

## II

### *Outwitting Fatigue*

Most people fall into the habit of judging a man's energy by the frequency and ease with which he fatigues. But nothing is more misleading. One of the most revolutionary discoveries in psychology is that lack of close connection between the loss of energy and the sense of weariness or revulsion, accompanied by muscle pains and headache and sometimes nausea, all of which men call "fatigue."

There are two kinds of fatigue which have little to do with each other. One is physiological, the other psychic, or what we commonly call "brain fag."

Physiological fatigue is a toxic state brought on by the failure of the body to slough the waste products of muscular effort fast enough. Carbohydrate is the primary fuel of the muscles. This forms glycogen in the liver. And whenever you move your muscles, they burn up some glycogen. There is left over—somewhat like ashes, so to speak—lactic acid which, in some manner not at all understood, stiffens the muscle fibres. During hard work, the amount of lactic acid in the blood rises

steadily and the muscle fibres cease to react. That is exhaustion. When the worker ceases his efforts, the lactic acid spreads through all tissues in contact with the blood stream. A. V. Hill reports that as much as 3 grams per second may be liberated in the muscles of a powerful man, while his entire body can endure the presence of 130 grams. During rest, the lactic acid is removed by recombining with oxygen and eventually becoming glycogen again.

When a voluntary muscle is forced to contract rapidly and often, it lacks time to recover. So its power declines steadily. The accumulated toxins quickly disturb the highest integrative functions of the brain. Observers usually report that the tired person first loses his interest in whatever he is doing and then tends to become irritable or moody, according to his total condition at the moment. His motions lose their nicety, firmness and precision. And if he is employed in a factory, he is in grave danger of catching a hand or foot in a machine or walking into an elevator shaft. Speech deteriorates likewise. Slips of the tongue increase and various petty automatisms develop to vex the weary one.

People vary greatly in the speed with which they can clear their systems of this enemy of work, lactic acid. Individual differences among people doing the same kind of work are as great as 300%. An athlete in trim

will recover from exhaustion in six or seven minutes after strenuous exercise, while a sedentary person, put to the same task, may not come back to freshness in twenty minutes.

Seldom does recovery spread over twenty minutes in most kinds of normal hard work. One is about 90% recovered in six or seven minutes, according to A. V. Hill. As the process of eliminating lactic acid goes on continuously, a man need not stop for rests in most occupations except just after spurts of effort; and then it suffices to pause for two or three minutes. Nothing is gained by longer rests.

Both bodily and mental fatigue have one factor in common: most, if not all, cases are brought about not by loss of energy but by some difficulty in integrating all the impulses and drive of the personality around the exhausting activity. We grow weary in body and mind as a result of what we may call one-sided conduct. When some segment of ourselves stands idly by while other segments work, or when such a segment is prevented from functioning by these working parts, impulses and tensions are set up that break down our coordinations. We feel fatigue. And fatigue is a protest against monotony, for monotony is the *local exhaustion* of some nerve tract which, as it loses its own tiny fund of energy, induces disturbances throughout the body. This exhaustion favors the shifting from the reactions of the nerves of one sense organ to those of an-

other, from one set of muscles in reaction to another set. This guarantees a steady variation of behavior in which no segment of ourselves is worked at the expense of other segments.

Fatigue is like sleepiness and falling asleep. It is a preservative mechanism—sometimes a restorative, too. It is a protest against monotonous functioning which, as Sherrington has keenly pointed out, is a danger in the ordinary environment. In a world that shifts and changes every moment, the creature that rebels against monotony briskly thereby increases its own chances of survival.

Fatigue of body alone often occurs without any mental weariness whatever. Mental fatigue, however, occurs both independent of and in conjunction with bodily weariness. In the strict sense, "brain fag" always accompanies some slight muscle fatigue, since the very act of attending involves muscle tensions, however slight.

When we feel "brain fag," we experience the temporary failure of escape from stimuli and reflexes which have developed to the point of interfering with and even suppressing a host of others. Mental fatigue is the first step toward an escape which as yet cannot be consummated. Like sleep, it is no mere decline in energy. We have seen the tiny fund of energy required for hard mental work. Why, then, should most people be so weary after a little thinking? The explanation throws light on

the whole problem of tapping your energies. *It is not the burning of body fuel that exhausts us and produces feelings of fatigue. It is either muscle tensions set up by acts of attention to the mental problem or else it is boredom and a feeling of futility directed toward the task.*

Were mental fatigue no more than a decline of energy, we should expect the human body to behave more or less like an engine that begins to run out of fuel. We should look for a sudden slowing down and then a quick stop. A man reading a book would, in that event, go temporarily blind; or, if it was not his eyes which ran out of power, then it might be his brain, in which event he would become unconscious. And he could not resume his book until he had assimilated some food.

But this does not happen in ordinary mental fatigue. There is little or no connection between the feeling of discomfort, the unwillingness to go on working, and the ability to pursue fatiguing labors. Long ago William James observed the phenomenon of "second and third wind" in fatigue, a problem which we shall soon take up. Since James' time others, notably Thorndike, have conducted experiments which show that a normal man can carry on any mental or physical activity within his ordinary range of power for several hours at top speed, and at the end of the period be performing his task as well as he did at first. When he feels fit and enthusiastic, he achieves results

which are no better than those attained when he feels weary, disgusted, irritated, or bored, *provided he really tries to make the best possible showing when he is fatigued.*

All this, of course, does not imply that there is no connection whatever between energy and fatigue. It means that it is much slighter and more localized than is generally supposed. Extremes of energy affect one's capacity to integrate and hence play a part in determining the time and conditions of fatigue. A man of extremely high energy can keep going at a distasteful task longer than a weakling can, assuming that both men show the same degree of integration, more or less. Likewise a healthy man can continue unpleasant work more successfully and for a longer period than a man in poor health.

#### BAD HEALTH AND FATIGUE

Bad health, indeed, makes one susceptible to fatigue more than any other single factor. Does this seem obvious? It's not. For, fantastic as it sounds, thousands of people in need of prompt medical treatment don't even know there is anything the matter with them. Constantly fatigued, they blame the job, not the power plant.

Here are one thousand men employed as clerks, bookkeepers and the like in Cincinnati offices. In 1929 the Heart Council of Cin-

cinnati \* gave them physical examinations. Of all subjects, only six were physically sound. Two hundred and thirteen had minor ailments. Seven hundred and eighty-one had major defects. And though eighty per cent of the group needed medical care, *seventy-two per cent didn't know there was anything wrong!* Or if they did, they failed to report their defects to the examiners.

One year later, another thousand male factory workers were examined. Here only four were for the most part healthy. Minor defects afflicted 160; 836 had "severe impairments likely to influence their length of life and their work capacity"; 965 needed immediate medical care, and *eighty-eight per cent of them didn't know they were in any way abnormal.*

This sampling of two thousand workers is enormously significant. Most of them were subject to fatigue which greatly interfered with working efficiency. But remember that working conditions in large cities like Cincinnati are on the whole more healthful than those of most smaller localities. The environmental factors of the groups studied, therefore, were probably more favorable to reasonable health and efficiency on the job. Furthermore, the Cincinnati survey is large enough to indicate a similar ignorance of ordinary hygiene among the huge majority of American workers.

Even the young workers were in poor health. McCord estimates that fully seventy

\* As reported by Dr. Carey McCord, l.c.

per cent of those under thirty are hampered by major physical defects; nearly a fourth have minor defects; and *ninety-five out of a hundred would profit by early treatment.*

The afflictions, of which most were unaware, remember, varied from flat foot to sinus trouble. Nine out of ten had dental defects other than fillings and minor infections. Only eight per cent reported having had dental attention within the year. Seventy-three per cent had eye trouble. Thirty-six per cent were flat-footed. Thirty-seven per cent were over- or under-weight by twenty pounds or more. Forty-six per cent had respiratory defects, including sinus trouble and enlarged tonsils. And so on down a long and melancholy list.

Why recite all this? Simply because it demonstrates that the average American worker is so dull of sensitivity that he doesn't even know when his power plant is badly out of order. He has to be told when it balks and stalls and fails to run smoothly.

He economizes on medical care only to pay in the long run a price far dearer than the cost of prompt attention to major defects in his power plant. Here you may protest that the last four years have left you without cash enough for food and rent, let alone doctor bills. To which I answer that you may visit any good doctor or dentist, explain your financial situation, tell him the maximum amount you can afford for treatment, and, if he cannot take



your case himself, be referred either to some other doctor or to a clinic for the care you require.

Unless you are piggishly healthy, make it a rule to have a physical examination every year. And regardless of your health, visit your dentist every six months as the schoolbooks tell you to. *Keep your power plant in first-class order. Never economize on it.* There is no economy so stupid as that of ignoring the first principles of good health. And none of the latter is so obvious and so neglected as that old saw about the stitch in time.

The poorer your health, the more susceptible you are to fatigue. Likewise the converse is true. I can confirm these facts amply from my own experience. Taking as par 100, the healthy city dweller has a hæmoglobin count of about 90. Any drop below this is likely to reveal itself in some disturbance of energy. When my own count went down to 86 once, I was unable to shake off a light cold; I had serious stuffiness of the ears; I was digesting food slowly and with some distress; I disliked reading anything through to the end, unless it was very important; and my physical fatigue was so great that for long periods I was totally unable to talk for more than a few minutes at a time, while when writing long hand I found myself dropping the last letters of words. For weeks the slightest exertion fatigued me out of all proportion to the effort.

## COMMON CAUSES OF FATIGUE

Study well the relative importance of the common causes of fatigue among shop workers, as observed by Rexford B. Hersey in his interesting investigation of "Workers' Emotions in Shop and Home."\* Apply his findings to your own personal problem.

By a special weighted method which need not be explained here, Hersey ranks the fatigue causes as follows:

Outside activities; that is, things done out of work- ing hours either for pleasure or for social ends,	1,040
Physical activity on the job,	517
Emotional tension,	430
Bodily tension,	287
Mental activity,	237
Colds,	200
Malnutrition,	133
Boredom,	121
Physical environ- ment; that is in its unpleasant, de- pressing, or other- wise exhausting aspects,	119
Climate	110
Unsuccessful effort	100
Too much sleep	49

\* University of Pennsylvania Press, 1932. Especially see page 330.

Far and away the most frequent cause was "outside activities"—that is, things done in leisure time for pleasure or for purely social purposes. They caused fatigue more than twice as frequently as the next most important factor—physical activity on the job.

How easily this can be confirmed in the sorry records of students, housewives, athletes and would-be artists. Over and over I have watched promising youths arrive at college portals, make a fair flash of a start as freshmen, and then imperceptibly slip behind until, after a year or two, they have joined the mighty ranks of obscure mediocrity—if not the inglorious squadrons of the flunked. Tear aside the veils of privacy, and you behold card games until two in the morning, dances, petting parties, whoopee after the big college games, joy rides, movies, week-ends in the country—each taking heavy toll in the form of calories and hiding the debit side of the ledger with a pretty smear of pleasure. Say what you will as to the value of all such experiences—and I admit that a fairish case may be drawn up for the defendant—the fact still remains that the one ultimate asset of life, energy, has been squandered.

Turn to the elders, and you find a still stupider picture. They arrive at work worn out from the previous evening's late bridge or drinking bout and carry on through the day in half-hearted interest and easy exhaustion.

Many a worker past forty does not realize the heavy price he pays, too, for strenuous exercise in evenings and week-ends. The older he is, the more he should pull in on games and exercise which drain his energies heavily. After forty, he should give up tennis, and play golf only moderately if at all. If greatly fatigued by any more or less strenuous exercise, he should give it up at once.

Sensible people need few tips on how to reduce fatiguing outside activities. The duller your evenings, the better you sleep. The better you sleep, the more consistently efficient your work. Need more be said?

The rest of these causes of fatigue we discuss in their more general aspects throughout this book. It is your business to study them not only in relation to yourself as a worker, but in all your activities. You must, of course, learn how to rest and relax. But before we embark on that phase of the action-rest cycle, we must first look at the phenomenon of "second wind."

You have probably often experienced complete exhaustion followed by a curious return of energy which many people believe a case of tapping "hidden reservoirs of energy."