

stituted. This is the essential process which underlies all life; not that of man only, but the life of all animals and of all plants. This process is what might be called vital chemistry, but vital chemistry rests upon, absolutely depends upon, organic chemistry, and this again as absolutely rests upon and depends upon inorganic chemistry; so that these two last named had to be mastered before vital chemistry could be successfully studied.

(4) And if we pass now to the fourth or Dynamic series, we shall see that this is just as true of the *forces* which animate our bodies as it is of the *material* of which these bodies are built up. Just as the matter of which our bodies are composed is related to all other matter—is built up of dead matter and returns to dead matter again—so is it equally true that every one of the varied forces which reside in our frame, and which we call vital forces, is merely borrowed for a moment from the great ocean of force in the outer world, and when used is returned to that again. And this is true not only of the force which drives the blood through our arteries and veins, of the force which we exert with our limbs, and the force with which we breathe; but it is true also of those far more ethereal and (so to speak) human forces called thought, desire, emotion, passion, and will. So true is all this that it is now well recognized that before the forces that make up the life of a human being can be in any radical sense comprehended, it is necessary to understand not only the vital forces generally (those of the vegetable as well as those which belong more especially to the animal kingdom), but those of inorganic nature also.

When these last have been mastered we find that they all, motion, heat, light, electricity, magnetism, chemical affinity, are continually passing into one another; that the same unit of force is at one moment one, and the next moment another of these; that they each have a definite value in relation to all the rest; that, for instance, so much motion is equal to (will produce) so much heat; that so much chemical force is equal to (will produce) so much electricity; that so much light is equal to (will produce) so much magnetism; and so on of them all. Not only so, but as with matter so with force. As far as our experience goes, none is ever

created and none is ever lost; but the total quantity in the universe remains always exactly the same. And just as light, heat, magnetism, motion, and the other forces of the inorganic world, are continually passing from one of these forms to another, so also in a living body are these inorganic forces becoming from moment to moment vital forces; and the vital forces are as constantly reassuming their original non-vital character. The same substance which was yesterday food is to-day a part of my living body, and to-morrow will be part and parcel of what we call the dead world. And the force which one moment ago existed within my brain as chemical affinity is now a thought, and in another instant will be heat. But what I especially wish to draw your attention to is that all vital dynamics, of which I have just presented a momentary glimpse, is a constituent and necessary part of the study of the human body and therefore of the study of medicine; and that that study involved and necessitated the mastery of the laws of the forces of the outer world.

(5) In still another series of facts we see the same truth illustrated. Man has not only a body, but a mind as well. *Ab initio*, the study of the human mind was part of the study of medicine. Before the time of Hippocrates, physicians studied psychology and classified mental diseases, and ever since the healthy and the diseased mind have been among the primary objects of medical science. To throw light on this great subject all nature has been ransacked, but, above all, the mental operations of animals, from the lowest to the highest, have been explored and considered. And with this result, that here again we find two parallel series, the one in man and the other in animals, leading from the same point to the same point and each pursuing on its way the same route. Low down in the scale of animated nature mind has its deepest taproot in protoplasmic movements, in non-nervous adjustments, in partly nervous adjustments, and in nervous adjustments—then what may be called mind itself begins in the rudiments of sense, the faculty to feel pain and pleasure. With this faculty, or immediately after it, comes memory; then the primary instincts, as surprise, fear, and association by contiguity. As we ascend the animal scale, we