloride as a solvent in industry, and in displacing that extremely useful and extremely dangerous solvent benzol. These agents have almost completely vanished from American industry and where they are used, they are used with very careful controls. It caused some inconvenience to do this, and maybe it raised the operating costs a little, but the increased cost was more than outweighed by the saving in workmen's compensation expenses and particularly by the saving of lives.

The second principle is, if you can't get rid of the beast, put it in a cage. Many hazardous operations like the machining of beryllium or beryllium alloys can be made safe by totally enclosing and ventilating the procedure. If you can't do that, as a third line of protection, you can dilute and displace the dangerous material by ventilation, preferably carrying material out by a closed duct to a safe point of discharge.

Finally, if no other way is feasible, one can resort to personal protective devices, such as gloves or respirators or ear plugs. These usually are the cheapest and there is a great temptation to use them, but, when you do, there is a great risk involved, because you put too much reliance upon the human factor, that is, the element of the willingness of the worker to use the protective device, and on the mechanical barriers which are too often fallible. I am sure you have all seen instances where rubber gloves extended to provide protection against some corrosive material got holes in them and soon simply became containers which kept the irritant material in contact with the skin. Very few of us are willing to bear the burden of wearing a respirator for hours on end; this is unpleasant, and the impediment to breathing is not acceptable. I don't think it's ever reasonable to pick up a respirator as the answer to a toxic gas problem or a noxious dust; it's only temporary.

Any of us can practice industrial hygiene, but we have to learn the limits of our abilities. It will quickly become evident that we need measurements of noxious vapors, mists, and dusts in the area, and an analysis of mixtures of chemicals which are encountered. As physicians, we may lead the way to acceptable solutions of relatively simple problems, but interest and ingenuity are not enough to solve the more severe problems. They are not enough to assure the design of an effective, efficient ventilating system for a large shop, nor for the control of noxious mists from a plating tank. Here the professional industrial hygienist steps in.

An industrial hygienist is skilled in the collection of samples, he is familiar with the numerous instruments which are available to measure toxic materials in the work place, and he knows how to interpret the results. He knows when to take a sample to the laboratory for analysis by the emission spectrograph, for example, and he knows when to take another sample to the laboratory for analysis by a long path infrared spectrometer. He is familiar with all of these available resources; he also has the skill to design suitable guards, enclosures and ventilating systems.

The industrial hygienist may come from any of a number of backgrounds; chemistry and biology are fairly common examples, but most commonly he will have taken a college engineering course.

To this he adds a year or two of graduate school work in one of the dozen schools which give advanced training in this field. His graduate studies include toxicology, an introduction to occupational disease, pathology and symptomatology, bio statistics, epidemiology and administration. However, his main concentration is on getting the special skills for the detection, evaluation and control of environmental hazards to health.

If he has unusual talent and energy, he may go on to earn a doctorate in science. There are great opportunities for careers in research and teaching in this rapidly expanding field of industrial hygiene.

The railroad industry has long recognized its multitude of problems related to health. It is an integrated industry in the sense that it carries out all phases of the activities which go into transportation, which is its final product. It builds the roads, constructs the cars, paints the stations, even caters food for its passengers. Although engine building and car building of new equipment are done by independent companies and new roadbeds are constructed by independent contractors, the maintenance of the railroad and its equipment involve the operating companies in nearly every task known to the basic manufacturers; thus, the railroad employee is exposed to nearly every kind of occupational hazard known to man.

A quick scanning of the medical journals in the past five years reveals very few publications in the United States relating to the health of railroad employees or the industrial hygiene problems encountered in railroading. By contrast, incidentally, there are about a dozen titles for each year in the Russian literature. Apparently they are getting around to building some railroads and operating them, perhaps on the scale that was characteristic of our own country 50 years ago. I think the reason we don't have more publications in the United States about railroad occupational disease is because of the maturity of the profession in this field and the fact that these things are not unique to railroads but cover the whole breadth of industry.

One valuable report recently published is by one of your colleagues, listed in tomorrow's program, Dr. Isadore Kaplan of Baltimore. He has a paper of a couple of years ago in the Archives of Dermatology which reports an excellent epidemiological study of occupational skin disease. As you must be aware, the dermatoses constitutes more than half the number of cases of occupational disease, and they also contribute very heavily to the disability caused by occupations.

Kaplan observed that the majority of these cases occurred in the operating department, mainly in the maintenance shops. Contact

with solvents, oils and greases were foremost causes, with chromate exposures due to anticorrosive compounds in engine cooling water next. I know you are going to have a much more detailed discussion of occupational dermatoses, so I will dwell no more on that but go on to some of the other things likely to be encountered.

Many of you will have in your shops vapor degreasers which use chlorinated solvents, which properly used are safe, but improperly used can cause liver and kidney damage. Improper use means that the degreasers get too hot, and, in particular, that the cooling coils around the top of them are not operated cold enough, and so the vapor gets away from the degreaser and spreads around the shop.

Nowadays every shop must have a good bit of welding going on, and welding fumes will constitute a risk. I don't suppose it's necessary to mention to anyone here the problem of welding fume fever, metal fume fever, which we have encountered so frequently when people use welding torches or arcs on galvanized metal. Railroad shops often have foundries associated with them where heat, fumes and silica dust are encountered. Plating operations are also not infrequent.

Small plating shops are, in my view, more dangerous than large ones. A big plating shop almost has to be operated safely because the people who are involved in the work are sufficiently expert, the suppliers of materials call attention to the hazards, and a large operation will come to the attention of the State agencies which endorse safety regulations.

Dangers are more likely to arise from the operation of a small plating plant where some foreman has thought, "You know, this would be a good idea, we could save a lot of time and trouble if we would just plate these bolts and nuts ourselves instead of sending them out," or something of this sort. These amateur operations are, of course, the ones most likely to cause trouble.

You still have a good bit of lead in railway shops, used in the soldering of radiators, and in the repair of storage batteries. Wherever lead cell storage batteries are handled, a lead hazard is inevitable. I understand that typesetting is now pretty well out of the railroad industry, though this may still persist in a few places as a source of lead poisoning.

Noise has been mentioned already this morning, and you will have more attention to this later today, so I will skip over that.

We have two relatively new and relatively serious problems; one of these is the use of epoxy resins. I think in the heavier industries, and I think of railroading as among these, the use of epoxy resins has not become so widespread as it has in the aircraft and the missile building industries, but I think you are bound to come to it, because the epoxy resins are so highly satisfactory materials for so many things.

When reinforced with glass fibers or other materials, they make strong light structures. Epoxy resins are quite remarkable adhesives for sticking together pieces of metal or even causing glass pieces to adhere to each other. You will find increasing use of this extremely valuable material.

These are substances for which I am afraid we will be a long while in finding a suitable substitute, much as we would like to have one. The reason for wanting to substitute something else for the epoxies is that they are notoriously troublesome as sensitizers. Almost all of the troubles are skin troubles, though other possibilities have to be considered. I have not encountered a case of a systemic sensitization related to the handling of the epoxy resins or the catalysts, which are used with them, but I think this is a theoretical possibility which has to be kept in mind always. The skin trouble alone is sufficient to keep you quite busy, however, another new material which is not quite so hazardous but which we have to watch with care is polyurethane foams. These are materials which are extruded through a nozzle, the resins and the amine accelerators being mixed together in this way and the resultant foam being deposited as an insulator against heat and shock. The stuff is used at a temperature of about 80 degrees Fahrenheit, and problems of heat may be encountered. Also, the temperature is such as to vaporize some of the materials in these polyurethane foams and pulmonary irritation may result from this.

The safe way of handling this is by supplied-air respirators, or a very effective dilution system of ventilation. These foams are being used as insulators for refrigerator cars, and for a variety of other situations in which heat insulation and also some padding against mechanical shock is desirable.

Finally we must look at our old friend, the painting problem. While lead paints are no longer in use, the synthetic resins which have replaced them may in some instances be sensitizing agents. The biggest problem arises from the solvents which are used for these modern paints. Most of the solvents are not severely poisonous. They are, for the most part, anesthetic agents and local irritants. One has to keep close watch on what is being used. One of the difficulties is that the advances in the paint industry are very

rapid and new materials are coming along all the time. You have to be on your toes to keep up with what the latest one is.

I have also in part of my career worked as a consultant in the paint industry and I can tell you that you must not put too much reliance upon the warning labels which their products carry. As in a good many other situations, the attitude of the paint industry is, "Let's play it safe," so they label everything as if it were very hazardous. The fact that you know in a good many instances that you have breathed these vapors and they haven't caused any trouble causes one to lose faith in the whole warning label system.

I want to say a word about the future in the toxicology field and the role of the industrial hygienist in connection with this. I think that within the next ten years or so, we are going to look in different ways for the effects of toxic agents. This is the field of our own research at Stanford, so I suppose I am something of an enthusiast. We are looking for ways to measure the behavioral manifestations which result from exposure to toxic agents. We have used as our typical toxic agent carbon monoxide. This is one with which certainly all of you are familiar, but mainly as it produces symptoms of headache, lethargy and nausea. At our laboratory we have been able to demonstrate effects on behavior with a hundred parts per million within a period of 30 minutes. These effects are subtle and they cause no symptoms.

We do this in rats by training them to perform on a standard behavior pattern, using techniques of modern behavioral psychology. With these techniques we can observe minor changes in the behavior pattern. In animals exposed to one hundred parts per million, we see, within half an hour, distinct deterioration of performance. One of the interesting things is that within a half an hour they are removed from the exposure, they are back up to normal performance, which suggests that carbon monoxide is acting directly and not merely as an asphyxiant.

In general, what we have done is simple. For men, we have a task which involves the discrimination of duration of different sounds. A 50-cycle tone, which is a low pitched buzzing sound, is delivered to the subject through earphones. He hears two presentations; the first is one second in duration and the next is slightly longer, or slightly shorter, or it may be the same. He has to decide whether it's the same, longer or shorter.

Within an hour at a hundred parts a million of CO a man's ability to discriminate between the durations is perceptibly diminished. Now, I don't know how serious this is. Does this mean that the engineer who is getting some CO in the cab begins to lose some of

his judgment? Is he not so sharp at detecting signals?

On the face of it, one would suspect that he is less capable of performing his exacting job, but we have a great deal more to do before we can say how much of a hazard this causes, how much weight we should put on this, and please don't think that I am about to recommend that we change the threshold limit value to some still lower value. We are going to have a lot more information before we do anything so bold as that.

I think this kind of study is going to go on with respect to a lot of toxic agents and in many different fields of activity, so that you will have the information available to you to say how long a man can be exposed to a certain concentration of a toxic agent in the air, and what sort of performance decrement you may expect as a result of various degrees of exposure. We are also going to learn more about how these things act. This is the basis of industrial hygiene, knowledge about how things act, what the toxic effects are, and in the use of skilled personnel, specialists who know how to measure and how to control the toxic agent.

I think you will find yourselves using these skilled people more as time goes by, because they constitute an important part of the occupational health team. The industrial hygienist does not work by himself, he works with the doctor, with the nurse, with the safety director, with the personnel manager. Those are the people that I see as the key elements in maintaining occupational health. Each of them has an important role to play and they have to work together as a team if they are going to get good results. They call upon other specialists from time to time, psychologists, specialists in speech and hearing problems, noise specialists, people who are specialists in radiation hazards. But the fundamental team is the physician, the nurse, the industrial hygienist, the safety director and the personnel director, to see that things are done with due regard for protection of human life, but not only that, for protection of human efficiency.

Thank you very much. (Applause.)

CHAIRMAN OLSON: Thank you very much, Dr. Beard. I am sure that we have found this presentation to be intensely interesting. I see that we have about ten minutes, and it occurs to me that some of you might want to ask Dr. Beard some questions about his work.

DR. MILTON B. CLAYTON (Southern Railway System, Washington, D. C.): Dr. Beard, will the inhalation either of a short or over a longer period of time of polyurethane fumes cause a sensitivity in an individual to the extent that he cannot go into an atmosphere where

for example, there is smoking or inhalation of other kinds of fumes? No. 1, will the inhalation of polyurethane fumes cause lung damage to the extent that you will have impairment or disability or permanent disability?

We have an identical case of that kind now who is threatening to sue us. That is the reason I am asking the question.

DR. BEARD: On the basis of previous experience with similar materials, I would expect that polyurethane foams, especially the accelerators which are used with them, could be sensitizers, in some proportion of the population. As yet, I don't know whether they are frequently going to sensitize people like some of the epoxy materials or whether they will only be occasional sensitizers. But I should say that this is one instance where I would be inclined to accept the ad hoc ergo propter hoc doctrine. If a man had such an exposure and subsequently showed sensitization to the material, I would say this is a reasonable expectation. I don't know about the permanently disabling effects. Save that question for Corwin Hinshaw. I know he is here.

CHAIRMAN OLSON: Anyone else?

The question that you proposed about noise has not been discussed in our group until last year. I believe there has been some reluctance on the part of management to get into this field, principally because they feared that they would have the same kind of experience as they did in the dermatology field, which leads me to this question: Does the presence of the industrial hygienist in the plant provoke claims on the part of the employees because of what he is investigating?

DR. BEARD: That's a very difficult question. On the basis of experience, my answer would be no. I cannot recall instances of claims specifically being provoked as a result of investigations by industrial hygienists which I have seen carried out. I have to put a little reservation on that, in that I am currently remotely involved with a claim which originated because a man came into a hospital which is staffed by Stanford University; he was found to have a peculiar pulmonary disease which resembled Farmer's lung. The man gave a history of having worked in the Redwood lumbering industry for some time and it happened that there was a young man doing some basic science work there at the hospital, who was able to provide a redwood antigen by which this man could be tested for sensitivity. It turned out this fellow had a lot of antibodies against this redwood antigen and nobody else in 200 patients from whom bloods were taken showed similar antigens. At this point I got interested in seeing what it was like out in the field, and a group of us

went up to Eureka and got some bloods from people in the industry. Well, nobody else had quite as strong a pattern of antibodies as this patient had, but some of the people who had been employed in the redwood industry for some time showed reactions. Information concerning this got back to the patient, who did file a workmen's compensation claim, which is now being contested. So I suppose we did set something off, but I think that actually it was as much the hospital as it was the field industrial hygienist.

Are we going to have a whole slew of claims coming on after this one? It's too soon to know. I think that that industry, the railroad industry, or any other industry will be best served with respect to workmen's compensation claims by having the most precise information they can get, and though you may have a few claims which appear to originate because of an investigation which is carried out, you will, in the long run, save money by having this precise knowledge.

CHAIRMAN OLSON: I think it's generally recognized that railroads as well as other industrial concerns are concerned about the welfare of their employees, and I would assume from what you say that the preventive effort would produce in the long run a better overall result.

DR. HARVEY NELSON (Soo Line Railroad, Minneapolis, Minn.): Doctor, may I ask a question?

When you go into a shop, supposing you went into the Southern Pacific shops, how open are you with the use of your instruments? How do you answer questions as "What you are doing?"

DR. BEARD: This will depend on the experience of the particular industry and of the particular shop which is involved. If you have not previously had such observations made, if the workers are not accustomed to seeing a doctor wandering around the place asking questions, watching them work, if they are not accustomed to seeing a man going around with some kind of an air sampling device, you had better give them some education ahead of time. If I were to go into the Southern Pacific shop, this would be no problem, they are used to it. If I go into another shop where they haven't had this sort of service, the first thing I would do would be to find out from the personnel manager who are the people who are topmost in the employee power structure in this plant, who are the leaders among the employees. It may be that they are the union officers, it may be that they are not the union officers at all. There may be some employee social club which is more important.

I would look for these people and would explain to them what we were about to do and why. Depending upon the extent of the program,

would issue more or less elaborate written information to the employees. In short, I would try to help them to understand the purpose behind this, which is, in the long run, for their own protection.

DR. NELSON: Thank you.

CHAIRMAN OLSON: Judging by the show of hands, it was quite obvious that industrial hygienists are not in great use in the railroad industry. I'm sure that after your discourse this morning that that might change things considerably.

I want you to know that we all appreciate very much your coming here and talking to us this morning.

DR. BEARD: Thank you.

CHAIRMAN OLSON: We are now in line for a short intermission, during which time I think there will be a cup of coffee or two served to you. We will convene again promptly at 10:30, please.

(Short recess.)

CHAIRMAN OLSON: Gentlemen, we have a very distinguished group of professors who are going to discuss the question of cardiopulmonary problems. I would like to ask each of you at the conclusion of their discussion, if you have any questions, to please state your name clearly so that it may be recorded.

Dr. Stanley J. Cyran, Medical Director, Pennsylvania Railroad, Philadelphia, Pennsylvania, will act as the Moderator of the program and I will ask him to introduce his panel.

PANEL SYMPOSIUM - CARDIOPULMONARY PROBLEMS

MODERATOR STANLEY J. CYRAN: Thank you, Dr. Olson.

Well, this is the cardiopulmonary panel, and I, too, would like to thank Dr. Strange for arranging such a distinguished group. I am honored to moderate this.

I will introduce our members first.

We have on the end Dr. Frank Gerbode, who is Chairman of the Department of Cardiac Surgery, Presbyterian Medical Center, at San Francisco Hospital.

Next to him is Dr. H. Corwin Hinshaw, the Clinical Professor of Medicine at the University of California, San Francisco, California, and I believe the attending physician of the Southern Pacific

Railroad, and also a co-editor of the volume "Diseases of the Chest,

We have next to him Dr. John Sampson, Clinical Professor of Medicine at the University of California. He is the Chief of the Cardiac Clinic of the University of California Medical Center and a past President of the American Heart Association.

Peter Vaughan is one of our own, who is the Medical Director of the Canadian National Railways, Montreal, Quebec, Canada and he will probably be discussing some of the views he may have on some of the problems that will be discussed here.

This panel today is actually in keeping with many of the panels we have had across the country over the past year. These are informative panels, they tend to be a review of some of the things we know, we should know, and some of the things we would like to know. There are formal presentations at first, followed by questions and answers after the speakers have presented their topics. I don't know whether we can really expect them to solve all our problems that we have on the railroads, but we can expect them to give us some ideas, to give us the information which will make us more knowledgeable in evaluating and assessing the problems that we have on the various railroads.

Those of you who were present at the last meeting in April in Chicago will remember that we did have a panel on pulmonary disease then. Our Panel dealt with pulmonary diseases rather generally and their relationship to the railroad industry. I recall some of the questions dealt with disability, estimation of functional capacity, but time did not permit more than generalizations.

Part of this morning's session--the pulmonary half--was prompted somewhat by some of the recent ads and headlines appearing in journals and newspapers, magazines, and especially the medical journals. "One million are disabled." "70,000 will die in this year." "Deaths from chronic bronchitis and emphysema have increased from 2300 in 1945 to 19,443 in 1963, the latest year for which Public Health Service figures are available." "The Social Security Administration pays more than \$60 million a year to men disabled by emphysema."

I wonder how expensive this is to the railroad industry. Maybe Dr. Rosen would be able to tell us that.

In ten short years, chronic lung disease has become the fastest growing cause of death in this country. Only cardiovascular disease, the nation's No. 1 killer, eclipses chronic lung disease as a disabler of men. It would appear pertinent, therefore, to discuss some

aspects of these problems, even though our time is necessarily limited and the scope of the subjects overwhelming.

One of the more striking advertisements for their product, but also concerning chronic lung disease, is being sponsored by a well-known pharmaceutical company. I think many of you have seen the multiple-page advertisement concerning lung disease in the various journals. They show a dramatic picture of four horsemen likened to the riders of the Apocalypse, to whom power was given to kill. The ad goes further to say that three of these horsemen kill with suffocation; namely, asthmas, chronic bronchitis and emphysema. The fourth horseman is called Despair, for he attends the mounting toll of death and disability. Chronic respiratory diseases are not inevitably disabling. New means and methods of treatment may reverse these chronic respiratory diseases and prolong life.

Notable advances have been made in the diagnosis and treatment of cardiopulmonary disorders. In one decade, this has moved from the pure research laboratory to the cardiopulmonary laboratory, the clinic, and now into the physician's office. Highly technical procedures that have been developed are now able to definitely establish specific disorders. Thus established, there has been the opportunity to prove the correlation of simpler testing procedures.

Office diagnostic procedures now can provide permanent records of the status of the patient at the first examination. They not only often disclose unsuspected pulmonary disorders in patients thought to have heart disorders, but may detect diseases early enough to permit effective prevention of its progression and also serve as an objective guide for differential diagnosis and therapy. Consequently, just as the EKG and the chest films are providing the characteristic patterns of altered function, graphic patterns of pulmonary function now fulfill an important position in the alliance to diagnose and combat cardiopulmonary and respiratory disorders.

The use of pulmonary function studies has led to more precise knowledge of the pathophysiology and the natural course of pulmonary disease, and has provided a better understanding of normal pulmonary physiology in healthy men and women of all ages. Pulmonary function tests may be useful in ruling out lung disease in non-organic types of dyspnea such as conversion and other psychoneurotic disorders. They may aid in differentiating primary from secondary polycythemia. They have been useful in preoperative and postoperative assessment of the patient with known or suspected cardiac or pulmonary dysfunction. In addition, and most importantly for our industry, as well as all industry, these tests may be helpful in achieving an objective evaluation of disability claims. They may be useful in pre-employment examinations, especially in occupations known to be potentially hazardous to the respiratory tract.

They can, and probably should, be used as screening procedures in our periodic evaluation of the employee's health, just as we use EKG's, chest X-rays and urinalyses. Of course, the pulmonary function studies cannot supplant a good history and physical examination nor offer a pathologic or etiologic diagnosis.

Limitations are present in all tests used in medicine, and pulmonary function testing has not escaped these limitations. They must be appreciated in the light of the condition of the patient. In our capacity as medical directors and chief surgeons of the various railroads, with the increasing importance of chronic lung problems, we are faced with making decisions concerning the employability of such workmen.

Does the chronic cough mean anything? Is this just a cigarette cough or does it actually indicate some incipient serious lung disorder? Should this man be working in a potentially irritating environment? Will the diesel exhaust be more disturbing to this employee than the average, normal employee? Is this man's dyspnea or apparent slowing down at work due to heart disease, or, perhaps, a potentially reversible lung problem or both?

How should he be evaluated?

After he has been evaluated, how to interpret the various reports of pulmonary function.

What does FEV mean, MEFV, MVV, and what do these mean in relation to his functional capacity?

Should he or should he not work?

Will his preexisting pulmonary disease be aggravated?

This is the purpose of the pulmonary part of the panel this morning.

I have asked Dr. Hinshaw to discuss how the pulmonary specialist approaches the lung problem. I expect he will stress some important points in history, some important physical signs that perhaps will give clues to expected results of the function studies and, then, give a description of the various practical lung studies that can be done without need for much complicated machinery. Can these be used to differentiate the various disease states? What can they tell us about the man's functional ability?

I am honored at this time to present Dr. Hinshaw, who will start the discussion.

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DR. HINSHAW: Thank you, Dr. Cyran.

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Dr. Cyran has pointed out the importance of the recently augmented informational campaign about chronic lung diseases. This field has long been neglected as far as the general public is concerned. Very few people knew the word emphysema until recent years when the National Tuberculosis Association made this a major field of activity in the expectation that tuberculosis prevalence would continue to decline.

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Much of the apparent increase in emphysema and other respiratory disorders is only apparent. Public health educators have used all news media to arouse interest in this subject.

The recognition of emphysema, the recognition of obstructive airway disease, the appreciation of the importance of chronic bronchitis, all these are relatively new to physicians, as well as to the public.

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We must also realize that this is to some degree a problem of the aging lung, and much of what we call pulmonary disability is really the natural process of wear and tear on the lung.

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Dr. Cyran has mentioned the Social Security Administration expenditures in this field. In the State of California emphysema is responsible for more disability payments, than any other condition, with the exception of arteriosclerotic heart disease, and this surely could not have been said many years ago, because doctors did not then recognize the importance of emphysema. We shouldn't underestimate this simply because it is a more recently recognized field of importance.

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In the estimation of employability, we don't know the breathing requirements of different jobs in industry. I am constantly surprised to see how little breathing capacity is necessary for the performance of many jobs in modern industry. Any number of men who have been disabled or at least taken off the job and given disability benefits undertake other work or even recreational activities which require much more breathing capacity than their original job required. But lungs do wear out. There's no doubt about that. They do fail. Just as hearts fail, just as livers fail, just as brains fail, so do lungs. Some aspects of lung failure are easier to measure than in the case of heart failure. Too often the patient has not sought medical advice during the years of a troublesome cough and the associated chronic bronchitis, which eventually has led to pulmonary emphysema. Too often he has given little consideration to the fact his exertion tolerance has been dwindling and he doesn't do the things he used to do.

Shortness of breath should be an ominous sign of impending disability if shortness of breath is a progressive symptom. Very few people regard it as such; not until it interferes with the pleasures of life does the average man pay much attention to his breathing ability. He will often assume that it's due to advancing age--and perhaps it is. He will assume that it's due to lack of physical fitness, which it often is in part, and will not seek medical advice nearly as quickly as he would if there were a pain somewhere, or if he had known that this was in truth an ominous symptom.

Breathing ability is not likely to be regained in any very large measure: the loss is permanent. I am not saying that there's no help for a man with emphysema. I am saying that the destructive aspect of the disease is permanent and there is no such thing as lung regeneration. But had the patient sought help earlier, I believe his physician might have given him some advice, might have given him some comfort, might have been able to preserve his working efficiency, and possibly could have extended his life span.

Most of the changes tend to be progressive as well as permanent. The aggravating factors can to some extent be controlled and can to some extent be prevented.

We are called upon occasionally to evaluate the pulmonary reserve of a patient who complains of shortness of breath, or one who is considered to be a marginal risk for some major surgical procedure. Dr. Cyran has indicated that simple examinations are often sufficient. When we send the patient for the more sophisticated tests to a larger medical center, such as we have up at the University of California, we are rarely confronted with any surprises. It's nearly always possible, on the basis of physical examination, and some simple measurements of breathing capacity, to evaluate the individual's ventilation function. It's true, of course, that the fine equipment and the skilled clinical physiologists of a medical center can provide us with quantitative figures and very often these figures are important. They are more accurate than we can obtain with the simple devices we have in our offices. But the final evaluation of anyone's pulmonary reserve and our estimation of his ability to withstand the stresses of surgery or the stresses of daily work are not very often altered by the sophisticated tests of a medical center pulmonary function physiology laboratory.

It's interesting but very rarely is it very important for us to know such factors as lung compliance, diffusion data, precise blood gas studies, pulmonary artery pressures, and even such fundamental factors as residual capacity can usually be anticipated at least by simple office procedures which are adequate for most purposes.

In other words, the research capabilities of the pulmonary function laboratory are not essential to the solution of most of our clinical problems. Unfortunately most of our measurements in the office, and quite a few of the measurements in a pulmonary physiology laboratory are measures of voluntary effort, and the malingerer or the stupid person may not perform very well, but there usually is no difficulty in recognizing him and usually he can be persuaded into revealing some of his true ability. I don't believe that a clever malingerer could often delude an experienced examiner.

Normal standards have been established, but these are often misused. For example, the range of normal is extremely wide in most measures of pulmonary function, and often we incorrectly use the word "abnormal," when a patient fails to attain predicted performance. Predicted values are not necessarily synonymous with normal values.

For example, 70% or more of a predicted forced expiratory volume is normal. Some of the standards which are quoted do not take into account the man's age. Often tabulations and graphs which do take into account age can be distorted in such a way as to make it appear that a man of 60 years who has only 60% of predicted breathing capacity is disabled. In actuality his job may not require even that much exertion tolerance and it may be a serious injustice not to permit him to work to the usual retirement age.

Frequently, we ask the question: "How much can a man breathe?" We are asked to measure his air capacity. How much can a man breathe is a good deal like asking how fast can a man run. What is the normal rate of running? And you would find a wide range of variation within people who have normal legs. The man who wants to run fast will run better. The man who is trained and experienced as a runner will undoubtedly run faster. The young man will run faster than an old man, and the figure we come up with, expressed in miles per hour, really doesn't tell us whether or not his impaired speed is due to lack of effort, whether it's due to arthritis, whether it's polio, whether he has an amputated leg, or whether he has just had a recent bout with the flu. Any one of those things might reduce the man's running capacity and the same things might well reduce his breathing capacity temporarily or permanently.

When it comes to the measurement of breathing capacity, we are mostly concerned with the common disorders and the most common disorder is generally spoken of as "obstructive airway disease." This is almost synonymous with emphysema, but not quite. Obstructive airway disease refers of course to obstruction in the flow of air in and out of the lungs. Fortunately, here the simplest measurements are also the most meaningful and most of these are

measures of air flow rates; how much air can a man exhale in a space of time. Most important is how much can he exhale in one second and hence FEV, the forced expiratory volume in one second, is probably the most useful single measure that we have in estimating obstructive airway disease. We don't care so much about how much he can exhale in five or six seconds, simply because no one can take five or six seconds for a single respiration. "Vital capacity," or "timed to vital capacity" is exactly the same thing.

Machines are available which make this measure very simple. Those machines which produce a graph to show the rate of air flow during exhalation are more valuable than the ones which give you a single figure. When that graph, repeated again, and again, shows a series of identical curves, you can be confident that the subject is not a malingerer, that he is exerting his maximum effort.

I think you find if you play with the machine using yourself as a subject that it almost is impossible to reproduce the same graph intentionally over several tries, unless you are using your absolute utmost of breathing capacity. These machines are relatively simple. There are about a half a dozen different types. The Jones Metabolism people make a bellows machine "Pulmonor" which is quite reliable, reasonably accurate for all our ordinary purposes. The McKesson people make a little machine they call the Vitalor. These cost in the vicinity of one hundred fifty to two hundred fifty dollars apiece. They should be in every hospital, and the house staff should know how to operate the device and how to interpret the findings. Most machines provide a graph of the forced expiration, and this graph is spoken of as a "spirogram." From the shape of the curve you can estimate the air flow rate in liters per minute the graph provides estimation of the one second forced expiratory volume, the two seconds and the three seconds forced expiratory volume.

The air flow rates will vary for different machines. For example, with the McKesson machine a normal person will only be able to blow out about 200 to 300 liters per minute. That is because this machine offers relatively high resistance to air flow. Some of the more fancy electronic actuated spirometers will give you an air flow rate much greater than that. The most simple measure of air flow is to light a cardboard match, hold it a foot in front of the mouth, and with the mouth wide open, try to blow it out. It requires an air flow rate of a few hundred liters per minute to blow out such a match at the approximate distance of one foot. Don't let the subject purse his lips, or you will get a false reading.

We used to speak a good deal of maximal breathing capacity, but the maximal breathing capacity designation is not so frequently

used these days because it isn't feasible to get the average person to maintain forced breathing long enough to get a good measure of maximal breathing capacity.

I had intended to discuss some other aspects of obstructive airway disease. I may have inferred that emphysema is the only condition we are concerned with. Of course it's not. Obstructive airway disease can also be caused by asthma, which of course is a reversible condition. This, again, can usually be detected by physical examination and simple office laboratory procedures. Such pulmonary disabilities as may be due to pulmonary fibrosis, will be shown on simple machines of this sort.

There are other conditions less commonly encountered. For example, a case of asbestosis might give a reasonably normal measure of breathing capacity, and yet the man might be incapacitated by reason of a peculiar type of pulmonary fibrosis which leads to an interference between exchange of oxygen in the air and hemoglobin, so-called--"alveolar capillary block." This is found also in conditions like sarcoidosis and in a few other pulmonary fibrotic disorders.

MODERATOR CYRAN: Thank you very much, Dr. Hinshaw. There will be time for questions after the panelists have presented their topics. I know there are many other things that probably we can ask Dr. Hinshaw, and I'm sure he will be happy to answer those.

In preparing this panel, of course, this necessitated correspondence between Philadelphia and San Francisco and Dr. Strange, et cetera. We had planned on going into heart disease and pulmonary problems. However, we realized that perhaps it would be more practical to talk again about coronary heart disease, since this is one of our major problems today in the railroad industry, so Dr. Sampson will discuss some of the practical aspects of coronary heart disease. How do we approach this. What are the diagnostic procedures available? What are some of the newer procedures available that can be used to again give us more knowledge to assess the functional ability of the railroad employee?

Dr. Sampson.

DR. SAMPSON: Dr. Cyran indicated in his introduction that I would discuss some of the practical aspects of coronary heart disease, but, insofar as it was his desire that heart disease and pulmonary problems would furnish the core of the presentations of this morning's session, I am taking the liberty of opening my remarks with certain brief comments on cardio-pulmonary disease.

Cor Pulmonale is one of the most subtle forms of heart disease, and its existence is often suspected by the accompanying pulmonary parenchymal or vascular abnormalities without obvious cardiac manifestations. The commonest forms of the parenchymatous disease, pulmonary emphysema, is commonly associated with some degree of pulmonary arterial or arteriolar obstruction, which, through increased resistance to the pulmonary blood flow, impresses an elevated load of work on the right ventricle. Under these circumstances, the electrocardiogram may suggest right ventricular hypertrophy prior to the increase in the size of the cardio-silhouette by roentgenograms or by any evidence of right ventricular cardiac incapacity. The physical signs may be relatively inconsequential with the exception of an accentuated pulmonic second sound.

Primary pulmonary arterial hypertension is a relatively unusual entity, which most often occurs in childhood. Similar to the pulmonary hypertension which exists in certain congenital and acquired heart disease, such as interatrial septal defect, interventricular septal defect, mitral stenosis and mitral insufficiency, it is the result of the thickening of the pulmonary arterial or arteriolar walls, and the narrowing of these vascular channels, which may be either transient or permanent. It is important, by the right sided cardiac catheter studies, to determine the existence of such pulmonary hypertension, and by dynamic studies on both sides of the heart to determine the source of it. Very often it is possible to relieve the defect and to cause important reduction of the pulmonary arterial resistance and the accompanying pulmonary hypertension, and thus prevent the crippling or fatal right ventricular strain and failure. Certain of the defects, such as patent ductus arteriosus and interventricular septal defect, are likely to be accompanied by pulmonary arterial hypertension in early life, but inter-atrial septal defect, and mitral valve disease, resulting in pulmonary arterial narrowing, appear relatively late and are more likely to be reversible.

In the congenital defects, a flow of at least 1.5 times in the pulmonary vascular bed, as compared to the systemic flow, seems to be necessary to lead to these pulmonary arterial changes. However, there is considerable difference from patient to patient in the tendency to develop increased pulmonary arterial resistance, the reason for which is not as yet known. Undoubtedly, Dr. Hinshaw and Dr. Gerbode will present the pulmonary diseases, other than emphysema mentioned above, which could cause these vascular changes, and also of the surgical procedures with the proportion of success now exhibited in erasing the damage done by the cardiac lesions mentioned. Although the risk is quite high in attempting to close the right to left heart shunt when cyanosis is marked and when the pulmonary arterial changes apparently have reached a high degree of development, some success in relatively late cases, es-

pecially in mitral valve disease and in interatrial septal defects, are occasionally reported. These reversals of the pulmonary arterial resistance may, however, occur slowly, and at times six to twelve months is necessary to pass before seeing favorable results in correcting the cardiac defect. The reversals are more likely to occur after acquired heart disease, such as mitral stenosis, than after a longstanding congenital shunting lesion.

One of the most tragic examples of the mistake that has occasionally been made is from the diagnosis of primary pulmonary hypertension, assumedly irreversible, by only partial right sided cardiac catheterization which has revealed a high pulmonary arterial pressure, when, in reality, a mitral stenosis without characteristic auditory signs is the basic lesion. Obviously, this lesion is surgically correctable and could have led to correction if the diminution in blood flow through the restricted pulmonary vascular bed had not led to the loss of the characteristic mitral diastolic murmur, or if a rigid mitral valve had failed to exhibit the characteristic opening snap.

Recurrent pulmonary embolism may, and often does, lead to decreased cardiac output and acute, subacute or chronic right heart failure and death. Since prevention and control of this condition is possible by venous ligation or by anticoagulant drug therapy, and since the results are very often fatalities frequently undiagnosed, it is of vital importance that it be recognized. Recurrent pulmonary embolism is one of the most subtle and difficult entities to diagnose since frequently the roentgenograms of the lungs, the electrocardiographic changes by right ventricular strain, and the physical signs and symptoms often present no characteristic diagnostic picture. There are two technical methods for assisting in diagnosis, and it is recommended that they be used: The first is the scanning of the lung and angiography by radioactive material in scanning and radioopaque material in angiography. An additional method, which is of less specific value, is the measure of CO₂ in the alveolar air or expired air, which would be lower than expected where areas of the lung were blocked, as by thrombi. Frequently, wrong diagnoses of recurrent pneumonia, emphysema and chronic bronchitis, and congestive heart failure are made and retained especially in the presence of a low grade, prolonged or remittent fever. Such useless therapy as antibiotics, digitalis, diuretics, fail to terminate the advance of the process, which eventually becomes irreversible and cyanosis and failure of cardiac outflow from poor intake, eventually terminates life. As a practical matter, the use of adequate anticoagulant therapy, generally Heparin and the Coumadin drugs, should be initiated on suspicion of the existence of pulmonary recurrent embolism, especially in individuals who are recognized candidates for this condition, such as elderly individuals who have been bedridden with longstanding heart failure or immobilized by broken

late already.

To her right is Dr. John Moody, Clinical Instructor in Psychiatry at the University of California and to his right Dr. Philip R. Calanchini of the Teaching and Research Staff of Presbyterian Medical Center in San Francisco.

Dr. Calanchini and Dr. McAuliffe are closely associated with the Southern Pacific Memorial Hospital, where they are in an enviable position among their colleagues across the country, I am sure, because they have a separate inpatient service of neurology. I am sure that this makes for good feeling of the staff and better care of the patients.

Dr. Morrissey has not yet arrived. As Dr. Nelson indicated, to the best of my knowledge last year was the first time this organization had ever tackled neuropsychiatric problems in a panel form and, in fact, in practically any form. We realized at that time that we were just opening a door in this complex subject. It has many ramifications and I am sure it is going to take us many sessions to get very far along the road.

Meanwhile, with our group today we will become much better oriented. I remember Dr. Winston pointing out last year that railroads will get bids and spend weeks, days or months investigating equipment that costs fifty, a hundred, \$150,000, but when you consider the cost, no matter how you count it, of a valuable employee, are we spending enough time in evaluating our applicants?

Without further from your moderator, I will ask Dr. Stockwell to open the program and give us a little of the railroad doctors' approach to the complex subject.

Dr. Stockwell.

DR. STOCKWELL: Thank you, Dr. Skinner.

Gentlemen, I hate to waste the time of this valuable panel speaking, of course, as a general surgeon, but I have been asked to present the railroad physicians' point of view.

It is interesting and challenging to sit on a panel with such distinguished company to discuss a subject that I know so very little about. When asked by our Chairman, Dr. Ernest Olson, to participate in this discussion, he told me that my function was to present, if possible, the practical viewpoint of the railroad chief medical officer in the handling of these perplexing situations.

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In presenting the industrial physician's viewpoint, I would like to recommend for all of you the textbook entitled "Occupational Diseases and Industrial Medicine" which was published in 1960 by the W. B. Saunders Company and written by Dr. Rutherford T. Johnson, Consultant, Industrial Medicine Clinic, Professor of Preventive Medicine and Public Health, and Clinical Professor at the University of California, Los Angeles; and Dr. Seward E. Miller, Director of the Institute of Industrial Health, Professor of Medicine, Medical School, Professor of Industrial Health, School of Public Health, at the University of Michigan, Ann Arbor, Michigan. Specifically, Chapter 5 in this text, entitled "Man's Adaptation to Industrial Life," is pertinent to our problem. It is pointed out that in our rapid evolution from a strictly agrarian life to our present highly mechanized life it has placed tremendous stress upon all individuals. Thus "An increasing number of people need help in achieving a satisfactory adjustment."

JAPA
K

It is suggested that emotional disturbances are responsible for about one-third of all adult sickness and absence from work with a tremendous loss of productivity.

JERSI
F.

KANSA,
G.

The immature individual presents a real problem for the railway industry. It is suggested that the first job may be the first contact with reality for many young adults. These people who may be classed as immature and inadequately adjusted individuals, appear normal on the street or in a crowd, and frequently in the examination room. Their identification is not easy and handling after identification is even more difficult.

LAKE
M.

These people lack self-discipline and are definitely accident prone, with high absenteeism rates.

It is stated, "They are the ten per cent that take 90 per cent of the supervisor's time."

MISSO
K

NATI
A.

They are constitutionally inadequate and not only are they unable to perform their duties properly, but they are very quick to blame their employer for this deficiency. It is apparent that this type of individual would be very prone to seek the advice of an attorney under the provisions of the Federal Employers Liability Act.

LE
NEW
G.

It has been suggested that most management groups should accept the responsibility of employing some of these inadequate individuals and training them to be productive workers. I suggest that the railway industry is in a little different situation because of its responsibility to the public.

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The next question is how can they be eliminated from the railway industry? It is my opinion that the experienced examiner who re-

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