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(2) LUNG CANCER AND TOBACCO CONSUMPTION

by

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(5) The significant increase of lung cancer has been an observed fact again and again since 1920. (6) The course of the increase is suspected in numerous circumstances by various authors. (7) One suspected it mainly in certain kinds of air pollutions. (8) We have to mention here that lung carcinoma caused by industrial damage, which like the Schneeberg lung carcinoma, the chromate cancer and asbestos cancer is acknowledged as an occupational disease. (9) Furthermore, one has especially been considering the damages caused by engine exhaust fumes, which are inhaled especially in some occupations, but also generally in our big cities and main traffic routes. (10) Until now, though, it has not proven likely that increased inhalation of such gases would lead to an increase of lung cancer. (11) Opposed to this are the experiments done by Schmidtman, opposed also is the fact that country and city pollution take part in the increase of lung cancer equally and the people working in occupations with combustion engines do not get sick exceptionally often. (12) Likewise, the fact that males are affected by lung cancer more often than females does not support the idea that this cancer is normally caused by exhaust fumes, since both sexes are exposed to them to almost the same extent. (13) The marked predominance of males with lung cancer (in our material 6 times more men than women) rather suggests internal influences over the development; however, there is another external influence, which man is much more subject to, than women: smoking. (14) It has been mentioned occasionally that there is a strong interrelation between the increase of the tobacco consumption and the increase of lung cancer. (15) Above all, this assumption is supported by the results of experimental cancer research.

(16) Roffo amongst others succeeded in producing cancer by applying tar obtained from tobacco. (17) Roffo also was able to identify the heavily carcinogenic benzopyrene in tar. (18) Since from cigarette tobacco, which a heavy smoker consumes in ten years, 4 kg. of tar can be extracted, it is understandable that by this considerable damages of the epithelia of the airways may occur, especially if the smoke is inhaled.

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(19) But also on the clinical side, the attempt was made to prove the connections between tobacco consumption and lung cancer. (20) Muller registered the tobacco consumption in 86 male lung cancer patients during a certain period of time, in comparison to 86 healthy men of the same age. (21) The figures reveal that a much larger portion of the lung cancer patients were heavier smokers than one might expect, whereas on the contrary, the non-smokers or moderate smokers were more highly represented in the comparative lot than amongst the lung cancer patients. (22) Muller concludes from that, that the increase of lung cancer is at least to a considerable extent caused by an increase of tobacco consumption.

(23) These data by Muller seem very significant to us concerning the problem of lung carcinoma. (24) But we regarded further investigation as necessary, to prove their general validity. (25) From the material of the Institute of Pathology in Jena as well, we found, as Berblinger earlier, a considerable absolute and relative increase of lung cancer, whereas for instance stomach cancer did not show a relative increase. (26) We derived Table 1 from a thesis by Wustner; from this follows the increase of lung cancer during the years 1910-1939 which also stayed the same in the war years 1941. (27) The ratio of the number of bronchial carcinoma compared to the reduced number of dissections was in 1949 3.61% in 1941, 2.95%.

Table 1. Increase of Lung Cancer in the Dissected Material from the Institute of Pathology in Jena 1910-1939 (according to Wustner).

Years	No. of Reduced* Cancer Lung				Proportion in %		
	Dissec.#	of dis.	Cases	canc.	Total # compared red.# dis.	Lung can. compared red.#dis.	lung can. compared red.#dis.
1910-1914	2347	1725	363	8	21.05	0.46	2.2
1915-1919	3280	2400	337	10	14.05	0.42	2.9
1920-1924	2430	1629	341	24	21.08	1.53	7.0
1925-1929	3358	2368	443	31	18.74	1.31	7.0
1930-1934	3220	2462	439	46	17.82	1.87	10.5
1935-1939	4714	3462	734	88	21.87	2.77	12.0

* Dissections of 20 years and over.

(28) Hence we started investigations of our material (of the years 1930-1941) of lung cancer patients (195 cases) concerning the tobacco consumption, comparable to the ones done by Muller. (29) We sent a questionnaire to the relatives, who resided mainly in Thuringen, which was very similar to the one compiled by Muller and in which we inquired whether the departed was a smoker, what his daily tobacco consumption was, whether he possibly reduced or stopped smoking especially during his illness. (30) Moreover, we collected information concerning his profession and possible occupational damages from air pollution.

(31) Corresponding questionnaires have been sent to the relatives of stomach, rectum, prostate, esophagus, and lung cancer patients who died during the same period of time. (32) By that means, we wanted to obtain a very accurate comparative basis, and possibly record the influences upon other cancer types.

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(33) As seen in Table 2, the questionnaires have been answered in such a way by 50-60% of the questioned that they could be only evaluated, for instance, in 109 out of 195 cases of lung carcinomas.

(34) Besides that we sent questionnaires to 700 men in the city Jena of age 53 and 54 (in accordance with the average age of 53.9 years old from our death cases from lung cancer) to assess their tobacco consumption before the war and during the war. (35) These questionnaires have been answered satisfactorily by only 270 men.

(36) The results of these inquiries are shown in Table 2. (37) In the first vertical column, a separation between men and women has been made. (39) Hence one can see that in lung cancer 6 times more usable answers were given by men than by women, corresponding to the 6 times higher morbidity rate. (40) The corresponding fact applies also to esophagus and tongue cancer, whereas the ratio in stomach and rectum cancer is 2:1.

(41) Since amongst the women there were only two moderate and one average smoker (see last column of Table 2), they have been omitted from further revision. (42) In the four additional vertical columns of Table 2, the men are arranged in order of tobacco consumption (before the onset of their illness). (43) Here we used the classification by Lickint. (44) According to him a "moderate smoker" smokes 1 cigar or up to five cigarettes, an "average smoker", 2 cigars or up to ten cigarettes, a "heavy smoker" 3-4 cigars or 11-20 cigarettes daily. (45) A "very heavy smoker" smokes more than 4 cigars or over 20 cigarettes daily.

(46) From Table 2 one clearly derives that amongst the lung cancer patients the non-smokers rather scarcely emerge, the heavy and especially the very heavy smokers are very strongly represented on the other hand, if we compare them, for instance, to the stomach cancer patients and the average cases. (47) The ratio in tongue and esophagus carcinoma is similar to the one in lung cancer. (48) However, the figures for both cancer types are too low, to be evaluated statistically. (49) In Table 3, we have combined those in one group in which an influence of smoking was not very likely since the number of rectum and prostate cancer was also relatively low.

TABLE 2

	# of quest. sent out	Usable answers	Men	Women
1. Lung cancer	195	109	93	16
2. Tongue cancer	32	17	15	2
3. Esophagus cancer	35	14	10	4
4. Stomach cancer	320	189	128	61
5. Rectum cancer	108	65	40	25
6. Prostate cancer	60	33	33	
7. Average Population	700	270	270	

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TABLE 3. Percentage Distribution of Tobacco Consumption amongst Various Kinds of Cancer and amongst the Average Male Population.

	Non-smokers	Moderate	Average	Heavy
Lung cancer	3+1.8	12+3.7	33+4.9	52+4.7
Stomach cancer	16+3.3	43+4.5	20+3.6	21+3.7
Rectum/Prostate cancer	12+3.8	32+5.4	18+4.6	38+5.7
Total of Examined Male Cancer Patients	10.7+1.7	28.4+2.6	24.2+2.4	36.7+2.7
Average Male Population 53-54 years old	15.9+2.2	36.3+2.9	21.1+2.5	26.7+2.7

(50) In Table 3, we have stated in percentage the number of non-smokers, moderate, average, and heavy smokers (we have combined the number of heavy and very heavy smokers in Table 2), in each of the three main categories of cancer (lung, stomach, rectum and prostate cancer) which we have observed to facilitate an immediate comparison. (51) The female illness cases are not counted in this, since the women were non-smokers, with a few exceptions. (52) We have recorded in the same way as the 4th group, the entire male cancer cases revised by us, correspondingly about 2/3 of the sum total of male cancer cases in this time span and as the 5th group, the normal comparative cases.

TABLE 2

Men were ...					Women have smoked
Non-smokers	Moder.	Aver.	Heavy	Very heavy smokers	
3	11	31	19	29	0
2	0	4	6	3	0
0	2	3	1	4	0
20	55	26	14	13	2
					Moderate
3	14	6	8	8	1
					Average
6	8	7	6	6	--
43	98	57	47	25	--

(53) From Table 3 one can learn that the distribution of cases of the respective cancer types rather varies amongst the various groups of smokers. (54) In lung cancer we find the fewest number of non-smokers and the most heavy smokers, in stomach cancer to the contrary, we find the most non-smokers and moderate smokers and the fewest heavy smokers. (55) The percentage in the group of rectum/prostate cancer are almost in between both, as well as -- as anticipated -- the percentage for all types of cancer combined.

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(56) Hence, the figures for the average population are found in between those of stomach cancer and those of rectum/prostate cancer. (57) Thus, one gets the impression that lung cancer is much more predominant in heavy smokers and extremely rare in non-smokers than rectum/prostate cancer. (58) In reverse, the heavy smokers seem to be relatively scarce in stomach cancer patients also in comparison to rectum/prostate cancer or in comparison to the average population. (59) The differences between lung cancer on one hand, stomach cancer and the average population on the other, as far as the groups of non-smokers and heavy smokers are concerned, are likely statistically.

(61) Muller, as mentioned above in his material from Cologne, comes to the conclusion that heavy smokers get sick from lung cancer more often than non-smokers or moderate smokers. (62) A comparison of our results presents difficulties at first, since Muller had established another classification of smokers. (63) His "heavy to extreme smokers" correspond roughly to our "heavy and very heavy smokers", his "moderate smokers" correspond to our "moderate and average smokers". (64) In Table 4, we made a comparison on this basis, in which the percentage was given. (65) One sees that the figures from Cologne and Jena essentially match. (66) Indeed, the heavy smokers are more frequent amongst the average population of Cologne than that of Jena, but also corresponding to lung cancer patients. (67) In the research material by Muller, the differences between the average population and lung cancer patients are for the group of heavy smokers and non-smokers statistically proven.

Table 4. Comparison of Tobacco Consumption of Material from Cologne and Jena (in percentage).

	Lung cancer		Average cases	
	Col.	Jena	Col.	Jena
Heavy smokers (heavy to extreme according to Muller)	65.12	52	36.04	26.7
Moderate & Average smokers (moderate according to Muller)	31.19	45	47.68	57.4
Non-smokers	3.49	3	16.28	15.9

(68) Peculiar is the high number of 15-16% non-smokers from the Cologne comparative material as well as the one from Jena. (69) The percentage of non-smokers is, for instance, indicated as being much lower (5-10%) by Lickint. (70) One could imagine that the age groups in question possibly do not smoke as much as the younger people. (71) But one must suspect that some of the people questioned about their tobacco consumption have not declared it entirely faithfully. (72) This is true for the comparative cases from Cologne. (73) But also our comparative material shows certain weaknesses. (74) In 700 questioned people, only 270 -- this is less than half of them -- have answered satisfactorily. (75) One must suspect that in some people, consideration affected by the war conditions influenced the answering of the questionnaire. (76) One

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could therefore imagine that more heavy smokers than non-smokers resisted the answering so that a one-sided selection has occurred.

(77) Considerations of such-kind-might not have made a difference in our comparative cases, i.e., stomach cancer and rectum/prostate cancer. (78) The investigation has been done here in exactly the same way as for lung cancer. (79) A comparison of the material is therefore possible and admissible. (80) As mentioned before, we have found differences concerning lung cancer.

(81) This mainly applies to the groups of stomach cancer. (82) The ratio of distribution amongst the various groups of smokers almost corresponds to the average male population. (83) Heavy smokers are even less represented in this group. (84) If we may assume that our surveys have actually represented a cross section of our average population, then we may deduce that there is no connection between stomach cancer and smoking. (85) Since we have reason to assume that amongst our "average cases" too many non-smokers and too few heavy smokers appear, we also have to consider that there are amongst the stomach cancer patients exceptionally few heavy smokers and too many non-smokers and moderate smokers. (86) This probably can be explained by the fact that a part of stomach cancer patients had already suffered a "weak stomach" for a while and therefore renounced heavy smoking.

(87) The differences in tobacco consumption between stomach cancer and for instance lung cancer are certainly not explained by the fact that during the illness, the smoking was cut down more often in cases of stomach cancer than lung cancer. (88) This can be seen clearly in Table 5. (89) Herein is specified in percentage of how many of the smokers in their last disease renounced or cut down this pleasure. (90) One can see that this was the case in both cancer types to exactly the same degree.

Table 5. Reduction of Smoking during the Cancer Illness.

During the illness smoking was:	In lung cancer	In stomach cancer
terminated in	60%	56%
reduced in	20%	28%
not reduced in	11%	10%
increased in	5%	0%
no definite information in	2%	6%

(91) The group of rectum/prostate carcinoma shows also, as shown in Table 3, considerable differences compared to the group of lung cancer. (92) The distribution of the various smoker groups corresponds largely to the groups in which all the male cancer cases studied are compared. (93) Any interrelation between smoking and the development of rectum/prostate carcinoma is -- with reservation -- not probable. (94) We therefore believe that the distribution of smokers in this group corresponds most likely to the norm group. (95) Unfortunately, the number of cases is relatively small (73) so that the average statistical error becomes rather high. (96) The

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difference to lung cancer, which seems considerable in itself, is therefore not valid. (97) The difference between lung cancer on one hand and the group of all cancers together on the other hand is also only probable statistically in the group of heavy smokers and non-smokers.

(98) When we draw the conclusions from the material which is available at present, (including the one by Muller), it is possible to say that there is a "high probability" due to the fact that lung cancer is much more frequent in heavy smokers and much more rare in non-smokers than it would be equivalent to the average expectation.

(99) Unfortunately, it has not been possible to collect totally errorless standard material respectively to allow reliable statistical conclusions. (100) It will therefore be a further task to follow up the correlation between smoking and lung cancer in a larger amount of material. (101) The same is true for the totally different conditions in stomach cancer.

(102) In short, we now have to discuss the question of how those shifts in tobacco consumption might come about. (103) In stomach cancer, one might only imagine as mentioned above that in many cases an already long existing "sensitive stomach" has been leading to temperance in smoking as well as to the development of stomach cancer. (104) An obstructive effect of tobacco smoke upon the development of stomach cancer is not probable.

(105) On the other hand, it is obvious to assume a promoting effect of high tobacco consumption on lung cancer. (106) This is supported by the simultaneous high increase of tobacco consumption and lung cancer during the last decade. (107) The content of tar and carcinogenic substances in tobacco may be of major importance in this. (108) It contradicts the assumption that the increased tobacco consumption derives from the fact that the already ill smoke more to desensitize themselves, as it is shown in Table 5. (109) According to this, only a few smoked more, whereas most patients have stopped or reduced smoking during their illness.

(110) We thus have to assume that heavy smoking is a cause for the increase of lung cancer. (111) It certainly cannot be the only cause of lung cancer, since some non-smokers are afflicted with this disease. (112) We might assume after all that smoking is an important cause, that an already existing lung cancer disposition might fully develop. (113) We here recall experiments in which mice breeds, which have a moderate inclination to develop lung cancer, a much higher rate of lung cancer by additional application of tar or carcinogenic substances has been produced (Andervont). (114) There are plenty of examples around where in a basis already receptive to cancer, cancer has been produced by additional irritants. (115) Thus could, for instance, Rous and Friedlander produce a rapid mutation into cancer rabbit papillomas which were induced by a virus of methylcholanthrene application.

(116) By appropriate design of our questionnaire we have tried to include even more external causes of lung cancer, especially air pollution. (117) However, our material does not give us disclosures about this fact. (118) 52 of our lung cancer patients had a dust-free occupation. (119) 13 have been exposed to stone dust in their professions, ten were exposed to metal dust. (120) I refer

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