

excite the heart, the vascular system, and the glandular organs. As the emotions rise in strength, however, the various systems of muscles are thrown into action; and when they reach a certain pitch of intensity violent convulsive movements ensue. Anger frowns and stamps; grief wrings its hands; joy dances and leaps—the amount of sensation determining the quantity of correlative movement.

The intellectual operations are also directly correlated with physical activities. As in the inorganic world we know nothing of forces except as exhibited by matter, so in the higher intellectual realms we know nothing of mind-force except through its material manifestations. Mental operations are dependent upon material changes in the nervous system; and it may now be regarded as a fundamental physiological principle, that “no idea or feeling can arise, save as the result of some physical force expended in producing it.” *The directness of this dependence is proved by the fact that any disturbance of the train of cerebral transformations disturbs mentality, while their arrest destroys it* And here, also, the correlation is quantitative. Other things being equal, there is a relation between the size of the nerve apparatus and the amount of mental action of which it is capable. Again, it is dependent upon the vigor of the circulation; if this is arrested by the cessation of the heart's action, total unconsciousness results; if it is enfeebled, mental action is low; while if it is quickened, mentality rises, even to delirium, when the cerebral activity becomes excessive. Again, the rate of brain activity is dependent upon the special chemical ingredients of the blood, oxygen and carbon. Increase of oxygen augments cerebral action, while increase of carbonic acid depresses it. The degree of mentality is also dependent upon the phosphatic constituents of the nervous system. The proportion of phosphorus in the brain is smallest in infancy, idiocy, and old age, and greatest during the prime of life; while the quantity of alkaline phosphates excreted by the kidneys rises and falls with the variations of mental activity. The equivalence of physical agencies and mental effects is still further seen in the action of various substances, as alcohol, opium, hashish, nitrous oxide, etc., when absorbed into the blood. Within the limits of their peculiar action upon the nervous centres, the effect of each is strictly proportionate to the quantity taken. There is a constant ratio between the antecedents and consequents.

How this metamorphosis takes place—how a force existing as motion, heat, or light, can become a mode of consciousness—how it is possible for aerial vibrations to generate the sensation we call sound, or for the forces liberated by chemical changes in the brain to give rise to emotion; these are mysteries which it is impossible to fathom. But they are not profounder mysteries than the transformation of the physical forces into each other. They are not more completely beyond our comprehension than the natures of mind and matter. They have simply the same insolubility as all other ultimate questions. We can learn nothing more than that here is one of the uniformities in the order of phenomena.