

## Short Notes and Clinical Cases

### NARCOLEPSY AND THE MACHINE AGE ; THE RECENT INCREASE IN THE INCIDENCE OF NARCOLEPSY

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CASES of narcolepsy were exceedingly rare until after the war, since when the frequency of reported cases has increased at an astonishing rate. I know of but 4 cases reported in the past century; in 1901-1910 4 cases were reported; in 1911-1920, 13 cases; and in 1921-1930, approximately 120 cases. Ordinarily one might ascribe this increase to growing familiarity with the syndrome on the part of physicians. When, however, experienced neurologists like Kinnier Wilson<sup>5</sup> and Spiller<sup>4</sup> report that though they have been looking for cases for many years they saw few or none until recently, it is difficult to resist the conclusion that the increase is real and not illusory. Assuming this conclusion to be correct, I propose to consider what might be the explanation for this remarkable increase.

In a previous paper<sup>2</sup> I sought to show that the phenomena of narcolepsy may be interpreted in the light of Pavlov's studies on 'internal inhibition.' It seems permissible to assume that the narcoleptic patient possesses a brain in which inhibition occurs with undue ease, the character of the symptoms depending in part on the extent of the area inhibited. We must therefore ask: Do the conditions of modern life favour the occurrence of inhibition? I shall try to show that they do.

As the first item in the execution of this purpose, I shall call attention to the significance of an observation reported by many narcoleptics, viz., that they fall asleep while driving an automobile. On first thought, one might account for this phenomenon by saying that driving for any distance is monotonous even to a healthy man, and that the narcoleptic, with his abnormal tendency to fall asleep, merely succumbs with undue ease. This explanation, I believe, begs the question, since by definition 'monotonous' applies to those circumstances under which one becomes bored or sleepy. Viewing the matter realistically, one must say that sleep, as shown by Pavlov, represents the irradiation of inhibition of a sufficiently large area of the cortex. One must therefore ask: Does driving favour the spread of inhibition? Let us therefore inquire into the nature of driving, in so far as cortical inhibition is concerned.

The manipulations incident to driving an automobile represent a set of conditioned reflexes. For example, when the driver sees an object in his path, he presses his foot on the brake or steers to one side, or he merely sounds his horn; it is self-evident that these reactions represent conditioned, rather than unconditioned, reflexes. To say that one man is a better and safer driver than another is to say, in effect, that the one has acquired a more elaborate set of conditioned reflexes than the other.

The seasoned driver has acquired not only many positive conditioned reflexes, but also many negative, or inhibitory, reflexes. As an example, let us consider the reaction of a driver to the sound of an automobile horn. In a person driving an automobile for the first time, the sound of a horn evokes regularly a positive defence reflex; moreover, other sounds only remotely resembling that of an automobile horn may evoke the same reflex, so that the beginner at the wheel may react with defensive movements even to the sound of a factory whistle. When 'differentiation' has reached a certain point, the driver now reacts to the horn, but not to the whistle. In the course of time differentiation goes still further, so that now the driver reacts to a horn under some circumstances, but not under others. For example, when the seasoned driver, approaching a cross-roads, hears the sound of a horn apparently coming from the side street which he is nearing, the positive reflex appears (i.e. he slows down and assumes an attitude of greater alertness); when, however, on an unintersected highway he hears the same sound coming from the rear, the positive reflex is inhibited (i.e. he makes no defensive movements, his only response, if any, being to drive to one side to permit the driver in the rear to pass). This is a perfect analogue to the situations confronting Pavlov's dogs in his experiments on differentiation. Such situations occur many times an hour during ordinary conditions of driving. Indeed, to picture a driver in whose cortex the occurrence of differentiation is reduced to a minimum, one would have to picture him on a wide and perfectly straight unintersected highway where by prearrangement and with his knowledge there are no obstacles, no traffic, and no pedestrians. Here the driver would have relatively little need of being alert. But under ordinary conditions the cortex of the driver is continually called upon to differentiate a multitude of 'compound stimuli,' some of which call forth positive, others negative, conditioned reflexes.

These considerations, I believe, warrant the statement that when sleep occurs during driving, it is not because of monotony, but because the differentiation constantly going on in the cortex gives rise to an ever-increasing tide of inhibition which finally overwhelms the substrate of consciousness. The man who falls asleep at the wheel is strictly comparable to the dog which falls asleep during an experiment on differentiation.

In my paper<sup>3</sup> on some military aspects of narcolepsy, I referred to the fact that during the war soldiers sometimes fell asleep on sentry duty. The sentry and the automobile driver are each in situations calling for the

differentiation of stimuli, and they fall asleep from identical physiological causes.

Since driving seems to favour the occurrence of inhibition, one might ask whether there are cases in which there seems to be a relationship between excessive driving and the onset of narcolepsy. It is to be hoped that physicians who have narcoleptic patients under their care will inquire into this point. At present I know of only one case in which such a relationship seems to have existed—Case II reported by Harding and Berg.<sup>1</sup> The patient, a business man, attributed the onset of his narcoleptic symptoms to 'auto-intoxication due to the fact that I'd driven about 600,000 miles in the four or five years previous.' Since the figure seemed excessive, I wrote to Dr. Harding, who informed me that it is a misprint; it should be 100,000. Even 100,000 miles in four or five years represents a lot of driving, and many healthy people would find it taxing in the extreme; for a potential narcoleptic, with his greater tendency to cortical inhibition, it might well have proved to be the final straw that caused the symptoms to make their first appearance. I therefore consider it possible that the patient of Harding and Berg was not wrong when he designated his many miles of driving as a precipitating factor.

So far my remarks have been confined to drivers. Corresponding statements may also be made of pedestrians. Crossing the road in the era of horse-drawn vehicles required no very great degree of alertness; crossing the street today is a venture fraught with peril. The pedestrian, like the driver, at frequent intervals differentiates stimuli. Thus, when he is on the street, the sound of a horn evokes a positive defence reflex; when he is on the sidewalk, the same sound is followed by inhibition of the same reflex. Here is differentiation of compound stimuli. To take another example: if, while crossing the street, the pedestrian sees an automobile 50 yards away moving toward him at an apparent speed of 40 miles per hour, the positive defence reflex appears; if at the same distance he sees an automobile coming toward him at a speed of only 10 miles per hour, the positive reflex is inhibited, the pedestrian knowing that he does not need to hurry. This situation is comparable to that of the laboratory animal in which there is differentiation of tuningforks of different wavelengths.

The statements made about the driver and the pedestrian may be generalized to apply to *all people who work with, or in the vicinity of, life-threatening machinery*. When a working-man learns to obey a set of directions in order to avoid being mangled by his machine, he in effect acquires a set of positive and negative conditioned reflexes.

Thus one reaches the conclusion that people living in a modern civilized community must acquire conditioned defence reflexes to a far greater extent than their grandfathers. Our grandfathers were comparatively rarely in situations requiring instant and precise adjustment to dangerous mechanical forces; today such situations confront the majority of us many times a day.

This means a corresponding increase in the amount of cortical inhibition to which we are subject. Obviously, in 50 years the human cortex has not evolved to a degree comparable with the increased burden imposed on it by the 'Machine Age.' Nevertheless (so liberal is Nature in providing us with margins of safety), in the vast majority of people this increase in inhibition is compensated for; these people are clinically well.\* Of the remaining minority, some are so constituted that they would have developed symptoms of narcolepsy even under the simplest conditions of life. But there must be others in whom the morbid tendency is not so pronounced, with the result that today they have symptoms which would have remained latent had they lived 50 years ago. I suggest that this would explain the tremendous increase, in recent years, in the incidence of narcolepsy.

It should be emphasized that, so far as cortical inhibition is concerned, the significant thing about present-day life is the prevalence of conditioned *defence* reflexes, and not just of conditioned reflexes in general. Conditioned reflexes existed long before the age of machinery. Any learning process means, physiologically, the acquisition of a set of conditioned reflexes. Thus, when a child learns to eat peas with a fork and not a spoon, he has acquired two conditioned reflexes, one positive and one negative. But these reflexes, which do not pertain to the physical preservation of the individual, are, from the point of view of the aetiology of narcolepsy, of infinitesimal significance in comparison with the defence reflexes discussed in this paper. The excitations correlative with the act of eating peas with a fork are weak in comparison with the excitations which enable a pedestrian to jump clear of the automobile that is upon him. Correspondingly, the inhibitions correlative with the avoidance of the spoon are weak in comparison with the inhibitions by means of which the pedestrian checks his walking movements when these movements, uninhibited, would bring him directly into the path of a moving vehicle close by. The argument of this paper, therefore, may not be attacked on the ground that we have always had conditioned reflexes. Conditioned reflexes we have always had, but conditioned defence reflexes, with their powerful excitations and equally powerful inhibitions, we never had in such profusion prior to the present era of the machine.

#### SUMMARY

The widespread use of life-threatening machinery has resulted in a vast increase in the number of conditioned defence reflexes acquired by the

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\* I have reference here only to the more severe clinical manifestations of inhibition, such as sleep attacks and cataplexy. If we knew more about the milder clinical manifestations of inhibition, we might find them very widespread indeed. For example, there is some reason to believe that fatigue may occur as a manifestation of inhibition,<sup>3</sup> in which case we might well suspect that while the 'Machine Age' is causing only a few hundred people to develop the major symptoms of narcolepsy; it is causing many millions to suffer from increased fatigue.

majority of civilized mankind. The frequent occurrence of these reflexes and, especially, the frequent occurrence of differentiation must result in an increase in the amount of cortical inhibition occurring in most people. The case of the automobile driver is chosen as an example to demonstrate concretely the validity of these statements. It is to these circumstances that one may plausibly attribute the vast increase in the incidence of narcolepsy in the past two decades.

#### REFERENCES

- <sup>1</sup> HARDING, G. T., and BERG, T., 'Narcolepsy,' *Ohio State Med. Jour.*, 1932, **28**, 581.
- <sup>2</sup> LEVIN, M., 'The pathogenesis of narcolepsy, with a consideration of sleep-paralysis and localized sleep,' *Jour. Neurol. and Psychopath.*, 1933, **14**, 1.
- <sup>3</sup> LEVIN, M., 'Military aspects of narcolepsy, with remarks on the pathogenesis of narcolepsy and on fatigue,' *ibid.*, 1933, **14**, 124.
- <sup>4</sup> SPILLER, W. G., 'Narcolepsy occasionally a postencephalitic syndrome,' *Jour. Amer. Med. Assoc.*, 1926, **86**, 673.
- <sup>5</sup> WILSON, S. A. K., 'The narcolepsies,' *Brain*, 1928, **51**, 63.

#### SUPPLEMENTARY NOTE

After this article was accepted by the Editor of the JOURNAL, I came across a recent article by M. S. Kaplinski ('Anfälle von kurzweiligem Einschlafen bei Transportführern,' *Zeits. f. d. g. Neurol. u. Psychiat.*, 1933, **147**, 101). Kaplinski calls attention to the frequency with which sleep attacks occur in chauffeurs and street-car motormen. This frequency is so great that the authorities of the Moscow street railways have asked the Institute for Industrial Hygiene to make a study of the matter—a fact of great interest in view of the discussion offered in my paper.

On one point I must disagree with Kaplinski. In explaining the sleep attacks occurring in drivers of vehicles, he alludes to the fact that passengers frequently fall asleep, seemingly through the influence of the monotonous sounds and rockings of a moving conveyance. He clearly implies (in several places) that the somnolence of the driver is brought on by the same monotony which lulls the passenger to sleep. But, instead of being comparable, the situations of the passenger and the driver differ tremendously in their physiological import. The passenger relaxes; he makes no effort to 'take in' stimuli. The driver, on the other hand, 'strains his attention' to the utmost; he strives to see and hear everything, and, as I have already tried to show, there is in his case continual differentiation of positive and negative stimuli. I am not prepared to formulate the causes of the somnolence that overtakes the passenger, but, whatever they are, I should for the present regard them as negligible in their bearing on the somnolence of the driver.



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