VIS MEDICATRIX DEI

By Richard C. Cabot

I went into medicine in the hope of helping people. I found that I could help vastly less than I hoped. I was not wise enough to help as I wanted to. But though I could give a great deal less, there was a great deal more for me to receive. There was more for me to learn and to be inspired by as I watched the behavior of this extraordinary creation that we call the human body. I have been more and more amazed at the intelligence, not of the human brain but of the other organs of the human body.

Dr. Walter B. Cannon's book on The Wisdom of the Body gives the best account known to us of what "nature," or as we believe, God, does to keep the body sound despite the strains which challenge its strength in health as well as in disease. That book is a series of examples of what he calls the "homeostatic" power of the body. As a ship rights herself after a squall has heeled her over, so that body rights itself after the minor "squalls," chemical and physical, that strike it daily in health and after the tempests of disease. The body's power to right itself when something tends to upset it is what Dr. Cannon calls "homeostasis" or "standing the same."

In this chapter I shall give first a number of examples of this power and then explain why, though some call it homeostasis, we call it God. The examples which follow are familiar to all educated physicians but are not known to the public so widely as they should be. We divide the examples of "homeostasis" into four groups:

1. Reserve.
2. Balance.
3. Compensation.
4. Defense.

In one sense they are all defenses against attack present or threatened.

1. Reserve. In the chief organs of the human body we recognize an extra supply that can be called upon in need, like the reserve of a bank. When a man suffers from tuberculosis of the lungs, a certain portion of the lung is destroyed, but he has a great deal more lung tissue than he needs. He can call upon his reserve and get along, as the great Dr. Trudeau did at Saranac for nearly forty years of hard work, though he had only a part of one lung still healthy.

Experiments have shown that one can remove more than two-fifths of the human liver and still the remaining three-fifths will carry on the work of the organ, so far as one can see, just as well as before.

When we see a surgeon cut and tie thirty or forty blood vessels in the course of an operation, we may wonder what is to become of the blood that should circulate through them. The answer is that we have many more than we need. We can sacrifice a great many and still get on perfectly well with what are left.

Each of us has about twenty-two feet of intestine. By reason of disease a portion of it may have to be removed. One can lose three or four feet and hardly miss it at all.

2. Balance. In the laboratories where physiological and bacteriological work is carried on we use an instrument called a thermostat, that is, an instrument which keeps the temperature stable. In growing bacteria we have

to arrange that the temperature around them shall not vary more than a few degrees. If it rises or falls more than that the bacteria that we are trying to study die. A thermostat is a difficult instrument to manage. It seldom works perfectly, and it never works nearly so well as that extraordinary instrument, the human body.

Most of us know that if our temperature is taken with a clinical thermometer it is approximately 98.6 degrees Fahrenheit, varying only a few tenths of a degree during the twenty-four hours. But we do not realize perhaps that when a person goes into a temperature of 40 degrees below zero, or when, as used to be the case with the stokers in steamships, he has to live minutes or hours in temperatures of 130 degrees to 150 degrees Fahrenheit, still his body keeps its temperature the same. A piece of metal and most substances that can become heated or chilled, will respond to the temperature around them. The human body has the extraordinary capacity to keep its balance in terms of heat. Unless that were the case death would occur whenever one went into a cold temperature or into a hot temperature. This balance may be lost under a very hot sun, and then "sunstroke" occurs. The body's temperature runs up to 110 degrees or 115 degrees, which it cannot sustain for many minutes and still live.

By a number of ingenious devices the body ordinarily preserves its temperature at a point between 98 degrees and 99 degrees Fahrenheit. These devices are not familiar to everyone. For instance, if we are cold we often shiver, and we think of shivering, perhaps, as an inevitable misfortune. As a matter of fact, by shivering we keep ourselves warmer than we should be if we did not shiver. Shivering is a muscular action, and the action of any muscle tends to create warmth.

There are many other ways, which we shall not stop to describe, by which our body preserves its own temperature as it must if life is to go on. Our brains do practically nothing about this; it is beyond our conscious powers; it is part of the intelligent action of the body itself.

A second example of this intelligence is the balance of moisture in the body. The human body is about four-fifths water, and it must preserve nearly that proportion of water, or life cannot go on. We are giving out water and taking in water all the time, and yet the body by its own intelligent arrangements preserves almost exactly the same proportion of water in itself at all times.

Most of us, most of the time, preserve the balance of our weight. Some people tend to get too heavy and others to get too thin, but on the whole it is amazing how seldom this happens, in spite of the fact that we are putting bulky substances into our tissues all the time and losing pounds and pounds of weight in every violent exertion. A football player sometimes loses ten or twelve pounds in one game. Nevertheless we hold our weight, most of us, within a pound or two, year after year.

The most delicate of all these balances is our chemical balance. Most of us have heard of the common chemical terms, acidity and alkalinity. Most substances that enter or leave the body can be classified as either acid or alkaline. When a substance is in chemical balance between the two we call it neutral. The body has to be held very close to this neutral point. If it varies as much as a few parts in a thousand we become unconscious. But every act that we do, every muscular motion, every strong feeling, every deep breath, would change the chemical reaction of the body toward acidity unless the body balanced it by a change in the opposite direction. Every meal that we take pushes the body's reaction toward the alkaline side. And yet, although acid is

being taken into the body or made in the body in great quantities, in irregular quantities, and at irregular times from moment to moment, the healthy body still preserves almost unchanged this delicate balance of acid and alkali.

It is hard to bring this miracle vividly before ourselves. Imagine a bank with its receiving and paying tellers; imagine that thousands and thousands of dollars are being poured into that bank in various amounts, large and small, and at various times of the day, without any rule or order. Then at the same time imagine that large amounts or small amounts are being taken out of the bank by depositors. This is what is usually going on in fact. Now imagine what, of course, never happens, that the balance of money in that bank is preserved within a few dollars of the same amount at all times. Imagine that if the balance in the bank varied more than a few dollars the bank would break. Then you have a picture of what is actually going on at the present moment in your body and the bodies of all human beings. It seems too strange to be true, but it is true.

3. Compensation. We all know that if a person is unable to use one arm and as a result uses the other constantly, the arm which is used for two gains something like the strength of two. In the School for Crippled Children at Canton, Massachusetts, I saw a few years ago a little boy who as the result of infantile paralysis had lost altogether the power of his legs. He had been at home without treatment for a long time, and there he had learned to walk on his hands. When he wanted to walk he folded up his useless legs, pushed them out of the way over his head, stood up on his hands and walked on them. He could walk upstairs and downstairs. Of course, his arms were enormously developed. That is "compensatory hypertrophy," or enlargement of the muscles in response to need and use. It is familiar to most of us in muscles. It is not so familiar, perhaps, inside the body.

When heart disease takes the form of valvular inflammation and deforms the valve, the situation is like what would happen if one of the doors of a room were stuck halfway open, so that it would neither open nor close fully. That is what happens to the heart valve when the germ of rheumatism attacks it. The individual could not live if it were not that, as the deformity gradually occurs in the valve, the heart gradually thickens and so strengthens its own muscle. A heart that is ordinarily the size of an individual's fist will become as big as two or three or even four fists, because it must. In no other way can it push the blood along hard enough to maintain the circulation when the openings into the heart and out of it are narrowed. The circulation must go on about as fast as it normally does. The compensatory growth of the heart muscle makes this possible.

With automobile accidents as common as they are today, there are a great many cases in which children are run over by a wheel in such a way that the kidney is broken or cut. The surgeon, when he operates on such a case, tries to repair the damage and in some cases he can. But in many cases he cannot do so and in order to stop the bleeding he has to remove the kidney altogether. How can he possibly have the temerity to do such a thing as to remove a human kidney? Because experience has shown that as soon as one kidney is removed the other begins to grow, and in a very short time doubles its size so that it is as big as the two were before, and does the work exactly as well.

The work of the kidney seems to us one of the most wonderful things to be found anywhere on earth. In any pair of healthy human kidneys there are many miles of tubes, and within those tubes all sorts of processes are always going on. When the solitary kidney gets twice as big, something very complicated is rebuilt or enlarged. All the details are rebuilt so as to leave the patient in the end not merely somewhere near as good, but exactly as good as he

was before. The architecture of a kidney is far more complicated and differentiated than the architecture of any ordinary building. In a house we build a cellar, kitchen, sleeping rooms, attic, closets, and so forth, for different purposes. The kidney has as many different parts. It has its own chemical laboratory in which analytic and synthetic, dissolving and combining processes are done. Some of these chemical processes are new. On occasion they make substances which so far as we know have never been manufactured in that kidney before. They are made in response to a need for an antidote for a special poison.

We said just now that we have more blood vessels, tubes which carry blood, than we need. One of the reasons that we get along so well when a number of vessels are cut or destroyed is that some of those that are left become enlarged. One of the common diseases of the liver is called "cirrhosis" or the "gin-drinker's liver." That means that alcohol or some other substance taken in with the liquor circulates through the liver, hardens it and blocks it so that the blood which should go through it from the intestine cannot pass. Yet people sometimes live with this disease for many years and never find out that they have it, because detours, such as we provide when a street is blocked, are arranged by the wisdom of the body. The blood goes through a new set of blood vessels, partly newly formed and partly old ones enlarged. In this way we sometimes get such perfect compensation for the cirrhosis that the individual feels entirely well for years and finally dies of something else.

When one goes into a high altitude and lives above 5,000 feet, the air which one breathes is rarified so that less oxygen is taken in at each breath. No one would be able to live at this altitude were it not that the red corpuscles, which carry the oxygen from the lungs to all parts of the body, begin to grow in number as soon as the air becomes notably thinned, and soon increase to an extraordinary degree.

In every cubic millimeter of blood (which means a drop about the size of a large pinhead) we have five millions of red corpuscles. After a person has spent a few weeks in a high altitude he has six million, and if he goes to a higher altitude he has seven million. I have seen a person who had gone to so high an altitude and lived there so long that he had nine million red corpuscles to a cubic millimeter of blood. This was a compensatory change. He used the diminished supply of oxygen which came into his lungs in that high altitude so effectively and so rapidly that he was perfectly well. When he came down to a low altitude the extra red corpuscles were destroyed and put out of the body and he throve on five million, as he did before.

4. Defense. Rest is defense. If you sprain your wrist it becomes swollen and stiff. Nature says, "You had better rest that wrist." Even before the doctor comes, "nature" splints the wrist by making it so sore that you hesitate to move it, and so stiff that you cannot easily move it. The doctor reinforces nature's splint with an artificial one.

If a patient is strained emotionally or physically beyond a certain point by exertion or terror, nature says, "Take a rest," and he faints. Soreness and stiffness in a wrist, fainting after a hard race or in an accident, seem like something hostile to our welfare, something to be fought against. But the truth is that they are evidence of a power working on our side to do us service.

What we do in the treatment of an injured joint is to imitate nature and to supplement nature. What we do in most branches of medicine is to imitate and supplement nature. We imitate by means of a stomach tube one of the body's natural defenses: vomiting. When poison is swallowed the stomach usual-

ly rejects it before the physician with his stomach tube can get there to help in the emptying. The body rejects poisons through several channels; it throws out alcohol through the lungs so that we smell it in the drinker's breath. The body also puts out poisons by the bowels and sometimes by the blood. Nosebleeds in persons with kidney trouble help to get poisons out of the body. Any competent physician knows that when a person with kidney trouble has nosebleed it is one of the best things that can happen. By bleeding him nature is unpoisoning him and lowering his blood pressure at the same time.

The body also defends itself against poisons by neutralizing them. The most familiar example of this is in the germ diseases, from which we suffer because bacteria invade our bodies and form poisons or "toxins." These must be neutralized or we die. The body itself forms antitoxins which are specific, unique substances, each different from each and hostile only to the poison of the disease for which it is formed.

Before we had the remedy which we now call "antitoxin" for diphtheria the mortality was about forty per cent, which meant that in about sixty per cent of the cases nature formed enough antitoxin in the child to cure it, but that in forty per cent the body did not make enough antitoxin. To supplement it we make outside the body an artificial "diphtheria antitoxin," imitating nature as nearly as we can. We build up in the blood of another animal, ordinarily a horse, an antitoxin like that which the human body itself builds up against diphtheria, but which it does not always build in sufficient quantity. We put into the veins of a healthy horse a small amount of diphtheria poison. The horse eats a little less hay for a day or two and then he is all right. Then we put in double that dose. Again he may be a little under the weather but in a few days he is all right. So we go on step by step to build up in this animal the neutralizing substance opposite to this particular poison. His blood will not neutralize the toxin of any other disease except diphtheria. The new-formed antitoxin is a specific and unique substance.

Then we draw off from the jugular vein of the horse a certain amount of his blood, not enough seriously to incapacitate him but enough to be of use to many human beings. We drain off the corpuscles, put in a preservative, and the result is a yellow fluid which we call diphtheria antitoxin. That is what we put into the child's body to aid the antitoxin which the body has already made there after the disease began. In this way the mortality of diphtheria has been reduced to six or seven per cent, and with the protective injections which are now being carried out in every intelligent community we are reducing diphtheria to zero. Many of us now alive may see diphtheria wiped out altogether, as small pox is in places intelligent enough to down the antivaccinationists and enforce vaccination laws.

We have described how the body neutralizes poisons of the kind produced in infectious diseases by bacteria. But the body neutralizes poisons in many other ways. A suicidal unfortunate swallows a strong acid. Then the body manufactures enormous quantities of alkali, far more than it was making before for any other purpose, and so neutralizes the poisonous acid. When one recovers from certain kinds of poisoning it is nine-tenths by reason of what the body does by way of neutralization and one-tenth what the doctor does to imitate and to supplement nature.

Consider now another of the body's self-defenses. If you wound your finger with a splinter of wood or with anything else that is apt to be dirty, there often occurs the process that we call festering. What we call "pus" appears round the splinter. We do not stop to think what this means. To me it is one of the most dramatic and one of the most wonderful things that happen in

the human body. What is this stuff called "matter" or "pus"? It is the dead bodies of leucocytes, that is, of white corpuscles from the blood, which have come to the spot, have fought upon our side against the bacteria, have died in the fight and have piled up their bodies to make a wall of defense between the attacking bacteria on the one side and the free circulation on the other. If this wall were broken down and the bacteria got into the blood we should have blood poisoning and probably die. Every dirty splinter that we get into our hands might be fatal were it not for the fight put up for us by these little creatures called leucocytes.

The human body is built up of cells, just as houses are built up of bricks. Among these cells most are as fixed as the bricks in a wall, but there is one race of free, lively and intelligent cells, the leucocytes in the blood, which in response to a need for them, travel to any part of the human body and there fight, destroy many bacteria, and are themselves often killed in the fight. They conquer in the vast majority of cases because they build up the protecting wall just described. Almost every case of appendicities would be fatal if this wall of leucocytes were not built by "nature" around the diseased appendix. What doctors call "walling off" the disease happens without any surgeon and before the surgeon gets there, in the majority of cases. The bodies of the leucocytes shut in the inflammation until the surgeon gets there to remove it.

In my medical work I have had the chance to examine dead bodies of persons who had died in spite of the best we could do at the Massachusetts General Hospital, where I have worked for nearly forty years. Nothing sounds more sordid and more discouraging than the job of examining dead bodies. There we see the failures of nature's healing, the defeats of the human body in its struggle against disease. Yet the study of these bodies has been one of the most inspiring experiences that has ever come to me. For we see at an autopsy not merely the defeat that has resulted in death, but the whole history of that body's earlier victories written in its tissues. Here we see the battlefields on which the body has conquered disease years ago, without even letting the brain know that the disease was going on.

When we cut into a lung at autopsy we often find evidence of a healed tuberculosis which during his life the person never knew he had. The knife with which we cut may be broken across a stone, a mass of lime deposited there by the blood so as to wall in a group of tubercle bacilli, as in the Middle Ages they sometimes walled in a human being in the wall of a castle and left him to die. So the healing powers of the body, wall in the tubercle bacilli in the lung so that they are harmless. We cut through this stone and sometimes find the tubercle bacilli still alive but harmless, because they are shut off from the lung. Till recently the majority of all the bodies which we examined showed some signs of a healed tuberculosis.

Summing up this chapter I will describe one individual whose face comes before me as I write about him. An elderly man, sixty-four years of age, with a ruddy, fresh complexion and white hair, stepped off the corner of a street without looking where he was going, was struck by an automobile and fatally injured. He was brought to the Massachusetts General Hospital and died within an hour. His wife came soon after, and when we asked her about him, she declared that he had never been sick in his life. He was a bartender, a local politician, a most active person both in mind and body. I was present at the autopsy on his body, and this is what we found: (1) Healed tuberculosis of both lungs. (2) Cirrhosis of the liver, with all the blood going around by a new set of roads above and below his liver. (3) Chronic kidney trouble, but with enough reserve kidney tissue to carry on the kidneys' function perfectly despite the destruction of a large portion of one and a small portion of the

other kidney. (4) Hardening of the arteries and compensatory enlargement of his heart. No doubt he had had high blood pressure for a long time. All this he never knew. In other words, here was a perfectly well man with four fatal diseases inside of him, none of which had done him any harm!

When part of a vessel is injured in a storm, they rig up something to take the place of it. A "jury mast" is rigged up for a broken mast, or a "jury rudder" for a broken rudder. This man's body was full of "jury" arrangements. Four vital organs had these compensatory defenses, but he was a going concern. He could do what he wanted to do and felt no inconvenience, because of the intelligence of the human body exerted in his defense.

The facts are before us. Every doctor knows them. There is nothing new or doubtful about them. The conclusions are for each to draw for himself. The conclusion which I draw is a greater confidence in life. However we may fall short, a gigantic healing power fights on our side. Matthew Arnold defined God as the power not ourselves that makes for righteousness. The thing I am speaking of here is that great power in ourselves that makes for health, and that works day and night, when we are asleep and when we are awake, when we are good and when we are bad. Its beneficence falls like rain upon the just and upon the unjust.

To me that means the goodness of god--vis medicatrix Dei. It means that the powers which carry on the work of our body are not neutral in the battle between us and the enemies of our health. A great healing power fights on our side and wins most of our battles for us. When we look around at "nature" in the mountains, the forests, the plains or the sea, we see no evidence of powers that care about us. Nature seems indifferent to our welfare. But if we look at that portion of nature which concerns us most, our own bodies, we see no indifference, no neutrality, but an extraordinary bias in our favor. On the basis of these healing powers our intelligence and our will get their opportunity.