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WHAT BUSINESS LOOKS LIKE NOW

THE TRUTH ABOUT SMOKING AND CANCER

WHAT IS KNOWN AND UNKNOWN

**Interview with Dr. John R. Heller,
Director, National Cancer Institute**

INTERVIEW

with Dr. John R. Heller, Director,
National Cancer Institute, U. S. Public Health Service

THE TRUTH ABOUT SMOKING AND CANCER

WHAT IS KNOWN AND UNKNOWN

Millions of Americans continue to smoke—even though many medical authorities agree that a heavy smoker of cigarettes stands 1 chance in 10 of dying of lung cancer.

What are the facts about the relationship between smoking and lung cancer? Are cigarettes more suspect than cigars and pipes?

Do doctors recommend giving up smoking? What about smoking in moderation?

To get the truth about these and other questions on this subject, "U. S. News & World Report" interviewed in its conference room a leading health authority.

Dr. John R. Heller, director of the National Cancer Institute, of the U. S. Public Health Service, tells here what physicians in this and other countries have learned about smoking and the perils of lung cancer.

Q Dr. Heller, is cancer among smokers a serious problem?

A Well, let's put it this way: The problem first came to the attention of the medical profession when it was found that we had an increasing number of people who were dying of lung cancer. It was found that many of those dying from lung cancer were also heavy and prolonged smokers—cigarette smokers.

We don't know why people get lung cancer. We do know that men get lung cancer to a much greater extent than women.

Q If smoking is the cause, why doesn't it show up in women?

A It is showing up in women. There are several reasons, perhaps, why it is more prevalent in men. There is a sex difference, certainly. Men have a greater risk of lung cancer than do women, whether they smoke or not. That's first. Probably more men than women smoke, although we're speaking of proportional figures here. Men have been smoking longer than women, as a rule—for greater lengths of time. Therefore, our data are more complete on men.

However, data which have been reported recently indicate that, as one adjusts the length of time of smoking, of ages and what not, the death rate from lung cancer in women is beginning to come closer to that of men.

Q Does every heavy smoker stand a chance of getting lung cancer?

A He stands a chance.

Q Is that chance very slight?

A It's reported from the data in this country that, if one does not smoke, his chances are 1 in 275 of acquiring lung cancer. If one is a heavy cigarette smoker—two packages of cigarettes or more a day—his chances of dying from lung cancer are 1 in 10.

Q How many cases of lung cancer are there in this country in a year?

A Of reported lung cancer, there are about 25,000 deaths a year.

Q Out of how many deaths from all causes?

A The figure is about 1.6 million, I believe. Lung cancer is not a great factor but, when added up, year after year, the chances of one dying from this—if he is a man, if he is above 45, if he is a heavy smoker—his chances of dying from that particular condition are almost as good as his chances of being hit by an automobile.

Q This person you just described is 1 in 10 of these?

A His chances of acquiring lung cancer are 1 in 10.

Q Is lung cancer always fatal?

A Almost invariably fatal, unless found very early. The rate of survivors from lung cancer is less than 5 per cent. In other words, of all those who were diagnosed and sur-

John Roderick Heller is recognized as one of the foremost authorities in the U. S. on the subject of cancer. At 52, Dr. Heller has been director of the National Cancer Institute, financed by the Government, for nine years. He directs research into causes of cancer and methods of controlling it.

Dr. Heller was educated as a medical scientist at Clemson College and Emory University School of Medicine, receiving his M.D. degree in 1929. He is a member of the scientific advisory board of Sloan-Kettering Institute for Cancer Research.

► "We don't know why people get lung cancer"

► "Chances of dying from lung cancer are almost as good as being hit by an auto"

► "Heavy cigarette smoking is not the only factor in lung cancer"

► Data "indicate" moderate smoker is less of a risk than a heavy smoker



gery undertaken, less than 5 per cent survived for a period of 5 years.

Q If only 25,000 people die yearly of lung cancer, how can one's chances be 1 in 10 if he is a heavy smoker? Aren't there enough heavy smokers so that 1 in 10 would produce far more than 25,000?

A His chances of dying of lung cancer from the time he starts smoking until he dies are 1 in 10.

Q How does that compare with deaths from all cancer?

A There are about 250,000 deaths a year in this country from all cancer. It's about one tenth of the cancer deaths.

Q So you could escape lung cancer and still have nine other chances of dying from some other form of cancer?

A Cancers cause 13 per cent of all the deaths in this country.

Q Then lung cancer causes about 1 per cent?

A Yes, slightly more than 1 per cent of all the deaths.

Q Is the proportion of deaths caused by all types of cancer increasing and the proportion of deaths caused by lung cancer increasing?

A Yes. In other words, as we are surviving typhoid and gastroenteritis, malaria and so forth, we are living longer. We must die of something. We're most likely to die of heart disease—cardiovascular disease. But if we don't die of that, the next chance is cancer, and the next, I believe, is accidents.

The chances of any particular individual dying of any given disease—unless he has been exposed to an infectious disease or something on that order—can be mathematically computed, and it doesn't mean that he needs to worry about it particularly. A person who is a heavy smoker looks at these figures and says, "Well, I enjoy smoking. My chances of dying of lung cancer are pretty remote. I'm not going to worry about it." And maybe he goes on and lives to the age of 85 or 90 and dies of heart disease.

Q What would be the advice of the Public Health Service?

A The job of the Public Health Service is to present the facts, its best judgment or interpretation of the facts, to the health professions and the public generally. We don't, of course, generally act as a physician in giving medical care or advice to individual patients.

Q Have you noticed that the British Government has issued a warning about the dangers of lung cancer from cigarettes?

A Yes, we have read that in the newspapers.

Q What is the U. S. Government's position on that?

A You will recall that on July 12 the Public Health

(Continued on next page)



... Doctors are "not convinced" cigarette paper is to blame

Service issued a statement to the effect that there is increasing and consistent evidence that heavy and prolonged cigarette smoking is one of the causative factors in lung cancer.

Q Why do you put your finger right on smoking as the cause of lung cancer?

A I wouldn't say we put our finger "right on smoking." We simply say the signs are pointing increasingly to smoking as one of the factors involved in lung cancer. It's one of the common denominators we find around the world. It's been the British experience, Scandinavian experience, Austrian experience—the experience of anybody, I think, whose evidence we can rely upon. On the other hand, we know that heavy cigarette smoking certainly is not the only factor in lung cancer. Nonsmokers get lung cancer, too.

Q Were tests carried out in all those other countries?

A Yes.

Q What you are saying now is a new viewpoint for the Public Health Service, isn't it?

A Well, it brings our position up to date.

Q Is it because of some recent evaluation you've received?

A We believe that the increasing and consistent material which has come to our attention warrants this viewpoint.

Q Is that based on your own studies, as well as on others?

A The studies throughout the world that we have access to.

Q How recent is this conclusion? Six months ago would you have made the same statement?

A Well, we didn't. It has been arrived at gradually.

Q How does the incidence of lung cancer in the United States compare with the incidence in some of these other countries that made studies?

A The rate has been increasing in this country. It is not as great as the incidence of lung cancer in Great Britain, in Austria, or in Scandinavia.

Q Do those people smoke more than we do?

A They do in Austria, I'm told. In Great Britain it's very difficult because their smoking habits are slightly different. Their total cigarette consumption is less than ours, but they smoke a cigarette right down to the bare nub in Britain. They smoke different types of cigarettes in other countries.

Q But there is some common factor in there?

A There's some common factor, apparently.

ROLE OF TAR IN SMOKE—

Q Haven't there been some reports that substances in the tobacco smoke had been isolated which are known to be cancer-causing chemicals?

A Oh, yes, some tars.

Q Specific things in the tars themselves?

A Yes, there have been some investigators who contend that it is substances called aromatic amines but, as far as my knowledge goes, the exact chemical structure or the exact material at which one can point a finger with suspicion and say it is this and nothing else has not been identified.

Q Has the paper been suspect?

A Yes, the cigarette papers have been suspect. Many investigators have contended that it is something in the burned paper. Others contend that it is arsenic impregnated in the

paper; some that it is a substance called 3, 4-benzpyrene, which is known to be cancerigenic to animals. But I would sum it up by saying that the medical group involved and interested in this problem is not convinced that the agent is in the paper.

Q But they do feel that there is a criminal in tobacco?

A They do feel that somewhere in heavy smoking there is one of the causative factors.

Q They feel there is a relationship between smoking and lung cancer?

A Yes.

Q Then why is there a distinction made between cigarettes, apparently, and cigars and pipe smoking?

A It would appear—we know from our epidemiological data—that people who smoke cigarettes excessively are at a much greater risk of acquiring lung cancer than those who smoke pipes and cigars.

CIGARETTES VS. CIGARS—

Q Why is there that difference? Why are cigarettes more risky than cigars—if you smoke a lot of cigars?

A There have been two or three views expressed. One is that, first of all, cigarettes have something in them, either inherent in the manufacture, of the glycerin, of the arsenic originally that was said to be in the paper, or arsenic that was incorporated in the spray used on the tobacco, which ought to obtain the same as in the cigars.

There are those who believe there are chemical changes resulting from the higher burning point in cigarettes than in a cigar. For example, it has been stated that the critical temperature is about 800 degrees Fahrenheit at the end of a cigarette, and in anything less than that probably one has much less risk of acquiring cancer.

It may be a function of the packing of the tobacco in the cigarettes as contrasted with cigars and pipes. It may be the curing of the tobacco—the incorporation of certain chemicals involved in the processing, perhaps.

Q Could it be that cigarette smokers inhale, whereas many pipe and cigar smokers do not inhale?

A That has been advanced as certainly a cause of difference. It sounds very logical to me.

Q But then, at the same time, cancer of the mouth and of the throat is higher in cigarette smokers. Cigar smokers, I should think, would have the same danger, would they not?

A One might think so.

Q Doctor, in this relationship between cigarettes and lung cancer, is there any difference between filter cigarettes and nonfilter cigarettes?

A I don't know whether you have kept up with the current discussion concerning the contents of the several kinds of cigarettes—king size and regular size, tar content and nicotine content, etc. It seems to be factually correct that the presence of filters cuts down only slightly the amount of tars in cigarettes.

Originally, as I understand it, the filter really filtered out a lot of the tars, but it filtered out the taste of the cigarette as well. Then the manufacturers, attempting to market their product, very understandably wanted to retain the best features of their filter, I suppose, and at the same time allow taste, too, and presumably loosened the cellulose acetate of which the filter is composed, or otherwise made it less effective. Or

SMOKING AND LUNG CANCER



WHAT IS KNOWN ...

- Death rate from lung cancer is rising.
- More men than women get lung cancer.
- Lung cancer is fatal in more than 95 per cent of all cases.
- The death rate from lung cancer, studies show, is 64 times greater among heavy smokers—2 packs or more a day—than among nonsmokers.*
- Cigarette smokers, according to statistics, are in more danger than cigar or pipe smokers.*
- A nonsmoker, by the latest figures, has 1 chance in 275 of getting lung cancer; a heavy cigarette smoker, 1 chance in 10.*
- A person who stops smoking, researchers say, decreases the risk of lung cancer.*

*Latest findings, American Cancer Society.

WHAT IS NOT KNOWN ...

- Why people get lung cancer.
- The exact relationship between smoking and lung cancer.
- A sure way to detect lung cancer early and cure it.
- Why cigarettes supposedly are more dangerous than cigars and pipes.
- Whether inhaling is a factor in causing lung cancer.
- If some people have a "tendency" to get cancer.
- Whether a virus is involved in cancer.
- If the "tar" in tobacco is the "criminal" in causing lung cancer.

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maybe they have changed the type of tobacco they use so that more taste comes through.

Anything that will cut down the amount of smoke that comes in will automatically cut down the amount of tar. Filters help to some extent, but not nearly as much as some people might think.

Q Can a filter be designed that would help?

A I think it can, and the consensus among those who are in a position to know, with whom I have talked, believe that it is possible to design a filter that will cut down the tar appreciably.

Q Would that take out the taste as well?

A So far, the experience has been that it probably would take out the taste, but there are those who feel that it is possible, with the ingenuity that can be brought to bear, to retain a good bit of the taste and, at the same time, effectively filter out the smoke and, therefore, the tars.

Q What about the filters that are made to put in cigarette holders? Are they more effective than those built into the cigarettes themselves?

A I really don't know. Again, when we go back to the

fundamental concept that if this filter—or such as you mentioned, the kind that is not built in—would diminish the amount of smoke, or strain out the amount of smoke that enters the lungs, certainly one could see that it would be a useful and effective tool in preventing the amount of tars that enter.

Q Is nicotine itself dangerous?

A As far as the production of lung cancer is concerned, it doesn't seem to have any bearing.

Q Is nicotine the thing that a person seeks in a cigarette—the effects of nicotine?

A No, apparently not. Apparently it's the tars that give him that sense of satisfaction. I'm using tars in the broad sense. They seem to be the important constituent in the satisfaction to the user.

Q How is that determined? How can you tell such a thing?

A For one thing, when you use filters, when you remove the tar, the cigarette is said to be tasteless. People simply will not stand for it. It doesn't give them satisfaction.

(Continued on next page)

... "Several of my associates stopped smoking; some have not"

Q And when you remove the nicotine there isn't the same reaction?

A Not the same reaction.

Q Does nicotine stunt your growth the way we used to hear?

A I've always heard that, but I don't know any reason why it would stunt one's growth.

Q If you had a perfect filter you really wouldn't be smoking, would you?

A Taken to its ultimate conclusion, that's correct. With a perfect filter no smoke would get through—just hot air.

Q Doctor, are you a smoker?

A I am not. I have never smoked.

Q How about some of the people you are associated with, people who have the same knowledge of these matters as you? Do you notice that a good many of those people have stopped smoking?

A Yes. Several of my associates in the National Cancer Institute in the study of this problem stopped smoking as long as 2 to 2½ years ago. Some have not stopped.

Q Would you recommend, Doctor, that any smoker should stop smoking?

A I would say this: I believe the weight of the evidence, from the data we have at hand, is that a man who is a heavy and prolonged smoker is at a much greater risk of acquiring lung cancer than a man who does not smoke.

Nobody has ever contended that smoking is good for one from a health point of view. But, if a person gets pleasure out of it and desires to smoke, knowing the facts, then, in the final analysis that's his determination.

Q Would you say, "Smoke what you like, but do it in moderation"?

A If a patient said to me, "Doctor, I just can't stop smoking," I'd say, "Well, the data that we have at hand indicate that a moderate smoker is less of a risk than a heavy smoker, and that a man who smokes a pipe or cigar is less of a risk than a cigarette smoker."

WHAT IS "EXCESSIVE"—

Q What do you regard as excessive?

A Two packs a day or more.

Q What do you regard as moderate?

A Certainly less than a pack a day.

Q What if you smoke moderately?

A You have less risk of acquiring lung cancer.

Q Is there any risk?

A There is still a risk. One may acquire lung cancer even though one doesn't smoke, I hasten to add. However, the risk of acquiring lung cancer begins to climb appreciably as one smokes more—more cigarettes, particularly—and to some extent with pipes and cigars, but much, much less.

Q But your advice would be moderation, certainly?

A That would be my personal advice as a physician.

Q Or would you advise complete abstinence?

A If an individual is up to it, I think as a physician I would say to him if he was sufficiently afraid—if he was in the age range and was sufficiently worried about lung cancer—I'd say, "If you can quit, quit."

Q Would you say, "Switch to a pipe"?

A Switch to a pipe or a cigar.

Q Is there general agreement on that?

A Among many students of the problem, yes, although naturally there are also some differences of opinion.

Q Is there any sure way that a person can detect lung cancer early enough to be almost sure of curing it?

A No.

Q You can't tell a person that he can go ahead and smoke and rely on a certain regimen to protect him—

A Not to my knowledge. The only dependence we've got is X ray and, of course, the introduction of a bronchoscope into the bronchi to take out material for examination. But this is an impractical procedure from a screening viewpoint. Or taking sputum and examining it under the microscope. Frequently, by the time that one finds cancer cells in the sputum, the lesion may have progressed to the point that it's too late for surgery to be effective.

Q Is surgery effective if the lung cancer is detected soon enough?

A Yes, it is, in the hands of a good surgeon.

Q Does this surgery remove the cancer?

A It removes the lung, usually.

Q Is early cancer painful? Can you rely on a pain in the chest?

A No, as a rule it would be painless. It could be that a ruptured blood vessel possibly would result in hemorrhage, or cancer adjoining a large nerve might create pressure that would cause the individual to cough frequently, or some other such warning. Usually, the lung cancer would be so small it would be unnoticeable. Unhappily, there's no easy way to pick it up early enough for it to be really classed as a good risk. This is an area in which prevention is important.

PREVENTING CANCER—

Q Prevention calls for what?

A Prevention calls for staying away from those things that we have reason to believe are cancer-causing or tied up with the things that cause cancer. For example, we could help protect people in the chromate industry by keeping them away from the chromium material or by having them wear masks. People who are out in the sun a great deal—and therefore much more likely to get skin cancer—should cover their heads, bodies; or, if it's arsenic with which they come in contact, we should protect them by suitable clothing or keep arsenic out of the industrial process—or whatever it may be. Those are preventive measures.

In this instance there seems to be reason to believe that cigarette smoking is increasingly important in the scheme of things. Then, to prevent lung cancer, you simply say, "O.K., let's tell the people what we know or believe so they can stop smoking excessively if they want to in the light of the facts." Or you can take out the thing in the cigarette that's causing it, or whatever preventive measures might be appropriate.

Q They have no idea yet just what they could take out—what the real cause is, have they?

A Some investigators believe it's the tars in the smoke. We refer to "tars" simply as the inconclusive term for all the "gunk" that's in cigarette smoke. They may be polycyclic hydrocarbons, chemically—a host of different chemicals.

Q At what age does lung cancer occur?

... "73 per cent of men and 33 per cent of women smoke"

A Usually above the age of 50. However, there have been cases at younger ages than that.

Q One thing that the ordinary person begins to think about in connection with what you have said is that if you discover it early you might be able to stop it. Are there any recognizable symptoms? Is there any advice you can give? For example: "If you get a persistent cough, get an X ray," or any other advice you can give to the average person on how to detect this thing?

A The best advice that can be given to anybody—about lung cancer, or anything else for that matter, but particularly in detecting lung cancer early—is to have an examination by a physician, at least once a year and preferably every six months when you are above 45.

Q Should this include an X ray, like the tuberculosis X-ray examination?

A It might, but that would be up to the physician.

HOW X RAYS CAN HELP—

Q Can signs of cancer be detected in a T. B. X ray?

A Yes, there have been many instances in which physicians have been searching for tuberculosis and have found the so-called "coin" lesion or other lesions of lung cancer.

Q As a matter of practice, in these large-scale T. B. X-ray programs, do they very often pick up signs of lung cancer?

A It is not a very important finding numerically. They find a few in these huge programs of 200,000 or 300,000 examinations, but as a cancer case-finding device the routine screening of chests is not economically feasible.

If you are going to examine individuals for something else, well and good. But to set out to examine thousands and thousands of persons by X ray just for lung cancer is not economically desirable.

Q What I was getting at was this: If a person gets his chest X-rayed every six months on one of these T. B. X-ray programs, will that in itself take care of early detection of lung cancer if he should ever get it?

A No, it would indicate pretty well to the examining physician that the chest is probably normal, but by no means does it completely rule out the presence of lung cancer.

Q What else should an individual who is past 45 do for his own protection against lung cancer?

A He should report to his physician. The physician probably will ask him questions which would be related to the presence of cough, weakness, a lot of other signs and symptoms which are of significance to the physician in the screening of a possible chest condition, whether it be cancer, tuberculosis, or what-have-you.

Q And what about all those roentgens from X ray? Don't they give you cancer?

A With these small machines—the little 70-millimeter or the 35-millimeter photofluorographic examination—you probably wouldn't get over a tenth of a roentgen at a time—not enough to make one uneasy about it becoming a cause of cancer.

Q Is that the sort of equipment that is in most of these T. B. X-ray trailers?

A Yes.

Q Have you given any consideration to writing off this generation of people who are now smoking, and directing advice against excessive smoking to the younger generation and people who have not yet started smoking?

A There have been a number of ideas expressed, as you can probably appreciate. There are those who feel that a proper course is, first of all, to put the facts from an authoritative source before the public, to advise moderation for those who are now smoking. If they wish to continue to smoke excessively, that's their business. Advise moderation, but advise young people of the risk and suggest that they do not start smoking.

Q Smoking cigarettes, or any thing?

A Smoking any way, but particularly cigarettes.

Q Is there any reason to believe that a heavy smoker improves his own chances by stopping smoking?

A Yes, there are data to indicate that one who stops smoking as long as a year, for example, improves his chances. Let me put it this way: He decreases the risk of acquiring lung cancer if he stops smoking.

Q Take a man who has been a heavy smoker for 25 years. If he stops smoking, wouldn't he be beyond redemption by that time?

A I'm not sure at what age the damage is irrevocable. The data that Dr. E. Cuyler Hammond of the American Cancer Society has produced would suggest that, if an individual stops smoking, his longevity increases generally; he's not so likely to die regardless of how long he has been smoking. There seems to be a correlation between excessive smoking and earlier death. The death rate in individuals who are heavy smokers is excessive in comparison with nonsmokers. Now, I personally would like to see that worked out much more precisely. I don't know what it means quite yet in measurable terms.

It may well be that the sort of person who is impelled to smoke heavily is the sort who has the body build or the other characteristics that lead him to take unnecessary risks. Maybe he is the sort who is geared up at a fast rate and is much more likely to have coronary heart disease, or maybe he is much more likely to acquire diabetes—he may be a heavy eater. All of these things have to be woven into the blanket we're talking about.

Q Do people who live in cities get lung cancer more often than people who don't?

A They seem to. The people in cities apparently smoke a little more heavily than do people in the country.

SHIFT IN SMOKING HABITS—

Q Smoking has been going on quite a time. Do you think there's any chance of a change?

A Possibly, if one goes by the experience that I've had in my own immediate circle of friends. A third to half of them have stopped smoking, but that is an unusual sample. Among the young people with whom I come into contact, less than half of them are taking up smoking.

Now, I don't know whether that is generally true throughout the country. I think the figures show that approximately 73 per cent of all men smoke and about 33 per cent of women smoke.

Q And yet the over-all cigarette consumption is on the increase, isn't it?

A It is on the increase, but there are almost 3 million more of us each year.

Q What can you tell us of the research being conducted by the Public Health Service on lung cancer and smoking?

(Continued on next page)

A We have undertaken research both in the laboratory and in the field. Statistical data usually result from field research. And, while the research we have been undertaking hasn't been the spectacular, earth-stirring sort, nevertheless it has been designed to get some of the answers we are anxious to have.

Q Has that research been going on some time?

A Yes, the study with the veterans' group with which you may be familiar has been going since 1953. It was started as a co-operative project with the Veterans' Administration and is designed to find out what happens to men in a certain age group—this particular group happened to be veterans of World War I—on whom we obtained smoking histories. And since they have National Service Life Insurance, their deaths come to the attention of the veterans' facility. Many of them, of course, die in veterans' hospitals, which have accurate records and data, so we know what happens to them. And they die at an almost predictable rate.

In this instance we started out with 290,000, I believe it was, and we have been able to get smoking histories and follow-up data on something over 260,000. That's the largest sample in existence, I believe.

THE AGE GROUP TESTED—

Q Is your group more representative than the American Cancer Society group?

A Perhaps. It must be remembered that these are all men in the age group from 55 upward. We have some of the same ones that the American Cancer Society has. I would say that, since we have more and they are veterans, it probably might be considered to be a more representative group.

Q Well, yours covers the entire nation, doesn't it?

A Yes.

Q There has been some criticism of the Cancer Society group because they were, in effect, selected from a particular economic level. Would that influence the statistical results?

A I don't think it would influence it very much. It might. I'm not a statistician, but I think the Cancer Society has a sufficiently large sample well enough based geographically to refute any undue criticism of the statistical sample. I do believe that the study of the 290,000 which we inaugurated in 1953 may be a better cross section. First of all, there are more of them, and they were soldiers and sailors who went back to all parts of the country and lived under all sorts of conditions. I think one of the principal advantages will be that we will have better autopsy records of these individuals.

Q Have you had any results yet?

A No results that can be indicated as anything more than a sample to show us which way things are going. So far, preliminary data roughly parallel those on which the Cancer Society has already reported. However, these are small samples so far and we are involved in coding all of the records. It takes a good while to get a record back from the veterans' hospital or the place at which death occurred. These records go first to the veterans' facility, then to us for coding and recording. We haven't been attempting urgently to process these data and get them out because we would rather do a good, thorough job and study them completely.

Q Doctor, have you set a time for this study? Will it go on for a given period of years?

(Continued on page 64)

WHAT THE HEALTH SERVICE SAYS ABOUT SMOKING

Following is full text of a statement issued July 12, 1957, by Surgeon General Leroy E. Burney of the Public Health Service in Washington, D.C.:

The Public Health Service is, of course, concerned with broad factors which substantially affect the health of the American people. The Service also has a responsibility to bring health facts to the attention of the health professions and the public.

In June, 1956, units of the Public Health Service joined with two private voluntary health organizations to establish a scientific study group to appraise the available data on smoking and health. We have now reviewed the report of this study group and other recent data, including the report of Dr. E. C. Hammond and Dr. Daniel Horn on June 5 to the American Medical Association in New York.

In the light of these studies, it is clear that there is an increasing and consistent body of evidence that excessive cigarette smoking is one of the causative factors in lung cancer.

The study group, appraising 18 independent studies, reported that lung cancer occurs much more frequently among cigarette smokers than among nonsmokers, and there is a direct relationship between the incidence of lung cancer and the amount smoked. This finding was



—Harris & Ewing

DR. LEROY BURNEY is the U. S. Surgeon General. In the statement above, he warns the public of possible danger in "excessive cigarette smoking."



—United Press

DR. C. C. LITTLE is chairman of the tobacco industry's Scientific Advisory Board. He says, in the statement at right, that there is "no new evidence" on lung cancer.

reinforced by the more recent report to the AMA by Drs. Hammond and Horn.

Many independent studies thus have confirmed beyond reasonable doubt that there is a high degree of statistical association between lung cancer and heavy and prolonged cigarette smoking.

Such evidence, of course, is largely epidemiological in nature. It should be noted, however, that many important public-health advances in the past have been developed upon the basis of statistical or epidemiological information. The study group also reported that, in laboratory studies on animals, at least five independent investigators have produced malignancies by tobacco-smoke condensates. It also reported that biological changes similar to those which take place in the genesis of cancer have been observed in the lungs of heavy smokers. Thus, some laboratory and biological data provide contributory evidence to support the concept that excessive smoking is one of the causative factors in the increasing incidence of lung cancer.

At the same time, it is clear that heavy and prolonged cigarette smoking is not the only cause of lung cancer. Lung cancer occurs among nonsmokers, and the incidence of lung cancer among various population groups does not always coincide with the amount of cigarette smoking.

The precise nature of the factors in heavy and prolonged cigarette smoking which can cause lung cancer is not known. The Public Health Service supports the recommendation of the study group that more research is needed

to identify, isolate and try to eliminate the factors in excessive cigarette smoking which can cause cancer.

The Service also supports the recommendation that more research is needed into the role of air pollution and other factors which may also be causes of lung cancer in man.

To help disseminate the facts, the Public Health Service is sending copies of this statement, the study-group report and the report of Drs. Hammond and Horn to State health officers and to the American Medical Association with the request that they consider distributing copies to local health officers, medical societies and other health groups.

While there are naturally differences of opinion in interpreting the data on lung cancer and cigarette smoking, the Public Health Service feels the weight of the evidence is increasingly pointing in one direction: that excessive smoking is one of the causative factors in lung cancer.

The Service notes that the study group found that more study is needed to determine the meaning and significance of any statistical association between smoking and heart disease. The study group reported there is no convincing biological or clinical evidence to date to indicate that smoking per se is one of the causative factors in heart disease. Although the report by Drs. Hammond and Horn has since provided additional data on this subject, the Service feels that more statistical and biological data is needed to establish a definite position on this matter.

TOBACCO-INDUSTRY REPLY

Following is full text of a statement by Dr. Clarence Cook Little, chairman of the Scientific Advisory Board to the Tobacco Industry Research Committee, issued in Washington, D. C., July 12, 1957:

The statement issued today by the Surgeon General adds nothing new to what has been known about the cause of lung cancer. It reflects the opinions of some statisticians and the relatively few experimental scientists who have actively charged that cigarette smoking is a cause of lung cancer.

No new evidence has been produced since the Scientific Advisory Board of the Tobacco Industry Research Committee last stated its position on this question on May 1, 1957. At that time, I said that, although anyone has the right to state an opinion on cancer causation, "the Scientific Advisory Board questions the existence of sufficient definitive evidence to establish a simple cause-and-effect explanation of the complex problem of lung cancer."

That is most definitely our position today.

The Surgeon General's own statement makes clear that "lung cancer occurs among nonsmokers and the incidence of lung cancer among various population groups does not always coincide with the amount of cigarette smoking."

The Public Health Service also supports the recommendation that more research is needed into the role of air pollution and other factors.

For the past three years, the Scientific Advisory Board has had the matter of tobacco use and human health

under continuous review and consideration, both in the Board's regular meetings and in individual endeavors. We have had the responsibility of guiding a research program through which the Tobacco Industry Research Committee already has provided 2.2 million dollars for grants to independent scientists working in the fields of cancer and other challengers of human survival.

This research, thus far, has produced no evidence that cigarette smoking or other tobacco use contributes to the origin of lung cancer.

Many experiments on inhalation of cigarette smoke in animals have failed to produce a single cancer similar to the most prevalent type of lung cancer in humans. This and other facts show the need for continued unbiased research into the causes of cancer and other diseases.

Statisticians have so far failed to consider adequately many variables in human habits, environments and constitution, such as biological susceptibility to cancer, the effects of previous lung disease, hormonal influences and many other factors. It should be remembered that statistical association does not prove cause and effect.

In advising and educating the public, the Scientific Advisory Board believes that one should be as cautious in accepting a claim that a cause has been found for cancer as they have found it wise to be in the past in accepting a claim of a cure for cancer.

The Scientific Advisory Board intends to continue expansion of its program of making grants-in-aid to qualified scientists who propose to explore those areas of human health where the basic research problems appear most compelling and the prospect of results most promising.

... "Of course, we don't know what causes cancer"

A We propose that the study should go on as long as we can continue to get these records back, which means, theoretically, as long as any of these original people are alive.

Q Let me put it another way: Do you have any estimate of how long it will be before you do have some results from it that you feel confident enough of to report?

A There has been a tentative timetable set. By next spring we hope to have some preliminary data.

Q Do you feel that you have enough results so that you are sure it's going to run along the lines of the Cancer Society study?

A No, I can't say that. Merely, when you dip into the stream of information coming in, the samples tend to indicate that it was something in the same order of magnitude of happenings that the Cancer Society studied.

AIM IN CANCER RESEARCH—

Q What about your research studies—actual scientific studies—on the subject? Have they been carried forward?

A We have not undertaken some of the same sorts of studies that the late Dr. Evarts Graham, Dr. Ernest L. Wynder and others have undertaken, although we have supported—and are still supporting—many projects of this kind under our grants program. However, many years ago some of our investigators started studies subjecting mice to smoke. But the results were somewhat inconclusive. There is not much point in some of our scientists attempting to duplicate unnecessarily something that has been pretty well done by someone else. We feel that our skills and resources probably can best be utilized by studies in the field, studies someone else would find very difficult to undertake.

Some of our scientists are working in the laboratory attempting to find out some of the morphologic changes that occur in the lung structure when exposed to things like tobacco smoke and irritants of other kinds.

Q Have you found anything?

A Nothing of any spectacular nature as yet. You are probably aware of the work that Drs. Graham and Wynder and others have done in painting the condensates of tobacco tar on the skin of animals over a continued period. They have found that skin cancers will occur in a certain percentage of these mice and rabbits.

Q How high a percentage?

A They'll go as high, I believe, as about 40 per cent.

Q Aren't they using mice that are especially susceptible to cancer, and when you use ordinary mice you don't get the same results?

A That is true. There have been differences observed, utilizing the same techniques that Drs. Wynder and Graham set forth, but at least five investigators in this country have duplicated the Wynder and Graham results, using their same techniques.

Q If you use mice that are especially susceptible, how can you jump to any conclusions that smoke is causing the cancer?

A Controls are used.

Q Just because it is caused on the back of a mouse doesn't mean that the smoke would cause it in a human lung, does it?

A No, you are quite right. That's been one of the criticisms, of course, that mice aren't men, and certainly one cannot extrapolate from mice to men. However, there has been more or less of a truism, or a rule of thumb, set forth that any compound or any material which can definitely be incriminated as causing cancer in an animal is looked at with considerable suspicion as a possible cancerogenic agent in humans. In other words, it is suspect until we can prove unequivocally that it does not cause cancer in humans.

Q Do you suspect that there is in individuals a tendency toward getting cancer?

A Probably there is something in that premise. Why are some individuals cancer-prone and others not? First of all, of course, we don't know what causes cancer. We don't know whether it is a combination of things; whether the particular combination of atmospheric pollution, cigarette smoking, a person's sex—all of these things happen to come together and one triggers the others; whether certain individuals are born with cancer cells quiescent and something in time triggers them. We just don't know these things.

There are those who are convinced that individuals with certain body builds are much more likely to acquire cancer. We know, for instance, that an obese person has a slightly greater risk of acquiring any sort of cancer than a man who isn't quite so obese.

Q What if you knew? It wouldn't do you any good, would it?

A You could be examined every three or six months.

Q Wouldn't you create a nation of people with phobias?

A One certainly might be confronted with that, but, if it is approached in a common-sense fashion, I don't think that necessarily we would have people with phobias. People who acquire phobias—cancer phobia, whatever the phobia may be—are the sort of people who have got to be afraid of something anyway.

Q Are you getting closer to finding the causes of cancer?

A I think we are. I don't know whether it is right around the corner or many corners away from us.

THEORY ABOUT VIRUSES—

Q Is it possible that a virus or organism might be a factor?

A We do not know whether viruses can cause human cancer. We do know that viruses can cause certain cancers in animals—leukemias and certain other tumors. There are many investigators in the cancer field who are convinced that many human cancers have a viral origin. That thesis has not been demonstrated conclusively, and whether or not it is true is simply in the future.

Q Is there anything to indicate any connection between alcohol and cancer?

A Not enough for one to speak with any degree of assurance. The Roswell Park group in New York noticed some correlation between alcohol and the occurrence of cancer of the urinary bladder. There have been some studies on alcohol in the occurrence of oral cancer, but not enough that anyone feels confident about it.

Q Doctor, you say that you don't know what the cause of

... "We don't know what happens" in a cancer cell

cancer is, but you seem to imply at the same time that you feel almost 100 per cent sure that there is some type of cause-and-effect relationship between excessive smoking and lung cancer. You haven't found out just what it is today, but someday you'll find it and it will be there in that relationship, is that right?

A When we speak of a "cause" of cancer, we don't know what happens in that cell to cause it to cease being a normal cell and become an abnormal, wild, berserk organism. What happens in there chemically, we just don't know. Whether it's something that normally resides in that cell or whether it's something that comes in from the outside and changes the chemical constituents in the cell or whether it's a combination of these things, we don't know. All these things we have to find out.

Q You don't know when the breakthrough will come?

A I don't know when it will come. I believe it will come.

Q Soon?

A I wouldn't stick my neck out that much. I believe it's coming. I think that a lot of good work has been done in many areas and many aspects of cancer research.

Q When you break through, will that cover the range of cancers or just one or two of them?

A No, I suspect that it will be in one site [location in the body] of cancer. It might be in leukemia or in Hodgkin's disease or in lymphosarcoma or in that class of so-called cancers.

For example, there's one very important ray of hope: A rather rare cancer called choriocarcinoma, occurs in the uterus of women who have just given birth to a youngster—only about 300 cases a year occur in this country, so you can see how rare it is. Using a drug called methotrexate, which is an antifolic compound, five cases have been treated at the National Cancer Institute and, to the best of my knowledge, all of them are doing well, even though the cancer had spread. Now, we're not contending that's a cure. I'm merely mentioning it here because of its pertinence. We are hoping for a breakthrough in this particularly rare tumor. If we can cure one human tumor with a chemical compound, that's a hand-hold and we will try to find out how it works and why it works and apply it to others. It's likely that a breakthrough will occur tumor by tumor or site by site.

[END]

A Chemical in Tobacco—Can It Cause Cancer?

What follows is one more phase in the dispute over cigarette smoking and cancer.

A news story by the United Press, distributed on July 15, said:

U. S. Surgeon General Leroy E. Burney said Government scientists have found a chemical agent in cigarette smoke which they suspect may cause lung cancer.

Burney, in an interview with United Press, identified the substance as benzpyrene. He said it is formed when the aromatic oils in tobacco are burned at a high temperature and "cracked" much like crude oil is cracked to make gasoline.

The chief of the Public Health Service emphasized that "no one has definitely isolated the cause of lung cancer." But, he said, researchers believe "excessive and prolonged" exposure to benzpyrene may be it.

Burney said benzpyrene was found in significant amounts only in cigarette smoke because only cigarettes burn at high-enough temperatures—800 to 815 degrees Fahrenheit—to crack the aromatic oils. Pipe tobacco and cigars burn at much lower temperatures, he said.

Dr. Robert C. Hockett, associate scientific director of the Tobacco Industry Research Committee, replied on the same day, July 15, to the statements attributed to Dr. Burney. Excerpts from Dr. Hockett's statement follow:

The question of the presence of benzpyrene in tobacco smoke has been under investigation for a number of years, and it has been widely discounted as a significant

factor in connection with lung cancer by scientists familiar with the work.

There are a number of reasons for this.

Scientists have not actually succeeded in isolating the substance from tobacco smoke. Some feel that they have identified the substance by means of extremely sensitive, indirect measurements as probably present in smoke. Several chemists have not been able to detect benzpyrene in smoke at all, so elusive is this substance.

The general conclusion is that, if benzpyrene is actually present in cigarette smoke, it occurs in such minute quantities it could not even account for such biologic activity as has been reported for tobacco smoke in some experiments on sensitive mouse skin.

* * *

The substance frequently is produced in minute quantities in the burning of any organic compound and is present in varying degrees in city air. Recent reports in England show that the daily intake of benzpyrene from breathing London air is equivalent in total volume to the intake from smoking about 100 cigarettes a day.

After seeing the press reports, the Surgeon General on July 16 issued the following statement:

There are some scientific studies which indicate that benzpyrene has been identified in cigarette tars. There is no evidence to indicate, however, that benzpyrene of itself is present in sufficient quantities in cigarette tars to cause human lung cancer. More research is needed on this question and the effects produced by other chemical agents, as well as temperature gradients and various specific materials in the original tobacco.

WHAT BRITONS ARE TOLD ABOUT LUNG CANCER AND TOBACCO

At the same time that Americans are being told officially of a link between smoking and cancer, the British Government is carrying the same process a step further.

In Britain, posters are being distributed that carry a warning from the Government about the risk involved in cigarettes.

What decided the British Government upon taking this unprecedented step were the findings of a new study on smoking and cancer made by a panel of independent scientists for that country's Medical Research Council.

On these pages is the study that brought official action in Britain.

Following is full text of a report, "Cancer of the Lung—Recent Knowledge of Causative Factors," released in England by the Medical Research Council on June 27, 1957:

In their Annual Report for 1948-50 the Council drew attention to the very great increase that had taken place in the death rate from lung cancer in Britain over the previous 25 years, and they referred to the early results of an investigation into the possible causes of this increase, which had been undertaken by Prof. Bradford Hill and Dr. R. Doll of the Statistical Research Unit.

Since that time the death rate has continued to rise, so that in 1955 it reached a level more than double that recorded only 10 years previously—388 deaths per million persons of all ages in 1955 compared with 188 in 1945. Among males, the disease is now responsible for approximately 1 in 18 of the deaths at all ages, while of those aged 45 to 64 years the proportion is as high as 1 in 9. The corresponding figures for females are 1 in 103 and 1 in 42.

Knowledge of the causation of the disease is still incomplete but, as a result of the great amount of work carried out in the last few years, much light has been thrown upon what now appears to be the principal factor, namely, the smoking of tobacco, particularly in the form of cigarettes.

The final results of the retrospective investigation referred to above were published by Doll and Hill in 1952. In the course of that study very nearly 5,000 hospital patients, including almost 1,500 suffering from lung cancer, were interviewed by highly trained workers.

Analysis of the histories and habits of the patients with various diseases revealed only one striking contrast—the difference in the smoking habits of those with and those without lung cancer.

The proportion of cigarette smokers and heavy smokers was larger in the lung-cancer group than in the "control" group, and the proportion of nonsmokers, light smokers and pipe smokers was smaller. Thus, of the men with lung cancer, 25 per cent reported that they had been smoking an average of 25 grams (nearly an ounce) of tobacco, or more, a day, in cigarettes or pipes; for the male "control" patients the proportion was only 13 per cent. The corresponding figures for women were 11 per cent and 1 per cent.

Many similar investigations have now been reported from this country and elsewhere—from Finland, Germany, Holland,

Norway, Switzerland and the U.S.A. In every case the principal results have been much the same.

Since then, the evidence in this country has been greatly strengthened by the results of a forward-looking inquiry—prospective as opposed to retrospective—reported by Doll and Hill in 1956.

In this study, a questionnaire was sent at the end of 1951 to all members of the medical profession in the United Kingdom—men and women—asking for brief details of their smoking habits. Over 40,000 doctors replied and, on the basis of their answers, were classified into a few broad groups according to the amount of tobacco they smoked, their method of smoking it, and whether they had given up smoking or were, at that time, continuing to smoke.

These groups have now been followed up over the subsequent four and a half years, information being obtained from the Registrars-General and other sources about the deaths that have occurred among them.

Analysis of the data relating to men has shown a marked and steady increase in the mortality from lung cancer as the amount smoked increases. Thus, at ages 35 and over, the death rate per year rose from 0.07 per 1,000 in nonsmokers—based upon the observation of one death only—to 0.47 per 1,000 in smokers of 14 grams a day, to 0.86 per 1,000 in smokers of 15 to 24 grams a day, and finally to 1.66 per 1,000 in smokers of 25 grams or more a day—one gram of tobacco is approximately the amount contained in one cigarette.

The death rate of the heavy smokers was therefore some 20 times the rate in the nonsmokers. In cigarette smokers the rate was substantially higher than in pipe smokers, while the rate for smokers by both methods fell in between.

Among men who had given up smoking within the previous 10 years the rate was lower than among men who, at the time of completing their questionnaire, were continuing to smoke, and among men who had given up smoking for more than 10 years it was lower still.

It follows that the highest mortalities were found among men who were continuing to smoke cigarettes, and among heavy smokers in this group the death rate was nearly 40 times the rate among nonsmokers—that is, an annual rate of 2.76 per 1,000 against an annual rate of 0.07 per 1,000.

Similar results have been reported from the U.S.A. by Drs.

E. C. Hammond and D. Horn of the American Cancer Society, and in total the statistical evidence from one or other form of inquiry is now very considerable. It is further strengthened by the observation from several sources that the extent of the relationship with smoking differs for different types of lung cancer. For the squamous, oat-cell and anaplastic cancers, which constitute the great majority of the cases, the relationship is close, but for one relatively uncommon type—adenocarcinoma—the relationship is weak or nonexistent. These forms can be distinguished only by microscopic examination of the tumors. So far, no adequate explanation of all this statistical evidence has been advanced except that of direct cause and effect—that smoking is, indeed, the principal factor in the causation of the disease.

From the physical and chemical point of view there is nothing inherently improbable in this interpretation. Tobacco smoke consists largely of microscopic oily droplets held in suspension in air, and these droplets are of a suitable size to be taken into the lungs and retained. The smoke may be condensed to a yellowish-brown tar, which is formed by partial combustion of the tobacco and by chemical changes produced in its constituents by brief submission to high temperatures.

Other materials formed by similar high-temperature treatments (for example, coal tar) are known to be responsible for certain forms of industrial cancer, and they have been shown to produce malignant skin tumors in laboratory animals. Dr. E. L. Wynder, of the Sloan-Kettering Institute for Cancer Research in New York, and his collaborators showed in 1953 that skin cancer in mice could be produced similarly by application of the tobacco tar formed by smoking large numbers of cigarettes in machines designed to reproduce as closely as possible the conditions of human smoking. Human skin, however, at least that on the fingers, does not seem to be susceptible to this action of the tar, at least in the amounts to which the smoker is exposed.

More recently, Wynder has shown that cancer may be induced in other strains of mice than those used in his first experiments, and also that the active material is contained in a chemically neutral fraction of the tar. Other workers, including Dr. D. L. Woodhouse in the University of Birmingham and Prof. R. D. Passey at the Chester Beatty Research Institute, London, have failed to elicit tumors in mice by application of cigarette smoke tar produced in a similar way.

Discrepant results in such experiments are not altogether surprising. Tobacco smoke is a most complex mixture. About a hundred constituents have been reported as having been identified with greater or lesser degrees of certainty. There must be many more not yet identified, and the composition of the smoke may be expected to vary with the type of tobacco, the method of smoking and the temperatures attained by the burning tobacco; these temperatures, in their turn, may be

HOW THE BRITISH ARE BEING WARNED ABOUT SMOKING

The British Government, acting on the findings made by the Medical Research Council, now is distributing posters through local health authorities that read as follows:

SMOKING AND HEALTH

It is my duty to warn all cigarette smokers that there is now conclusive evidence that they are running a greater risk of contracting lung cancer than nonsmokers. The risk mounts with the number of cigarettes smoked. Giving up smoking reduces the risk.

Medical Officer of Health

TO ALL SMOKERS

There are now the strongest reasons to believe that smokers—particularly of cigarettes—run a greater risk of lung cancer than nonsmokers. The more cigarettes smoked, the greater the risk.

influenced by the tightness of packing and the degree of humidity of the tobacco. Cigarette smoke is strongly acid, unlike the smoke from most cigars and pipes, but it is not known whether the enhanced liability to lung cancer of cigarette smokers, as compared with cigar and pipe smokers, is related to such a difference.

Complex aromatic hydrocarbons are commonly formed by submitting organic materials to very high temperatures; such compounds have been shown to be present in cigarette smoke by several workers, notably Dr. A. J. Lindsey of the Sir John Cass College, London, with his collaborators Mr. R. L. Cooper and Mr. R. E. Walker. One of these compounds is 3,4-benzpyrene, a constituent of coal tar which is very potent in producing malignant skin tumors in mice. Other workers, including Prof. G. R. Clemo at Newcastle and Dr. A. I. Kosak and his collaborators at the Institute of Industrial Medicine of New York University, have failed to find 3,4-benzpyrene in cigarette smoke, but Prof. H. Lettner in Germany has reported its presence in the material extracted from cigar stubs.

In view of these experimental observations, it may be supposed that a case is made out incriminating the carcinogenic substance 3,4-benzpyrene in tobacco smoke as a causative agent in lung cancer. But a closer examination leads to the conclusion that the case is not proven. The amount of 3,4-benzpyrene in the smoke from 100 cigarettes has been estimated to be about one thirtieth of a millionth of an ounce; about a fifteenth of this probably comes from the cigarette paper and the remainder from the tobacco. Even though this substance is known to be a powerful cancer-producing agent, there is no certainty that it is harmful in such low concentration.

A neutral fraction of cigarette-smoke tar, used in experiments reported by Wynder in collaboration with Prof. F. G. Wright of the University of Toronto in 1956, was found to contain 3,4-benzpyrene, but the amount present was considered to be much too small to account for the skin tumors in mice induced with this fraction; some unknown agent was therefore held to be responsible.

Another weakness in the evidence lies in the nature of the biological test. Apart from the methods, reported by Lisco and Finkel and by A. J. Vorwald, of producing lung cancer in rats by exposure to radioactive cerium and to beryllium salts respectively, there is no method of inducing in laboratory animals cancers arising from the bronchial tubes similar to those which constitute most of the lung cancers in man. The fact that a given material will produce skin cancer in mice or in rabbits is far from being presumptive evidence that the same material can cause lung cancer of the type with which we are concerned—experimentally induced lung cancer has usually been of quite another type.

A new biological test is required. Toward this end some

... "Many factors other than tobacco smoke" can produce cancer

promising tissue-culture experiments were reported in 1956 by Dr. I. Lasnitzki of the Strangeways Research Laboratory, Cambridge. She showed that small quantities of 3,4-benzpyrene induced hyperplasia of epithelial cells in human foetal lung tissue grown *in vitro*. If this technique can be suitably developed, it will help materially in the investigation of tobacco smoke.

Many factors other than tobacco smoke are undoubtedly also capable of producing lung cancer in man. At least five industrial hazards have already been recognized, and there is evidence that there may be others. For instance, in the last few years Dr. Lesley Bidstrup of the Department for Research in Industrial Medicine, London Hospital, and Dr. R. A. M. Case of the Institute of Cancer Research, London, have shown an enhanced risk in men engaged in this country in the manufacture of chromates from chromite ore; the extent of the risk for men heavily exposed to asbestos dust has also been demonstrated by Doll.

Dangers in Polluted Air

Moreover, studies of atmospheric pollution which suggest an association with lung cancer have been reported. Thus Dr. D. F. Eastcott found that immigrants into New Zealand—most of whom came from Britain—showed a higher mortality from lung cancer than native-born white New Zealanders. The mortality was particularly high among those who had immigrated late in life. Total tobacco consumption has been approximately the same in the two countries for the last 50 years, and Eastcott therefore suggested that differences in smoking habits were unlikely to be the underlying cause of the difference. However, cigarette consumption appears to have been much greater in Britain than in New Zealand; this may account for the difference, since the risk of developing lung cancer is greater with cigarette smoking than with smoking tobacco in other forms.

Some part of the difference may, perhaps, also be attributable to differences in the degree of pollution of the air; this additional factor has been suggested as the explanation of the higher mortality rates which have been consistently observed in the most densely populated parts of Britain and other countries.

A difficulty in assessing the effects of atmospheric pollution is that the smoking habits of persons resident in town and country are by no means identical—and may in past years have differed still more markedly. Dr. P. Stocks and Dr. J. M. Campbell have endeavored to overcome this to some extent by collecting data from persons dying of lung cancer in Liverpool, in mixed urban and rural areas in Cheshire, and in rural areas in North Wales. They have compared the smoking histories thus obtained with those given by hospital patients suffering from other diseases resident in the same areas.

By such means they have estimated the lung-cancer death rates for men in various smoking categories in each of the three types of area. They conclude that the great majority of cases in the semiurban and rural areas outside Liverpool can be attributed to smoking, but that in Liverpool itself about three eighths of the cases may be due to some other factor, which, they suggest, is likely to be a general atmospheric pollutant. Doll and Hill's data, on the other hand, failed to show any evidence of a substantial difference in the risk among nonsmokers in Greater London and in rural areas.

The particular kinds of atmospheric pollution which come

under suspicion as causes of lung cancer are exhaust fumes from petrol engines and diesel engines as well as smoke from chimneys. It has long been known that extracts of soot will produce skin cancer in mice, and it has also been shown that soot particles contain firmly bound, 3,4-benzpyrene. Moreover, soot is deposited in the lungs of town dwellers.

Recently Dr. P. Kotin, of the University of Southern California, Los Angeles, showed, with his collaborators, the presence of 3,4-benzpyrene in the exhaust smoke from a petrol engine and from a diesel engine under conditions of inefficient operation, although they found none when the engine was operating efficiently.

The presence of 3,4-benzpyrene in diesel-engine exhaust was also shown by Dr. P. R. Peacock in Glasgow, but Mr. B. T. Commins, Mr. R. E. Waller and Dr. P. J. Lawther in an investigation of smoke in a London bus garage concluded that the exhaust smoke from the buses in operation contains very little. Dr. Kotin and Dr. H. L. Falk obtained cancerous skin tumors in mice by application of an extract, freed from aromatic hydrocarbons, of a town atmosphere. The material was thought to contain oxidized products of petrol, emitted by internal-combustion engines.

Indirect negative evidence has been submitted by Dr. P. A. B. Raffle, senior medical officer to the London Transport Executive, who has found that in recent years the drivers, conductors and maintenance men in its employ—men who may be presumed to have had unusually heavy exposure to engine fumes—have suffered a death rate from lung cancer somewhat lower than the rate for the whole country.

Mr. R. L. Cooper suggested in 1953 that the solvent action of some of the known constituents of tobacco smoke might remove the 3,4-benzpyrene from the soot deposited in the lung and bring it into intimate contact with the tissues. In this way the tobacco smoke and the atmospheric pollution could be complementary to one another. Or it may be that the additive effect of these various sources of cancer-producing substance—which is not necessarily entirely, or even mainly, 3,4-benzpyrene—is sufficient to turn the scale and produce cancer when one of these sources alone would be harmless. These are some of the many questions that have been raised by recent studies.

Britain's Research Program

In their endeavor to answer them the Council have set up two committees to co-ordinate the experimental studies now being undertaken. Much of this work is being financed from a substantial benefaction by the British Tobacco Manufacturers' Association for research into the causes of lung cancer. With assistance from this fund the Council have provided laboratory facilities and staff in the University of Exeter, where the new Carcinogenic Substances Research Group has been established under the honorary direction of Dr. J. W. Cook; and they have set up two further research groups, on Atmospheric Pollution at St. Bartholomew's Hospital, London, under the direction of Dr. P. J. Lawther, where experiments on the effects of inhaling atmospheric pollutants, including tobacco smoke, are being undertaken, and for Epidemiological Research on Respiratory Diseases in the University of Sheffield, under the direction of Dr. J. Pemberton.

In addition, grants have been made to individual workers in universities, hospitals and elsewhere for personal remunera-

... "Amount of tar in cigarette smoke can be controlled"

tion, for scientific and technical assistance, or for special research expenses in connection with many different aspects of the problem.

The Council are therefore supporting an expanding program on lung cancer which is being directed toward elucidation of the various factors involved, and particularly that of tobacco smoke. The work is taking two main directions:

First, further investigations are being undertaken to follow up existing suggestions. In this category the greater part of the work is being directed (1) toward further statistical surveys bearing upon possible causative factors other than smoking, particularly occupational hazards in certain indus-

tries, (2) toward further tests on laboratory animals of the crude products of combustion of tobacco, and (3) toward investigations on the interrelationships that have been suggested between smoking, atmospheric pollution, chronic bronchitis and cancer of the lung.

Secondly, more fundamental work is being done on the chemical analysis of tobacco and its products of combustion, and the separate substances so detected are being tested biologically for cancer-producing properties. Much of this work is still in its comparatively early stages. In addition to these investigations, work is in progress to evaluate the results of different methods of treatment of lung cancer.

What a U. S. Scientist Says About Making "A Safer Cigarette" in Future

Following is text of a statement to the press, released by the Sloan-Kettering Institute, July 19, 1957:

"A safer cigarette can be made today by using an effective filter plus the proper blend of tobacco," said Dr. Ernest L. Wynder of the Sloan-Kettering Institute for Cancer Research.

Some tobacco companies, however, have taken advantage of the public's desire for filtered cigarettes by marketing increasingly ineffective cigarette filters placed on cigarettes containing tobacco which yields greater quantities of cancer-producing tar, he reported. Recent laboratory studies indicate that the majority of filtered cigarettes on the market have a tar and nicotine content which is at least as high, if not higher, than that of unfiltered regular-sized cigarettes. This is current despite the fact that the amount of tar (cancer-causing material) in cigarette smoke can be controlled without further delay with the knowledge about filters and types of tobaccos already at hand.

Dr. Wynder was testifying on July 19, by invitation, before the House of Representatives Legal and Monetary Affairs Subcommittee of the Committee on Government Operations.

In outlining the magnitude of the problem, Dr. Wynder pointed out that 25,000 deaths from lung cancer will occur this year and that at least 80 per cent of these deaths could have been prevented had these patients not smoked tobacco, and in particular cigarettes. Because it is such a firmly entrenched habit, however, more practical solutions than elimination of tobacco smoking have to be found, said Dr. Wynder.

The general use of an effective filter was one of the suggestions made by Dr. Wynder. He defined an "effective filter" as one which removed at least 40 per cent of the tar and nicotine from tobacco smoke of the average regular-sized cigarette. This is based on Dr. Wynder's laboratory findings and statistical studies which indicate that "the value of a filtered cigarette in reducing cancer risk is directly related to the decrease in tar content of the smoke over that of unfiltered cigarettes."

Dr. Wynder emphasized that to make a safer cigarette would require the addition of the effective filter to an average regular-size cigarette containing the proper blend of tobaccos. Some cigarette manufacturers have increased the tar production of their cigarettes by using high-tar-yielding tobaccos; the use of this tobacco plus an ineffective filter has actually

increased the tar yield of some presently marketed "filtered cigarettes." "However," testified Dr. Wynder, "in a recent laboratory study, attention was called to a new development in the filtered-cigarette industry which seems to be encouraging—a filtered cigarette with a good pressure drop and satisfactory tobacco taste can be produced which will yield 40 per cent less nicotine and tar than the average regular-sized unfiltered cigarette." According to Dr. Wynder, "uniform acceptance of a filter in this range will be a partial answer to the present problem, provided, of course, that the smoker does not decide to smoke twice as many cigarettes, and provided, too, that the tobacco selection, cut or packing is not altered in such a way as to yield increasingly more tar."

Other recommendations made by Dr. Wynder for the solution of the cigarette problem were: (1) the possible lowering of burning temperature of cigarettes, since virtually no cancer-causing substances are produced when tobacco is burned at 620 degrees or less (present cigarette burning temperature is 880 degrees); (2) "dry-cleaning" the tobacco leaf to remove the waxy coating, shown by Dr. Wynder's group to be a major source of most of the cancer-causing substances.

Dr. Wynder gave an extensive review of the accumulated statistical and laboratory evidence of cigarette smoking as the primary cause of lung cancer. He also summarized the evaluation of the evidence by responsible organizations such as the public health services of the United States, Great Britain, Sweden and the Netherlands, the American Cancer Society, and leading scientific journals.

An American study group convened, at the request of the National Cancer Institute, National Heart Institute, American Cancer Society and the American Heart Association, concluded that: "The sum total of scientific evidence establishes beyond reasonable doubt that cigarette smoking is a causative factor in the rapidly increasing incidence of human epidermoid carcinoma of the lung."

The Medical Research Council of Great Britain summarized that: "Evidence from many investigations in different countries indicates that a major part of the increase is associated with tobacco smoking, particularly in the form of cigarettes. In the opinion of the Council, the most reasonable interpretation of this evidence is that the relationship is one of direct cause and effect. The identification of several carcinogenic substances in tobacco smoke provides a rational basis for such a causal relationship."

[END]