THE CIGARETTE AND THE LUNG

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"A cigarette is the perfect type of pleasure. It is exquisite, and it leaves one unsatisfied. What more can one want?"

OSCAR WILDE

The rapid increase in the consumption of cigarettes since they were first manufactured in the latter half of the nineteenth century bears ample witness to the fact that a great number of people share Oscar Wilde's sentiments. Despite ever-rising prices the average number of cigarettes smoked per adult per annum has risen from 500 to 4,000 in Britain during the last forty-five years. It is estimated that three-quarters of the men and half the women of this country are regular smokers at the present time, and since all countries for which figures are available show a steady trend upwards in cigarette sales, it is clear that cigarette smoking holds an attraction, real or imagined, for very many of the population.

Although the beginnings of the smoking habit are obscure the tobacco plant seems to have played a part in primitive religious ceremonies among the inhabitants of ancient Mexico. The habit was passed on 500 years ago to the whole of Mexico, to the Red Indians and to the South American Indians, with tobacco being consumed in a variety of ways including smoking and chewing. It is to the voyage of Christopher Columbus in 1492 that the continent of Europe owes its gradual subjugation to the tobacco plant, for when Columbus sighted the New World and landed at the island of San Salvador in the Bahamas, he so impressed the natives of the island that he was offered as a token of friendship some dry leaves which possessed a most pleasant scent, a fact recorded by Columbus in his log. Two of his men,
Luis de Torres and Rodrigo de Jerez, sent on a subsequent occasion to establish good relations with the islanders, returned with the news that they met many natives who indulged in the pastime of wrapping dry herbs in large dry leaves, lighting them at one end and sucking in the smoke. The same two men later explored the island of Cuba where they discovered the inhabitants smoking rolled leaves of tobacco, which probably accounts for the way the Spaniards took to smoking cigars. The novelty soon spread to other European countries but while in France tobacco was initially taken as snuff, in England pipe-smoking became the most popular form of tobacco consumption after the return of Drake from his plundering voyages in 1586, bringing with him colonists who had adopted the pipe habit from the Red Indians. Sir Walter Raleigh himself soon succumbed to the habit, introducing it to court, and it was but a short time before people of all classes took up the fashion of smoking tobacco in new-fangled pipes.

This new-found and increasingly popular pastime was severely condemned by James I of England and VI of Scotland in his famous "A Counterblaste to Tobacco" in 1604. James' motive for his deep dislike of the smoking trend has been attributed to his intense hatred of Raleigh, and finding it impossible to abolish smoking he did the next best thing by introducing an import tax on tobacco of six shillings and tenpence per pound weight, though he later reduced this to a shilling. As a result smuggling of tobacco became highly prevalent and home-grown tobacco increased but was only moderately successful in its appeal because of lack of ability by the producers to master the art of curing.
Much of the rest of the continent of Europe learned the smoking habit from England and the famous Dutch physician Cornelis Bontekoe announced in 1685 that to his astonishment the English had made the three great discoveries of the age: the circulation of the blood, the circumnavigation of the world, and smoking. The cigarette as such is thought to have originated in Barcelona and Valencia. Casanova, in 1786, thought it worthwhile to record having seen an innkeeper in Spain "smoking a cigarette of Brazilian tobacco wrapped in a little paper tube, from which he blew great clouds of smoke with evident enjoyment." This new form of pleasure found its way to Levant and Russia, and cigarettes in small quantities were imported to England from Russia just before the Crimean War, giving rise to the generally held view that this war started the fashion for cigarette smoking in Britain. British troops returned from the campaigns showing a preference for cigarettes having been converted by the French, Turks, and Russian prisoners of war, and on their return the first manufacturer of cigarettes in Britain, Robert Peacock Gloag, set up a highly successful business in Walworth, London. And so the cigarette business began, and rapidly expanded in its extent and production as improved techniques and machines cut costs and improved output from 1,250 per day by handrolling methods to 200 per minute, one fifth of that achieved by modern machinery.

Originally Turkish tobacco was employed but its aromatic flavour was never widely appreciated and the mild-flavoured Virginian cigarette marked the beginning of the real popularity of cigarettes in this country.

As the enthusiasm for cigarettes grew however, so did the propaganda
of the numerous anti-tobacco societies which sprang into existence. A widely distributed and popular poem of the time told of young Robert Reed's fears about smoking:

"I'll never use tobacco, no:

It is a filthy weed,
I'll never put it in my mouth,
Said little Robert Reed.
It hurts the health,
It makes bad breath;
'Tis very bad indeed.
I'll never, never use it, no!
Said little Robert Reed."

Yet despite the childishness of this and other forms of their propaganda campaign, so successful were the anti-smoking factions that the consumption of cigarettes fell by fifty percent during a five-year period around the turn of the century. Anti-tobacco societies were by no means confined to this country; indeed their roles were assumed by certain states of America which actually prohibited the sale of tobacco, most other states greatly increasing the taxation on cigarettes in an all-out effort to persuade people to stop smoking, and countless emotional and hysterical statements were bandied about between the pro- and anti-smoking groups, generally without supporting evidence for their rival claims. The Waterville "Banner of Health," said upon the death of the author of "Ben Hur";
"General Lew Wallace, who died at the early age of 78, was another victim of the deadly cigarette habit. But for the filthy weed, he might have live to an even hundred."

But the "Jericho Primitive Christian" commented sternly:

"General Lew Wallace, who posed as a Christian, died at 78, having prolonged his life beyond the Scriptural three-score and ten by the use of those devilish drugs, cigarettes and coffee. God made seventy the sacred limit of our years, and those who violate it will surely suffer."

Though never quite reaching the absurd proportions it did in the U.S.A., anti-tobacco feeling was high in certain medical circles in Britain due mainly to the ferocious onslaught against cigarette smoking in an article in "The Lancet" in 1857 by Dr. Samuel Solly who believed that such smoking caused, amongst other things, paralysis, apoplexy, dyspepsia, deaths from typhus and all the misery of the working-classes. His article led to an avalanche of correspondence and smoking was blamed for almost every disease known at that time. The critics were temporarily silenced by the case quoted of a man who, between the ages of 18 and 91, drank more than 22,000 gallons of beer and smoked more than four tons of tobacco, and the accusations of Dr. Solly and his followers were rebutted by devotees of smoking, though again both sides failed to offer any kind of scientific evidence to substantiate their opinions. Similar controversies took place in respectable journals in other countries, but these were equally devoid of rational arguments, and it was not until 1930 that F.L. Hoffman in the U.S.A. and F. Lickint of Germany sounded a more serious note by pointing out a possible relationship
between smoking and lung cancer. Their pronouncement followed a report by certain American statisticians some thirty years earlier which noted a particularly significant increase in cases of lung cancer, and was also based on their own observations that, in common with many other countries, lung cancer was becoming a major cause of death compared with the relative infrequency with which it occurred fifty years ago.

Figures for England and Wales show that during the five-year period from 1916 to 1920 the average annual number of deaths from lung cancer in men aged 45 to 64 was 146, whereas from 1956 to 1959 the number was 9108, a sixty-fold increase. The corresponding figures for women are 87 and 1202. During the same period deaths from other forms of cancer and other respiratory have declined or, like bronchitis, remained stationary. It must be remembered, however, that over this length of time there has been a rapid growth of population, and, further, an increase in the age of the population. In addition, as many pathologists have pointed out, improved accuracy of diagnosis almost certainly means that the disease was more common than the early mortality figures suggest. Nevertheless it is exceedingly doubtful if these factors account for all of the huge increase that has been observed and though the increase is not as great as the figures apparently show, the only rational conclusion is that a notable rise in lung cancer deaths has taken place, and that to account for the rise a causative agent must be looked for. Graphs showing the increase in cigarette consumption and the increases in lung cancer deaths, allowing for the time lag during which the effects of smoking are assumed to manifest themselves, show a striking
agreement. These findings, together with the obvious fact that cigarette smoke is an agent to which human lungs have been increasingly exposed during the twentieth century, form the basis of the reasoning behind the intensive investigations which have taken place over the last 35 years, and especially over the last 20 years, into the chemical nature of tobacco and cigarette smoke and their effects on the lungs.

The simple experiment of taking a puff at a cigarette, not inhaling but merely holding the smoke in the mouth, then exhaling into a handkerchief, produces a brown tarry patch on the handkerchief which is difficult to remove. The same experiment repeated with inhalation of the smoke produces almost no stain at all on the handkerchief, and shows very roughly the extent to which the contents of inhaled cigarette smoke are retained in the mouth, airways and lungs. Demonstrations such as this have been the essence of recent anti-smoking campaigns familiar to a number of European countries. More refined techniques in the form of machines which simulate human smoking, have enabled chemists to analyse the nature and quantity of the many complex compounds present in cigarette smoke. Chief of these substances is nicotine, a well-known stimulant and a poisonous alkaloid, of which an average of two milligrammes is present in the smoke. The distribution of this quantity depends on whether the smoker is an inhaler in which case ninety percent will be absorbed, or a non-inhaler, when as little as ten percent is taken up by the organism. Another group of substances classed as irritants, including volatile acids and ammonia, tend to impair the respiratory tract by stimulating the secretion of mucus while at the same
time producing a dampening effect on the cilia lining the bronchi and bronchioles. Carbon monoxide is present in tobacco smoke but despite its high affinity for combination with haemoglobin, the amount present is deemed to have little if any clinical effect, although both smokers and non-smokers present in a room heavy with cigarette smoke are subjected to mild carbon monoxide poisoning with its attendant symptoms of lethargy and headache. Arsenic, in itself a carcinogen, is only present in infinitesimal amounts and it is unlikely to produce any deleterious effects on the lungs, though it was formerly used in insecticides on tobacco plantations, and as a possible adjuvant to carcinogenic action its presence cannot be ignored. The handkerchief experiment mentioned earlier demonstrates the existence of tar in cigarette smoke and it is the constituents of the tar which have given most cause for alarm. Some sixteen different carcinogenic compounds have been isolated from the tar, the main group of substances being polycyclic aromatic hydrocarbons of which benzpyrene is the best known, and whose carcinogenic properties have been evident since 1924. Only in 1954 was it found to be a distillation product of cigarette paper and this discovery resulted in the rapid replacement of the then-used paper with various substitutes. Many years previously the inventor Thomas Edison anticipated this finding. In a letter to Henry Ford, who hated smoking and sacked anyone found smoking in his factories, he wrote:

"My dear Ford, I have looked into cigarettes. The part that is harmful is the paper. It rots the brain!"

Independently of the investigations into the analysis of the constituents
of tobacco smoke other workers carried out retrospective studies in the smoking habits of two groups of people, patients with lung cancer and individuals not suffering from this disease, were ascertained and compared. In all some twenty-five such studies in nine different countries have been undertaken and all have shown that among the lung cancer cases there is a far higher proportion of heavy cigarette smokers, and a lower proportion of light or non-smokers, than in the second or control groups. Furthermore, the studies which covered the largest numbers of cases showed very close quantitative agreement. This type of study, however, was wide open to criticism and is far from being an ideal line of investigation. For non-biassed results the two groups of individuals must be carefully matched in respect of their age, sex, occupation, background, education and other factors, and in addition, it has been argued, the memory of one's smoking habits may be inaccurate. Another objection is that the smoking habits of the control groups used, who were generally patients in the same hospital as the lung cancer patients, may not have been representative of the habits of the population from which they came.

Undaunted by the setbacks which these criticisms induced, the investigator turned their efforts to a different type of study in which the smoking habits of a particular population group were established. Known as a "prospective study" this entailed the follow-up of the members of the group and the ascertainment of the causes of death of individuals during several year's observation. Two British doctors, Doll and Hill, started the first of these using a large number of their professional colleagues
as their subjects during the years 1951 to 1959. Seven similar studies in three countries, Britain, the U.S.A., and Canada, have now been completed and all show a steady rise in the number of deaths from lung cancer with the number of cigarettes smoked per day. Moreover, not only do they show a close quantitative agreement with each other, but also with most of the retrospective studies. All these prospective studies indicated that the risk of contracting lung cancer is less among those who have stopped smoking for some years than among those who have continued to smoke. From the records of the Doll-Hill study numerous calculations have been made in an attempt to assess the risk taken by an individual who adopts or continues the smoking habit. One such calculation expresses the average fractional risk of an individual man dying in each of the ten year periods between the ages of 35 and 74. A graphic illustration of the risk involved has been described in terms of a lottery, by assuming that for each ten year period the man draws from a container which holds one marked card among a number of blanks. If he draws the marked card he dies during the next ten years. For a non-smoker of 35 there is one marked card in a box of ninety, but for a heavy smoker - 25 cigarettes or more per day - of the same age there is one marked card in twenty-three. For a man aged 55 the risk of dying in the next decade is doubled if he is a heavy smoker, compared with the risk of a non-smoker.

Little criticism can be made of the methods employed in the prospective studies and such as there was became almost silenced by the work of Kreyberg in Norway who, after making an independent study of pathological sections
of the British deaths investigated by Doll and Hill, found a close relationship between the number of cigarettes smoked daily and the incidence of squamous cell carcinoma and undifferentiated anaplastic carcinoma, as opposed to little or none with the less common adenocarcinoma, known not to be caused by an external irritant.

The statistical association between cigarette smoking and lung cancer has now been established beyond any doubt, and yet merely to assert that the two are closely correlated is far from saying that the one causes the other. L.L. Thurstone, an American psychologist, once claimed that "a correlation coefficient is a confession of ignorance," evidently meaning that to know only that two variable factors are correlated, implies that one knows of no true causal relation between them. Statistical demonstrations in themselves are indeed inadequate to prove a direct relationship: supporting experimental evidence is required before the correlation can be taken as anything but a suggestion of a causal relation. Pathologists and other research workers have provided supporting evidence, both experimental and observational. Examination of the bronchial mucosa of heavy smokers shows a marked cellular hyperplasia and squamous metaplasia, both well-recognised precursors of carcinoma. Lasnitzki, in 1956, conducted a series of experiments in which he was able to grow lungs from human foetuses three to five months old in artificial conditions. He then studied the effect of benzpyrene on the bronchiolar epithelium and found that it encouraged the proliferation of the epithelium, increasing the number of cell layers and producing irregular enlargement of cells with abnormal mitoses. In the
following year Blacklock cleverly implanted tobacco tar in the lungs of rodents by open operation and later discovered an average of one cancer in every eighteen animals. Carcinoma of the skin can be produced in mice by the direct application of the tar obtained from cigarettes smoked in a machine. In an experimental project of this kind in New York in 1953, the first observed cancer was seen after 42 weeks, and the average time was 75 weeks, which represents half the life span of the species of mice used. The Tobacco Research Council recently published a review of its work from 1963-66 and provided conclusive confirmation of previous research, reporting that in experiments involving condensed tobacco smoke and its effect on 8,000 mice, tumours were formed on the skin of the mice in direct relation to the size of the dose.

The vast amount of evidence available relating to possible relationships between smoking and cancer of the lung, non-neoplastic diseases of the lower respiratory tract and cardiovascular diseases in general, has been very carefully considered by two eminent medical committees, the Royal College of Physicians who, in 1962 reported its findings in a publication entitled "Smoking and Health," and the Advisory Committee to the Surgeon General of the Public Health Service in the United States, who published a much larger work in 1964 with the same title. This committee concluded that: "Cigarette smoking is causally related to lung cancer in men; the magnitude of the effect of cigarette smoking far outweighs all other factors. The data for women, though less extensive, points in the same direction. The risk of developing lung cancer increases with duration of
smoking and the number of cigarettes smoked per day; it is diminished by discontinuing smoking."

This statement added weight to the British report whose conclusions were almost identical.

These conclusions have not gone unchallenged. The eminent psychologist, Professor H.J. Eysenck, has postulated the hypothesis that persons who are constitutionally predisposed to take up smoking are also constitutionally predisposed to develop cancer, which would explain the statistical association between smoking and cancer. The rapid growth in the increase of lung cancer cases he explains by the growth in air pollution. However, as Eysenck himself admits, his evidence for the constitutional hypothesis is not based on very large numbers, nor does he explain why those evidently predisposed to cancer, and also to cigarette smoking, develop lung cancer far more so than any other form of cancer. His hypothesis takes no account of the diminished risk of contracting lung cancer amongst pipe smokers and those who have given up smoking. If predisposition to smoke implies predisposition to cancer, former smokers should contract cancer as much as those continuing to smoke. This is not the case. The simplest explanation of the strong correlation between smoking and lung cancer, and the compatible but not conclusive pathological and laboratory evidence, is that a causal relationship exists.

Cigarette smoking is held to play a part in the aetiology and aggravation of other lower respiratory tract disorders, though investigations and criticisms have never been undertaken so extensively as for lung cancer.
In America seven major prospective studies all showed a higher mortality rate for chronic bronchitis and emphysema among cigarette smokers than among non-smokers, which led the American report mentioned earlier to state that cigarette smoking is the most important cause of chronic bronchitis, and that a relationship exists between cigarette smoking and emphysema, though not necessarily a causal one. Random surveys of the population of Britain have shown that recurrent chest illnesses are found more in heavy smokers, and observations on patients admitted to hospital with chronic bronchitis are much heavier smokers than controls of the same age and sex. C.R. Lowe of Birmingham found, in 1956, so significant an association of smoking with pulmonary tuberculosis that he estimated that the risk of needing treatment for tuberculosis is four times as great in heavy smokers than in non-smokers.

Since its introduction to this country the cigarette has been the subject of much abuse and praise, lengthy and expensive investigations and time-consuming arguments. Its reputation has been severely tarnished as evidence that it is a major causative agent in a number of lung disorders, notably lung cancer, has mounted despite objections and criticisms, and one can do no other than find it guilty as charged, beyond all reasonable doubt. What, if anything, can be done to help people avoid succumbing to one or more of these diseases? Preventive measures, by the removal of harmful substances by filtration or modification of the tobacco; discouragement of smoking among the young; government action promoting public education, restricting advertising, curtailment of smoking in public places, introducing a differential increase in the tax on cigarettes with a reduction in pipe
and cigar tobacco; advice by doctors to their patients as to the hazards of smoking. All of these and more have been advocated in an effort to make the ash-tray as outdated as the spittoon. Much harm has been done, and much more will be done before this occurs. A great deal of suffering and misery are due to the cigarette. One is tempted to agree with King James in his aforementioned "A Counterblaste to Tobacco" when he wrote:

"Smoking is a custome loathsome to the Eye, hateful to the Nose, harmful to the Braine, dangerous to the Lungs, and in the black stinking Fumes thereof, nearest resembling the horrible Stygian Smoke of the Pit that is bottomless."
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