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OF

TOBACCO.

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THE PHYSIOLOGICAL POSITION OF TOBACCO.

Recherches Physiologiques et Cliniques sur la Nicotine et le Tabac. Par le Docteur A. BLATIN. Paris, 1870. 8vo.

Ueber Tabak in toxikologischer Beziehung, mit besonderer Berücksichtigung der im Tabaksrauch enthaltenen chemischen Verbindungen. Vom Dr. HERM. VOHL und Dr. HERM. EULENBERG (Vierteljahrschrift f. ger. Med., N.F., xiv., 2). 8vo.

L'Absinthe et le Tabac (Académie de Medicine). Par M. JOLLY. Paris, 1871. 8vo.

Tabak ist Gift! Physischer und psychischer Einfluss des Tabaks auf den menschlichen Organismus. Von B. LUNDAHL. Berlin. 8vo.

Du Tabac. Son influence sur la Santé et sur les facultés intellectuales et morales. Hygiène des Fumeurs par le Docteur DRUHEN ainé. Deuxieme Edition. Besançon, 1867. 8vo.

Die Rauchhexe. Von J. V. STREBEL. Zweite Auflage. Stuttgart, 1869. 8vo.

IS Tobacco good for the health of man? Does it add to his strength, make him readier for work, more capable of endurance, add to his length of life and happiness?

The question may for all practical purposes be confined to humanity, for, with one or two exceptions, the brutes avoid the tobacco-plant, and we are not aware that any of them are in the habit of burning its leaves and inhaling the fumes in the manner adopted by man. We may conclude, then, that if tobacco has any uses, to man is due the credit of having discovered them.

In speaking of the physiological position of tobacco, we

have to deal with the action of the essential principles of that plant upon the human system. The peculiar effects of tobacco are due to the action of the essential oil of tobacco in the case of chewing and snuffing, and to that combined with the empyreumatic oil in smoking. Nicotine, as this essential principle is called, is so deadly an alkaloid, that the amount of it contained in one cigar, if extracted and administered in a pure state would suffice to kill two men. According to the experiments of Vohl and Eulenberg, the nicotine is decomposed in the process of smoking into pyridine, picoline, and other poisonous alkaloids, which can also be obtained in varying quantities by the destructive distillation of other vegetable substances.

Nicotine, as for convenience we may continue to call the poisonous principles of tobacco, can enter the body through various channels—by the stomach, by the lungs, by subcutaneous injection, and by the skin itself. But in whatever manner it enters the human system, its effects are, in the main, uniform.

The most immediately noticeable symptom following smoking is the undue acceleration of the labouring forces of the heart. Under the stimulus of tobacco the heart beats more quickly, as is evidenced by the rising pulse. We have not the mass of detailed evidence as to this fact which exists in relation to alcohol, but the experiments made by Dr. Edward Smith, and related to the British Association in 1864, are full of interest. "The experiments were made at 10 p.m., when the rate of pulsation naturally declines (as he had proved by hourly experiments published in his work on the 'Cyclical Changes of the Human System'), and at least four hours after any fluid or solid food had been taken. They were made in the sitting posture, after it had been maintained fifteen minutes, and with the most absolute quietude of body and mind; and thus all influences were eliminated but those due to the tobacco. The rate of the pulsation was taken every minute for a period beginning two or three minutes before the smoking began, and

continuing during twenty minutes, or until the pipe was exhausted.

The following are the chief results obtained :—

Experiment 1.

Pulsation before smoking was 74½ per minute.

Smoking 6 minutes—79, 77, 80, 78, 78, 77 per minute=78·1 average.

Smoking 7 minutes—83, 87, 88, 94, 98, 102, 102 per minute =93·4 average.

Smoking 8 minutes—105, 105, 104, 105, 105, 107, 107, 110 per minute=106 average.

After smoking 11 minutes—112, 108, 107, 101, 101, 100, 100, 100, 100, 98, and 91.

There was thus a maximum increase of 37½ pulsations per minute.

Experiment 2.

(Smoking through camphor julep in a hookah).

Pulsation before smoking, 79½ per minute.

Smoking 6 minutes—81, 81, 81, 83, 82, 82 per minute=81·6 average.

Smoking 17 minutes—85, 89, 89, 93, 96, 90, 94, 94, 93, 92, 95, 95, 95, 96, 94, 97, 93 = 93.

The maximum increase was 17½ pulsations per minute.

Experiment 3.

(Smoking an empty pipe).

Pulsation before smoking, 78 pulsations per minute.

Smoking 11 minutes—76, 78, 77, 76, 79, 79, 80, 80, 79, 78, and 79.

There was no increase in the rate of pulsations from the effort of smoking, or from its interference with the respiration.

Experiment 4.

(To ascertain if, after smoking 6 minutes, during which the

effect is very small, and then ceasing smoking, any increase in the effect would follow).

Pulsation before smoking, 75 pulsations per minute.
Smoking 6 minutes—76, 75, 79, 79, 76, 78.
Smoking 1 minute—82. Cease smoking.
Smoking 10 minutes—81, 88, 83, 82, 84, 83, 83, 80, 82.

The rate of pulsations was maintained, but was not materially increased.

Experiment 5.

(To prove if the rapidity of smoking causes a variation in increase of pulsation).

a. Greater volume of smoke.—

Pulsation before smoking, 70½ per minute.
Smoking 6 minutes—68, 70, 71, 70, 72, 74 = 70·8 average.
Smoking 6 minutes—76, 77, 86, 89, 91, 94 = 85·5 average.
Smoking 4 minutes—98, 95, 96, 95 = 96·0 average.

The maximum effect was thus 27½ pulsations per minute.

b. Smoking faster.—

Pulsation of the last minute in the previous part of this experiment, viz. 95 per minute—smoking 3 minutes, 94, 94, 96.

c. The pipe recharged.—

Smoking 5 minutes—86, 93, 96, 96, 96.

There was, therefore, a large effect upon the pulsation, but probably not more than would have occurred with ordinary smoking.

Numerous other experiments were made with tobaccos of different reputed strengths and upon different persons, and the author gave minute directions as to the proper method of making such inquiries."

The heart, then, during the act of smoking, was doing extra work; in some of the experiments this additional labour amounting to more than 50 per cent.

The effect upon the heart is not caused by direct action upon that organ, but by paralysing the minute vessels which form the batteries of the nervous system. Thus paralysed, they can no longer offer effectual resistance, and the heart, freed from their control, increases the rapidity of its strokes, expanding the vessels, with an apparent accession, but real waste, of force.

Its effect in lowering the animal temperature is very striking. When the walls of the blood-vessels are distended with that fluid, the increase in volume decreases the rapidity of the circulation and augments the local warmth. When the walls partially collapse, the circulation becomes quicker, but the heat diminishes. The heat, in fact, is transformed into motion.

Blatin illustrates this by an experiment upon a dog. He took a spaniel of medium size, and noted the arterial tension in the carotid, and the rate of pulsation before and after the subcutaneous injection of 0·004 m.grm. of nicotine into the abdomen. The tension increased from between 0·141 m.grm. and 0·144 m.grm. to between 0·148 m.grm. and 0·155 m.grm.; the pulse rose from 115 to 328 beats per minute.

Again, he introduced the hæmadynamometer into the abdomen of a dog four or five months old, and found the pressure to be 0·082 m.grm. On injecting 0·002 m.grm. of nicotine, the pressure increased to 0·090 m.grm.

The spaniel named as the subject of the first experiment was selected fifteen days after for another operation. Its pulse was at 120. Section of the pneumogastric nerve increased the beats to 210, but the injection of 0·004 m.grm. of nicotine into the abdomen, whilst producing the usual symptoms of poisoning, had no influence upon the circulation. In a terrier dog, poisoned with 0·003 m.grm. of nicotine, the pulse rose from 104 to 190 beats, and the exposure of the pneumogastric nerve to the action of galvanism did not diminish them. Thus the increase of the heart's action, caused by tobacco, results from its paralysing effect upon the pneumogastric nerve. The increase in pressure he considers due, first, to the quickened

heart-beat, and secondly, to the paralysing influence of tobacco upon the splanchnic nerve, which is to the vascular system what the par vagum is to the heart. In small doses it increases the excitability of these nerves; in large doses it diminishes it, and that in proportion to their extent. The secondary effect of this is to augment the arterial pressure and heart-beats, and to contract the muscles of the vessels.

The vertigo and trembling noticed in animals poisoned by tobacco are owing to the smaller calibre of the blood-vessels, consequent upon the contraction of their walls produced by nicotine.

Blatin also endeavoured to ascertain the effects of tobacco upon respiration. A small dog, making 16 respirations per minute, was pricked ten times in the abdomen with a needle dipped in an aqueous solution of nicotine; the effect was, in five minutes, to increase the breathings to 38. Three days after, a drop of pure nicotine was introduced into a wound made on the inside of the leg. In an instant the respirations rose from 16 to 25, another moment saw them rise to 38; they then began to decrease, and in five minutes had fallen to 12. Two more drops were now placed on the wound; the breathings descended from 11 to 10, then to 9, stood five minutes at 8, and then another drop of nicotine reduced them to 4. The respiration was now quite irregular. Section of the pneumogastric caused no change, and in a quarter of an hour the animal died. From this it is clear that a small dose of nicotine accelerates, whilst a large one progressively diminishes them. Section of the pneumogastric produces the same effect as a strong dose of nicotine. A small dose accelerates the respiration, even after the section of the par vagum. This will be caused by its action upon the spinal cord. Strong doses cause the same paralysing action we have already noticed acting upon the circulation.

Blatin was struck with the diminution or destruction of the excitability of the nervo-motors when the doses were feeble. Sensibility is only affected by very large doses. When a

strong solution of nicotine is injected under the skin of a frog, galvanism has little or no effect upon the nervo-motors. The effect is most noticeable on the nerves nearest the wound.

From this he concludes that the paralysis is caused less by the circulation than by absorption across the tissues. This he tested further, by tying with ligatures one of the posterior members of a frog, leaving only the blood-vessels and nerves free, so that the poison could only reach the nerves by the circulation. Some nicotine was then injected subcutaneously into another member. The poisoned limb did not respond to electrical excitement, but the one which bore the ligatures was evidently sensible to it, though not to the normal degree.

The action of nicotine upon the iris is well known, yet whilst some consider it to produce dilatation, others affirm its effect to be contraction. The iris is composed of two orders of muscular tissue. The circular fibres influenced by the motor oculi, and the radiating fibres obeying the great sympathetic, perform the two functions of the iris, dilatation and contraction. The stimulation of the third pair of nerves causes a contraction of the pupil; a larger dose of nicotine destroys its susceptibility and dilatation follows, the upper lid falls, strabismus ensues, the eyeball becomes fixed—in short, the motor power of the eye is paralysed. M. Blatin considers that the muscular fibre of the eye is not at all affected by the poison.

To determine the influence of tobacco upon the secretions, he made some experiments upon a dog, to which small doses of nicotine were daily administered. An increased dryness of the mucous system and a large secretion of urine were the first result. A wound made on its leg had not cicatrised in eight days, in spite of the well-known rapidity with which wounds usually heal in dogs. The mouth became dry, the throat inflamed, the animal, although constantly drinking, was unable to quench its thirst. Some drops of water placed upon the wound moistened it only a few moments. As the pressure of the blood is increased by this poison, in small doses it is a diuretic.

From all these experiments we may conclude that nicotine acts both on the heart and vessels, and is a vasculo-cardiac poison.

Blatin proposes to divide tobacco poisoning into two classes, acute and chronic. The first is the result of a large or unaccustomed dose ; the second, the accumulative consequences of doses, perhaps small, but continually repeated.

The unpleasant experiences of the first pipe will enable most smokers to understand the nature of this acute poisoning. Children have even been made ill by sucking at pipes, empty, but already coated with tobacco juice. Sometimes a very slight dose exercises a fatal effect upon systems in which tolerance has not been established. Thus a youth of 14, having smoked 15c. worth of tobacco as a remedy for toothache, fell down senseless and died the same evening.* Blatin also tells us of a medical student, aged 22, who, after smoking a single pipe, fell into a frightful state—the heart became nearly motionless, the chest constricted, his breathing was extremely painful, the limbs contracted, the pupils insensible to light, one dilated, the other contracted. These symptoms gradually lessened, but did not disappear until four days after.†

But it is chronic nicotism which has the greatest interest for us. The poisonous effects of tobacco in larger doses are too evident for denial, and need scarcely be insisted upon. Far more important is it to learn whether tobacco, in the quantities daily consumed by its habitual users, has a permanently injurious effect upon the human system.

It is often only after a number of years that nicotic symptoms appear, as though the poison acted by a process of accumulation, until the system was charged to satiety. And thus anything which disturbs the equilibrium of the functions, and so diminishes the elimination of the poison, may give rise to morbid phenomena.

There is a theory not unknown, even amongst medical men, that the toxic influences of tobacco are only transitory, and

* DRUHEN, p. 44.
† BLATIN, p. 76.

that all the poison is ultimately expelled from the system. But it is certain, from an experiment of M. Morin,* that the nicotine can be detected in the tissues of the lungs and liver after death.

So little is the theory true which would have us believe that the tobacco poison is immediately excreted, that the very cannibals turn up their noses at the nicotised flesh of smokers! †

Blatin made experiments upon three dogs to determine the effects of chronic poisoning. From 15 to 30 c.grms. of tobacco were mixed with their food, and given twice or thrice daily. The vomitings which were noticed at first soon ceased, the action of the heart became extremely irregular, the circulation grew daily feebler, digestion became difficult, appetite diminished, they were subject alternately to diarrhœa and constipation, the mucous membrane of mouth and pharynx soon became so dry that deglutition was very difficult, the gums swelled, the teeth loosened, and some of them fell out. These and other symptoms preceded paralysis of the posterior extremities, blindness, deafness, and death from sheer exhaustion. Their autopsy showed the heart to be pale, soft, slightly atrophied, the blood poor in the red globules, fluid, and deprived of fibrine.

A closely parallel case in a human subject is given. Brigitte V., a married woman, of 46 years, having lost one of her children, took to tobacco as a consoler. She snuffed, smoked, and chewed, spending about two francs weekly for tobacco. When Dr. Le Briert was called, her voice was rough, not a word could be distinguished, respiration was difficult, pulse feeble and intermittent, the heart beat with difficulty, the pupil dilated and insensible to the light, hearing defective, but not absolutely lost, swallowing difficult, &c., &c. Next day she died, all her organs being in a manner paralysed by the influence of tobacco.

The rough voice of snuff-takers, and the "smoker's sore

* Year Book of Medicine (New Sydenham Society), 1861, p. 447, and BLATIN, p. 93.
† STREBEL, p. 30.

throat," are also due to the influence of tobacco. Some smokers occasionally spit blood, often immediately after going to bed, and this affection may be confounded with true hæmoptysis.

M. Blatin regards all these local affections as trifling, when compared with the gradual saturation of the system with nicotine, which, accumulating in the tissues, waits for the opportunity, varying, according to individual habits and constitution, of declaring its poisonous nature.

The trembling, which is one of the usual symptoms of acute, is also a common result, of chronic, nicotism. A very distinguished Parisian physician had hands which shook so much that he could not write. Whenever he remained without tobacco for any length of time these tremblings disappeared. Another case mentioned by Blatin is noteworthy. A man of 45 years consulted him respecting violent and numerous attacks of vertigo. When he felt one of them approaching he was obliged to lie down wherever he might be in order to avoid falling. In the country, where he had plenty of exercise, they were less frequent than in the town, where his occupation was sedentary. Cessation from tobacco and a tonic regimen quickly restored him.

A physician of 52 was afflicted with similar disagreeable symptoms, and was also cured by abstinence. Habit had become so strong that he could not resist at times the temptation to slight indulgence. Finding that these returns to tobacco were immediately followed by his old painful attacks he renounced it for ever.

The circulatory system presents in chronic nicotism similar symptoms to those found in acute poisoning. The most noticeable of these is the intermittent pulse, of which many cases have been collected by Decaisne and others.

Decaisne speaks of narcotism of the heart, but Blatin does not consider the action to be directly upon that organ, but considers the effects described to result from any irregular relaxation of the ganglia of the great sympathetic nerve.

When a person suffering from intermittent pulse was carefully examined, Blatin found the stoppage in the heart's beat followed a series apparently normal movements. The systole and diastole succeeded in due regularity, and nothing in the play of the central organ indicated trouble, when the heart suddenly stopped in diastole, sometimes for the space of three arterial pulsations. When it awakens from this syncope its action is abnormally quick, as if it wished to make up for the lost time, and force the mass of blood across the organs at one stroke. But, with force insufficient for this purpose, it is exhausted in fruitless efforts, hesitates, wavers, acquires fresh power, commences again, now violent, now feeble, and fulfils very imperfectly the duties which it should perform. Gradually it calms ; a foreign element seems to appease the tumult, the heart again becomes regular. The explanation appears to be that the irritation of the sympathetic nerve stops short the movements of the heart, and thus causes the intermittence ; then the susceptibility of the nerve is lessened or paralysed, and the cardiac functions are left to the sole direction of the auto-motor ganglia ; hence the disordered beats, which decrease as the nervous force coming afresh from the pneumogastric moderates and regularises it.

From intermittent pulse to angina pectoris the distance is not far. That tobacco may produce all the usual symptoms of that painful disease has been abundantly shown by Beau. To the cases which he has cited may be added an epidemic of this nature noted by M. Gelineau, with which a great part of the crew of the *Embuscade* were struck. The patients were all great smokers. It is worthy of notice that this disease is much more common amongst men than woman.

Difficulty of breathing approaching asthma has also been recorded. Blatin gives a case of a young officer whose asthma could be attributed to no other cause, and who was cured by simple abstinence and tonic medicines.*

Tobacco, acting upon the cardiac and pulmonary branches

* BLATIN, p. 159, from l'Abeille Méd., t. iii. 1846.

of the pneumogastric, is not likely to leave untouched its gastric terminations. In an animal under the influence of small doses of nicotine the gastric juice is secreted with increased rapidity, and the action of the walls of the stomach is more noticeable. With strong doses or long-continued usage this secretion is very considerably diminished, and the peristaltic motion enfeebled. That is to say, the tobacco acts upon the pneumogastric, excites it in small, and paralyses it in large, doses. The smoker takes his after-dinner pipe or cigar to aid digestion. Undoubtedly, it excites the par vagum, increases the gastric secretion, and accelerates the peristaltic motion. Undoubtedly, also, this daily stimulation enfeebles the nerve, and digestion becomes more difficult. The swing back from the excitement causes a reaction, which only an increase in the doses can overcome. The nerve is partially paralysed. The appetite fails, nutrition is impeded dyspepsia reigns conqueror.

A military man of 37 years fell into a consumption without any other affection antecedent or concomitant than distaste for food, and salivation. Dr. Roques, after various essays, learned that he was a great user of tobacco, which had led to a sort of chronic fluxion of the salivary glands, and an almost total cessation of the digestive functions, and consequently caused the feeble and consumptive state into which he had fallen. Gradual diminution and ultimate abandonment of tobacco led to a cure in about three months.*

The influence of tobacco upon vision is well known. One of the symptoms produced in acute nicotism is blindness, and chronic nicotism gives rise to similar affections. Thus Mackenzie found that patients afflicted with amaurosis were mostly lovers of tobacco in some form. Sichel found cases of complete amaurosis, which, incurable by other means, were easily conquered by cessation from the weed. Hutchinson found, out of 37 patients, 23 were inveterate smokers. The observations of Wordsworth and others have so clearly established the fact

* BLATIN, p. 165, from Mémoire de Med., et de Chir. Prat., t. v.

that the continued excitement of the optic nerve by tobacco sometimes produces amaurosis, that it is now generally cited in text-books as one of the causes of that disease.

We have completed our brief examination of the physiological action of tobacco, but in concluding it may be well to point to some portions of the evidence which are especially noteworthy.

The fact that tobacco reduces the animal temperature is an important one. It shows the fallacy of those who smoke to keep the cold out, and proves conclusively that tobacco is neither a generator nor conserver of vital heat, but, on the contrary, a wasteful destroyer of it.

The influence of tobacco in liberating the heart from those restraints which regulate its healthy action, naturally leads to the conclusion that in frequent doses that organ must, sooner or later, undergo a structural transformation. Although when thus excited it has less pressure to overcome than when in a normal condition, yet the extra exertion cannot but be evil in its results, since it causes an irregularity in the supply of blood, and thus degrades tissue.

Tobacco belongs to the class of narcotic and exciting substances, and has no food value. Stimulation means abstracted, not added, force. It involves the narcotic *paralysis* of a portion of the functions, the activity of which is essential to healthy life.

It will be said that tobacco soothes and cheers the weary toiler, and solaces the overworked brain. Such may be its momentary effects, but the *sequelæ* cannot be ignored. All such expedients are fallacious. When a certain amount of brain-work or hand-work has been performed, Nature must have space in which to recuperate, and all devices for escaping from this necessity will fail. It is bad policy to set the house on fire to warm our hands by the blaze. Let it, then, be clearly understood that the temporary excitement produced by tobacco is gained by the destruction of vital force, and that it contains absolutely nothing which can be of use to the tissues of the body.

Tobacco adds no potential strength to the human frame. It may spur a weary brain or feeble arm to undue exertion for a short time, but its work is destructive, not constructive. It cannot add one molecule to the plasm out of which our bodies are daily built up. On the contrary, it exerts upon it a most deleterious influence. It does not supply, but diminishes, vital force.

It has been denied that tobacco leads to organic disease, but the evidence is very strong the other way, and it would be very remarkable if continued functional derangement did not ultimately lead to chronic derangement of the organs: that it causes functional disturbance no one dreams of denying; indeed it has been remarked that no habitual smoker can be truly said to have a day's perfect health.

It is scarcely requisite that we should add that tobacco is in no sense a necessary of life.

Even in our days, notwithstanding the vast consumption of tobacco, it is a habit of the minority only. The female sex, to their honour be it said, with very rare exceptions, abstain from this indulgence. If the claims of the apologists of tobacco are correct, why is it that an entire sex avoids it? The frailer body and more mobile mind of woman seem to stand in greater need of "soothing" and "refreshing" than the coarser frame of man.

It is not necessary; for all men do not smoke, and the abstainers are not subject to any inconvenience or disadvantage, but the reverse.

Homer sang his deathless song, Raphael painted his glorious Madonnas, Luther preached, Guttenberg printed, Columbus discovered a New World before tobacco was heard of. No rations of tobacco were served out to the heroes of Thermopylæ, no cigar strung up the nerves of Socrates. Empires rose and fell, men lived and loved and died during long ages, without tobacco. History was for the most part written before its appearance. "It is the solace, the aider, the familiar spirit of the thinker," cries the apologist; yet Plato the

Divine thought without its aid. Augustine described the glories of God's city, Dante sang his majestic melancholy song, Savonarola reasoned and died, Alfred ruled well and wisely without it. Tyrtæus sang his patriotic song, Roger Bacon dived deep into Nature's secrets, the wise Stagirite sounded the depths of human wisdom, equally unaided by it. Harmodius and Aristogeiton twined the myrtle round their swords, and slew the tyrant of their fatherland, without its inspiration. In a word, kings ruled, poets sung, artists painted, patriots bled, martyrs suffered, thinkers reasoned, before it was known or dreamed of. Who of us can realise Moses with a "churchwarden" in his mouth, or St. Paul smoking a prime Havannah?

Think of ancient Greece, of her glory in arts and arms and song, of her poets, sculptors, architects, after whom the moderns toil in vain. We do but follow in their tracks with halting steps and slow, and yet they lived their lives, and thought their deathless thoughts, and gave immortal beauty to the silent stone, without tobacco.

What shall we say, then, to this habit? It is in no case necessary or beneficial; it is a social nuisance; it is devoid of all æsthetic beauty; it is an unmanly leaning on a solace to care and labour neither sought nor needed by the weaker sex; it is an enormous and yearly increasing source of national improvidence. Above all it is the foe to youthful development, the bane of youthful blood and brain. The subject may seem to some too trivial for serious attention; but when we consider the extent of juvenile smoking, we see that the national life and stamina are seriously threatened by this ignoble habit. So a noble tree, heaven-aspiring, with wide-spreading branches, whose leaves are a refuge for the singers of God, may be attacked by some insignificant parasitical plant, which winds round and round it in serpent-folds, and sucks away its sap and vigour, till the green leaves are blasted and the singers flee away, till the glory is departed, and Death and Ruin alone remain.