

**Fragments of medical science and art : an address delivered before the  
Boylston Medical Society of Harvard University / by Henry Jacob Bigelow.**

**Contributors**

Bigelow, Henry Jacob, 1818-1890.  
Royal College of Surgeons of England

**Publication/Creation**

Boston : William D. Ticknor, 1846.

**Persistent URL**

<https://wellcomecollection.org/works/yjwzfq2b>

**Provider**

Royal College of Surgeons

**License and attribution**

This material has been provided by This material has been provided by The Royal College of Surgeons of England. The original may be consulted at The Royal College of Surgeons of England. where the originals may be consulted. This work has been identified as being free of known restrictions under copyright law, including all related and neighbouring rights and is being made available under the Creative Commons, Public Domain Mark.

You can copy, modify, distribute and perform the work, even for commercial purposes, without asking permission.

**wellcome  
collection**

Wellcome Collection  
183 Euston Road  
London NW1 2BE UK  
T +44 (0)20 7611 8722  
E [library@wellcomecollection.org](mailto:library@wellcomecollection.org)  
<https://wellcomecollection.org>

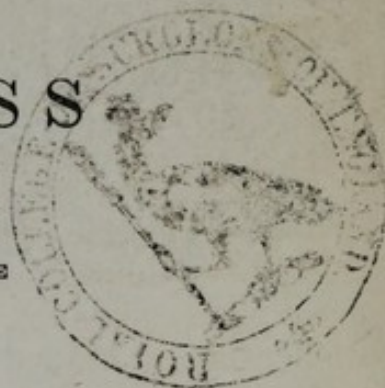
4  
FRAGMENTS OF MEDICAL SCIENCE AND ART.

---

AN

ADDRESS

DELIVERED BEFORE THE



BOYLSTON MEDICAL SOCIETY

OF

HARVARD UNIVERSITY.

BY HENRY JACOB BIGELOW, M. D.

PRESIDENT OF THE SOCIETY.

PUBLISHED BY THE SOCIETY.



BOSTON:  
WILLIAM D. TICKNOR AND COMPANY.

M DCCC XLVI.

ADDRESSES  
OF  
THE  
BOSTON MEDICAL SOCIETY  
HOLDING ANNUAL MEETINGS  
BY HENRY MOORE WELLS, M.D.

---

BOSTON:  
PRESS OF THURSTON, TORRY, AND CO.  
31 Devonshire Street.

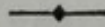
BOSTON  
WELLS, H. M. TORRY AND COMPANY

THE few details of astronomical discovery cited in the following address have been taken with one or two exceptions from the original works, or compared with them, when accessible. For the accuracy of the rest I have referred to the histories of science which furnished them.





## ADDRESS.



IN looking back upon the brief period that has elapsed since I had the honor to be an immediate member of your society, I am reminded of a number of general inquiries for the investigation of which time and opportunity did not always serve. I have thought that in occupying your attention this evening with the consideration of some of the more prominent of these, I might here and there do something to level the path you are all soon to follow. I have added to these glances at science, a few remarks bearing upon our art. I am aware that individual views are liable to be tinged by the fancy, or distorted by the immediate atmosphere of the observer; but I believe they may contain something common to the convictions of all. I offer no farther introduction to the following remarks upon Medical Science and Medical Art.

The inductive method is grounded on the knowledge furnished by the senses. It teaches that the senses supply to us our only true conceptions of external objects, and that true science consists in the progressive generalization of these conceptions. This position is now obvious and undisputed. But there was a time when a different be-



lief was prevalent. It was once thought beneath the dignity of man to deal with the physical conditions of nature; and partly because philosophers looked inward on themselves to gain ideas of intellectual phenomena, it was supposed that a knowledge of the material universe might also be derived from some source within the mind. Philosophers, impatient of the slow progress of discovery, sought to stride at once to their conclusions. It is now difficult to believe, that, for a period of nearly two thousand years, ending with the time of Bacon, the learned world was engrossed with error growing out of these false notions. The philosophy of Aristotle, for example, based upon apparent celestial phenomena, taught in astronomy, that the stars revolved in solid orbs around the earth; and in physiology, that *sensible species* or immaterial shapes came off from bodies, and passing along the nerves, were physically stamped upon the brain; and during this long period these empty theories and wordy nothings were received as truth by the philosophers of Europe and the sages of Arabia and Persia. Until the close of the sixteenth century, the philosophy of Aristotle still continued in the schools, and men talked of *intention* and *remission*, of *formality* and *individuality*; mere abstract ideas, having no prototype in nature, the fictions of a tortured intellect, "the idols of the human mind, and not the ideas of the divine mind." \*

In explaining this protracted prevalence of error, it should be remembered, that truth is difficult of access. It does not require patient investigation and laborious thought to frame a false system of philosophy, to deduce an ingenious theory from a few facts; but truth unveils herself to constancy alone, to persevering love, of which few are capable. Nor is it the cause of error to which man,

\* Nov. Org. B. 1, Aph. 23.



once enlisted, clings with such tenacity ; he clings to his own cause ; his own philosophy ; with the determination of a chief or the zeal of an adherent ; pride animates and prejudice arms him ; it is the cause of human passion. It is not then wonderful that there are so few minds able to divest themselves of human weakness, to acknowledge error and abandon cherished fallacy, to love truth for its own sake ; and to find in its discovery a source of elevated happiness. Bacon

‘ Led forth the true philosophy, there long  
Held in the magic chain of words and forms.’

The *Novum Organon* was published towards the end of the sixteenth century, its name being suggested by the *Organon* of Aristotle. It taught that science was “a knowledge of the world as God made it, and not as man made it ;” that nature, to be known, should be studied in her works ; that to obtain a knowledge of a stone, an animal, or a star, the philosopher should examine the objects themselves ; that he should not shut his eyes and his ears in a vain attempt to divine their occult qualities. More than this, it taught that “the true, but unattempted way” of discovering truth, “constructs its axioms from the senses and particulars, by ascending continually and gradually, till it finally arrives at the most general axioms,” \* “by intermediate steps ;” † “that we must add lead or ballast to the understanding, to prevent its jumping or flying.” ‡ These were no startling positions ; yet for two thousand years were men occupied with profitless speculation upon notions of the material world, drawn by some single hasty effort from the misty recesses of their own imaginations.

The inductive method also teaches, that if truth lies in facts, we have only to collect facts to discover it. But



Bacon knew how ready the mind is to pursue some false light into the morass of error; "to start off to generalities, that it may avoid labor;" \* that such "anticipations will be assented to readily, because, being deduced from few instances, they immediately hit the understanding." † He says, that the pursuit even of truth, in minute details, confounds and distracts the understanding, which, "undirected and unassisted, is unequal to and unfit for the task of vanquishing the obscurity of things." ‡ To insure accuracy, therefore, facts are to be written down and subsequently counted. In Bacon's own words, "we must form tables and coördinations of instances, upon such a plan and in such order that the understanding may be enabled to act upon them." § All this is now obvious and undoubted. False theory is not the error of our day, nor of our scientific community. But while in medicine, the value of facts is recognised, possibly overrated, their application is a fertile source of error.

Open any medical journal of the last week, or of last year, and you shall find an account of some new, successful remedy; and yet another year shall obliterate this record, and substitute new methods equally infallible. There is error either in the facts or in the induction. Here is Bacon's quaint exposition of this fallacy. "It was well answered by him who was shown in a temple the votive tablets, suspended by such as had escaped the peril of shipwreck, and was pressed as to whether he would then recognize the power of the gods, by an inquiry, 'But where are the portraits of those who have perished in spite of their vows?' " || We listen to partial or imperfect evidence. Impressed with an idea, we accept only the facts whose tendency confirms our notion. In the words

\* Nov. Org. B. 1, Aph. 20. † Id. B. 1, Aph. 28. ‡ Id. B. 1, Aph. 21.

§ Nov. Org. B. 2, Aph. 10. || Id. B. 1, Aph. 46.



of Bacon,\* "It is the peculiar and perpetual error of the human understanding to be more moved and excited by affirmatives than negatives, whereas it ought duly and regularly to be impartial; nay, in establishing a true axiom" (or law), "the negative instance is the most powerful." These natural tendencies of the mind, then, show the necessity of insuring accuracy by writing; "the understanding being as incapable of acting on such materials of itself, with the aid of memory alone, as any person would be of retaining and achieving by memory the computation of an almanack." "Yet meditation," says Bacon, and with almost equal truth might it have come from Louis, "has hitherto done more for discovery than writing, and no experiments have been committed to paper."†

In its most general sense, induction is not only applicable, it is essential to the discovery of all law in nature. The student admits this, and yet at some time or other most of us have felt a certain undefined doubt whether the inductive method was adapted to the wants of medical science. A recent able and elaborate work on medical philosophy, tells us that "physiology is not deducible from anatomy; that the knowledge of pathological phenomena does not flow from the knowledge of physiological phenomena."‡ In other words, that all we know, in each of the medical sciences, is the direct result of observation in that science; that there is no inference, no action of the mind upon the observation. And yet you shall elsewhere learn that it is the duty of great laws in science to predict results of new combinations. Such a law, to use Bacon's expression, "points out new particulars," a property he alludes to when he says,

\* Nov. Org. B. 1, Aph. 45.

† Id. B. 1, Aph. 101.

‡ Bartlett, Phil. of Med. Science, p. 99.



“ Our road is not along a plain, but rises and falls, ascending to axioms and descending to effects ;” \* in other words, rising to general laws from comparatively few data, and descending to new facts which these laws indicate. There are certainly anatomical facts which point to facts in physiology, just as the discovery of the venous valves, made by Sylvius and completed by Fabricius, foretold to Harvey their function in the animal economy. Here was undoubtedly an inference upon the existence of these valvular pouches ; and a similar process of inference has led to the discovery of other facts in each of the medical sciences. How far then is the method of Bacon, which is generally supposed to admit of no speculative action of the mind, applicable to our science ?—and what is the analogy between the laws of our science and those of other sciences ?—between a law, for example, of Louis, that tuberculous deposit exists in the lungs, if anywhere, and the laws of optics, which measure the velocity of the ray of light, as it travels many thousand miles while the eye winks ; and tell us that the retina receives from every violet ray, 727,000000,000000 of undulations in a second ? — what is the relation between the statement that Peyer’s patches are diseased in typhoid fever, a law absolute and immutable, but telling us of nothing new in the future ; true only of itself, narrow in its tendencies, and selfish in its relations ; between such a law and one which penetrates the mysteries of the future, which unerringly predicts the event of the conflict of unappreciable atoms, or speaks of the earth and stars, and assigns them their position in space through all future time ?

A great discoverer is commonly a great genius. And yet the student has a vague suspicion that the observer, with his note book, is a dull man ; that the process of induction does not require ability ; that statistic results, apart

\* Nov. Org. B. 1, Aph. 103.



from observation, are the work of laborious and slow minds, — of industry which plods, of intellect which never sparkles.

These are some of the unsettled positions and indistinct impressions I would attempt to define with a clear outline, if possible, without fatiguing your attention with unnecessary generalities.

And first, How much of medical science is drawn from facts by the process of induction, and how far are we able to anticipate this process, and to foretel certain facts by means of others? To predict in science the results of new combinations, we must be in possession not only of former results, but of the machinery which has produced them.\* A common loom and piece of cotton cloth being supplied us, we can foretel that linen or woollen thread will be woven by the same loom into a similar fabric. So when the mass of a heavenly body is given, with the mechanical attraction of gravitation, and the forces previously acting upon it, we can foretel its position at any future time. The rule which refracts the ray of light being given, we can calculate the results of any future combination of lenses. In the same way, if the tendencies of polar force, which exhibits opposite properties in opposite positions, are our data, we predict the effect of many untried combinations of magnetic or electric currents. But place a sheet of paper in the hands of a man ignorant of the process of paper making, and he cannot foretel what materials are capable of being made to assume this density; nor, before the properties of gravity or of refraction were known, could the philosopher predict anything of their effects. We can prophecy only after we understand the machinery which is at work. Now the only forces in the material world, of which we possess this sort of knowledge, are three: known as mechanical, chemical,

\* See Appendix A.



and, in a more limited degree, polar force ; the first of course including, among other sciences, hydrodynamics, optics and acoustics. In ascertaining, therefore, how far these three forms of force are exerted in the animal economy, unmodified by any other, we shall determine how far the medical sciences are capable of predicting one of another.

In anatomy, the valves of the veins and structure of the joints point directly to their uses ; and if final cause in medical science be synonymous with function, it is their mechanical final cause which leads us from Anatomy to Physiology. Again, explain to an engineer the system of the circulation, and ask him what will be the tendency of obstruction of the aortic valves, he will show you that there must be 'backwater ;' a reflux of the fluids into the channels, which deliver it into the left ventricles. And in fact there is this reflux of blood upon the lungs, producing local congestion, with its symptoms, in many cases of chronic cardiac disease. The optician tells you that the crystalline lens throws an inverted image upon the retina. A medical tyro will infer that opacity of the lens will obliterate this image ; or that perforation of the thorax will be followed by collapse of the lungs. Here physiology points by the aid of mechanical force to pathology.

Again, no man carries in his head the whole extent of auscultatory detail, without the acoustic principles which show why these phenomena take place. Induration obscures percussion, and other things equal, conducts sound. Pathology thus directs us to truths of semeiology, still by our knowledge of mechanical force. And in a symptom well known as acidity of the stomach, pathology by the aid of chemical force points to the appropriate therapeutic agent. Surgery abounds in extemporary mechanical remedies to which pathology directs it. It is obvious that these sciences are not independent one of an-



other; and for this reason, it can hardly be said that "our knowledge of pathological phenomena does not *flow from* the knowledge of physiological phenomena." On the contrary, facts in one of these sciences are frequently suggestive of facts in another; they lead to *hypotheses*, which I shall attempt soon to show bear no unimportant part in scientific progress. We are not compelled in the cause of medical science to divest ourselves of all experience that has not come to us in medical form; our previously acquired knowledge of acoustics or hydraulics, will in some degree serve us when their principles are involved in medical science.

Still are the facts to which we are thus pointed not decisive, because they are liable to be modified by another mechanism of which we know nothing. There are *vital* forces at work which counteract the most obvious tendencies of the material particles of the human fabric. What prevents the arteries from being dyed red, or the body from falling to the ground, or in short the whole mass from decomposing? It is vital force, whose power to hinder the most obvious effects of other force must, till we comprehend its nature, render all prediction in the vital science fallible.

There are but few sciences in which we have detected the machinery which is the immediate cause of their phenomena; and although, in the words of Bacon, "It is rightly laid down that true knowledge is that which is deduced from causes,"\* many sciences like ours are made up merely of aggregated facts, without reference to the manner of their production. Laws of phenomena are the sum and expression of knowledge already acquired; they open no new region of knowledge. Why do we know that lymph is and will be common on the tonsils and in the air tubes? Because we have observed it.

\* Nov. Org. B. 2, Aph. 2.



But what does this tell us of the intestinal canal, or other mucous surfaces, where it is comparatively rare? It tells us nothing; we know only what we have known. Our knowledge is limited by the fact; and with blind reliance we trust in nature's constancy, and in the accurate adjustment of her vast machinery. Far different is the science which studies the detail of the great machine, which understands its complex movements and detects its variations, which wrests from resisting nature her great secret, and foretels, ages beforehand, the workings of her universal laws.

Yet have these laws of phenomena a great and undisputed value. The facts, in the words of Kepler, "are collected into one fagot," though no scrutiny has enabled us to penetrate their substance. Laws of phenomena detect and assert the similarity of facts, they point out their common element, and draw from each a thread by which they are suspended from a common centre. In time these threads are twisted into cords, which in their turn are woven into some great fabric. They distinctly state a proposition which is to be subsequently proved or disproved, and supply a series of equations from which the value of the common  $x$  is finally deduced. In the instance, for example, of polarity, a force now in process of discovery, we thus trace the connexion of the ray of the setting sun as it was reflected from the windows of the Luxembourg with the phenomena of crystallization, chemical affinity, magnetism and electricity. Wild and straggling facts of unknown growth are here laid side by side. They are brought into the domain of science, and the wedge is at last entered which lays them open and reveals their hidden entity.

The chief employment of the medical philosopher is to establish these laws of phenomena; to ascertain the



frequency with which certain facts occur with other facts ; to point out the element most constant to a wide range of phenomena ; the very ends which the inductive method of Bacon, and the numerical method of Louis, its medical application, teach us to attain with certainty. Medical diagnosis and medical prognosis obviously grow out of rigid induction.

But let us note an important distinction in the present application of this return to diagnosis and to therapeutics. If we err in our principles of diagnosis, it is of comparatively little consequence. If we choose to consider sorethroat a necessary effect of the cause which produces the other symptoms of scarlet fever, or the eruptions essential to the exanthemata, when they are really only incidental to them, science alone suffers. The inductive method offers us the surest results we can obtain, even though these are uncertain. But if we err in therapeutics, it is not science alone, it is the patient that suffers. Suppose it is conclusively shown, that when a hundred patients are bled in a certain disease, fifty-five always recover ; and that when these hundred patients are not bled, only fifty get well ; and suppose we bleed our hundred patients ; we shall be very likely to kill somebody who, otherwise treated, would have proved a useful member of society. Science gains her five per cent, but humanity loses a man or a woman or a child. Such treatment may do for armies, where one man is as good as another ; but does not answer for individuals, by nature prone to over-estimate their personal consideration.

The fact is, the diseases we compare, and whose similarity we affirm, are very dissimilar. Every case of disease varies in its character from every other case of the same disease. It varies in its intensity, its complications, and its tendencies. It varies with the constitution of the patient, and with external influences. It varies in the



rapidity of its march, and in the duration of each symptom. The same treatment therefore affects single cases very differently. But it is a singular principle in nature, that differences tend to neutralize each other in the long run. That while individuals deviate, like the asteroids in their revolutions, equally above and below a fixed line, the tendency of the mass is to an average always constant. This principle equalizes the number of births and deaths ; of male and female children ; it makes the annual proportion of dead letters to other letters always the same in the English post-office ; and in exactly regulating the laws of mortality, it guarantees success to life insurance companies founded on proper computations. But it does not tell us the sex of the child, nor the length of any man's life, nor the chance any given letter has of being called for. Men vary above or below a certain healthy standard. If in some disease this standard is too high, it must be lowered, but in this process some one whose scale of mortality was already low will be submerged ; yet we cannot tell who this individual will be, until we know what constitutes vital force. No rule in therapeutics applies indiscriminately to any other than a theoretically fixed standard of disease ; if we can arrive at such an ideal standard only by averaging the mass, the rule is applicable only to this mass ; and so long as the practice of medicine is for the benefit of individuals, such a principle will be of limited utility to the physician. To give fair play to this equalizing tendency, induction should be based upon a broad range of facts. Narrow induction is the bane of medical science, and the physician who infers that nature will gain her equilibrium in three or five successive facts, and argues from them, might with equal wisdom, in a game of chance, bet upon *rouge*, because it has won but twice, while *noir* has gained three times.



But let no one argue for these reasons the inadequacy of the inductive method. It is ignorance alone that hinders us from availing ourselves of it. If medicine were an exact science it would be not only applicable but necessary to therapeutics; and as science advances, and we approach nearer and nearer this stage of medical knowledge, induction becomes more and more indispensable. And even now the self-adjusting tendency of nature furnishes us truth in its relation to the mass. The inductive method is of undisputed value in determining, for example, whether a supposed remedy has or has not a value. More than this, it tells us very nearly what this value is. If fifty patients in a hundred have recovered from a certain malady under the use of carbonate of iron, while fifty in a hundred have got well without it, I decide this remedy to be nearly inert in this disease. If the proportion of recoveries under the remedy much exceed this statement, I infer that the medicine possesses some efficacy; if the number of recoveries is much less, I am equally sure it is injurious. And I am right in all these suppositions. But there is another quality of the inductive method, and I am not aware that it has been observed, which requires that the results derived from it, at least in therapeutics, should be of unequivocal numerical force. The inductive method speaks of coincidence and not of cause. The lesion of Peyer's glands is coincident with febrile symptoms in typhoid fever, and so also is sore throat in scarlet fever; but we have only probable evidence whether either of these conditions is a cause or an effect. Now this relation is essential in therapeutics; we require that a remedy should seem to be a cause of convalescence, and not merely a coincidence. If with Hildanus I anoint the axe that made the wound, and fifty-five instead of fifty per cent. of wounded knights recover, does the additional five per



cent. make me believe in the efficacy of the "*unguentum*?" Can I believe in the therapeutic agency of dead man's touch, or

"Slips of yew silvered in the moon's eclipse,  
Nose of Turk and Tartar's lips."

Reason is against it, in spite of any possible and obviously accidental cajolery of the inductive method. In the connexion of remedy and disease, we must see a probable, or at least not impossible relation of cause and effect; and whence shall we derive this evidence? It must be supplied by the mind of the observer, and based either upon previous general or medical experience; or else upon the evidence of the immediate experiment, which must for this end be of overwhelming force.

To be applicable even to the mass, the evidence should be of weight, and it has been shown that unless the evidence be conclusive, and hold good of all the individuals upon whom the experiment is tried, we have no right to apply to individuals that which is true only of the mass.

We can follow no indiscriminate rule in therapeutics. We can only pause and weigh the indications, and decide each case upon its own requirements. It was a common saying of the late Dr. Baillie, "Learn your profession well, and practise it on rules of common sense;"\* and it cannot be denied, that in the therapeutics of the present day, the physician must rely to a great extent on the resources of his judgment. And what is judgment? It is the faculty which God has given man to supply the place of certain knowledge. Because invading pneumonia must be bled, will you bleed the wretch already lingering on the borders of the grave? Judgment is the act of common reason; it is a logical decision based upon the evidence of facts; and

\* Observations in Medicine, Marshall Hall, Chap. 2.



is this faculty impossible to you? Shall not your hundred cases of fever, analysed, combined, weighed, sifted in the wards of a hospital, be to you at least as the 'experience' of a hundred cases, scattered among the engrossing occupations of twenty years? Do not struggle with the crushing incubus, distracting you with its monotone, that judgment and experience come only with age. Is medical science the only one beyond the reach of active intellect? Is the mind to be depleted, and the vital force exhausted down to the comprehension of the vital science? But I am encroaching upon ground I intend to occupy at the latter part of these remarks.

I have purposely omitted, till now, any allusion to another form of induction, which involves the principle without involving the machinery of the inductive method. I mean the induction which goes on in the mind; which forms and shapes what is called *hypothesis*. And let not this name, suggestive of unsoundness and instability in science, startle the severer disciple of the statistic school. I shall attempt to show that hypothesis, in some form, is almost essential to the discovery of scientific truth. It is forced upon us in our examination of the lower and more obvious details; it is supplied by genius in the higher discoveries of science.

I am aware that this position is not recognized by many philosophers, especially in medical science of the present day. Bacon did not admit it. But the position of Bacon was peculiar, and in one respect resembled that of these medical philosophers. He knew that unfounded theory, gratuitous assertion, had been a stumbling block to all preceding science; that it had mired men deep in error. Inventing a new method, which contradicted in so many points all former systems, "founding a real model of the world in the understanding, such as it is found to be;

not such as man's reason has distorted ;" \* anxious to convince men, in the cause of science, that groundless theory was error, he attached to facts a too exclusive value. He taught that the only path to scientific truth was through the successive generalization of facts. "We must not imagine or invent," says he, "but discover the acts and properties of nature." † And in his anxiety to establish the one position, he undervalued the other.

And yet an expression now and then occurs, which seems to show that he was aware of the necessity of some suggestive principle of the mind. Thus he says, "After having constructed three tables of preparation,"... "we consider it useful to leave the understanding at liberty to exert itself, and attempt the interpretation of nature in the affirmative ;"... "which attempt we are wont to call the liberty of the understanding." ‡ And again: "The real order of experience begins by setting up a light, and then shows the road by it ; commencing with a regulated and digested, not a misplaced and vague course of experiment ; for not even the divine will proceeded to operate on the general mass of things without due order." §

Newton, who came soon after, seems to have had the same instinctive dread of an hypothesis. "Hypotheses," says he, "whether metaphysical or physical, or occult causes, or mechanical, have no place in experimental philosophy." || But, to Newton, hypothesis was unproved or false hypothesis. In his own words, "whatever is not deduced from the phenomena, is to be termed hypothesis." Unless we thus interpret him, his practice is at

\* Nov. Org. B. 1, Aph. 124.

† Id. B. 2, Aph. 10.

‡ Nov. Org. B. 2, Aph. 20.

§ Id. B. 1, Aph. 82.

|| Whewell ; Phil. Ind. Sciences, vol. 2, p. 438, and Scholium at end of Principia.



variance with his assertions. What was the theory of gravitation, before it was demonstrated, but a great hypothesis? "The first thought, we are told, which gave rise to his *Principia*, he had when he retired from Cambridge, in 1666, on account of the plague. (He was then 24 years of age.) As he sat alone in a garden, he fell into a speculation on the power of gravity; that as this power was not found sensibly diminished at the remotest distance from the centre of the earth to which we can rise, neither at the tops of the loftiest buildings, nor even on the summits of the highest mountains, it appeared to him reasonable to conclude that this power must extend much farther than was usually thought. "Why not as high as the moon? said he to himself; and if so, her motion must be influenced by it, perhaps she is retained in her orbit thereby." \* And the final calculations, which proved that the force of gravity actually retained the moon in its place, were not made till 1682. What was this improved truth, during this long interval of sixteen years, but a hypothesis? We have positive evidence that many, if not all great discoveries in science, have been thus preconceived before they were demonstrated.

Copernicus says: "Then I too began to meditate concerning the motions of the earth; and though it appeared an absurd opinion, yet since I knew that in previous times, others had been allowed the privilege of feigning what circles they chose, in order to explain the phenomena, I conceived that I also might take the liberty of trying whether, on the supposition of the earth's motion, it was possible to find better explanations than the ancient ones, of the revolutions of the celestial orbs. Having then assumed the motions of the earth, which are hereafter explained, by laborious and long observation I at

\* Whewell's Hist. of the Induct. Sciences, vol. 2, p. 153.



length found" \* in it a satisfactory explanation of the apparent motions of the planets.

What led Kepler to the discovery of the great laws which built the structure of astronomy up to the law of gravitation? It was a conviction of the existence of some appreciable and exact relations between the distances and times and forces of bodies which revolve about the sun. In his own words: "The motion of the earth, which Copernicus had proved by mathematical reasons, I wanted to prove by physical, or, if you prefer it, by metaphysical." † In 1619, he says: "What I predicted two-and-twenty years ago, as soon as I had discovered the five solids among the heavenly bodies; what I firmly believed before I had seen the harmonies of Ptolemy; what I promised my friends in the title of this book (on the most perfect harmony of the celestial motions); what I knew before I was sure of my discovery; what sixteen years ago I published as a thing to be sought; that for which I joined Tycho Brahe; that for which I settled in Prague, and for which I have devoted the best part of my life to astronomical contemplations; by the will of God who inspired me, and who excited in my mind an insatiable hunger — at length I have brought to light, and have recognized its truth beyond my most sanguine expectations." ‡

Davy did not plunge the wires of his battery into a promiscuous mass of inorganic compounds. His theory was, that certain alkalies were compound substances, and he proved his theory in decomposing them. Jenner, while yet a student of medicine, founded his theory upon the assertion of the simple peasant girl, who incidentally remarked, when small pox was mentioned in her presence, "I cannot take that disease, for I have had cow-pox." From that time the thought was ever in his mind;

\* Whewell, *Hist.* 1, 369.

† Wh. *Hist.* 1, 403.

‡ Kepler. *Harmonices Mundi*, p. 178.



and when John Hunter said to him, in the words of encouragement, "Don't think, but try; be patient; be accurate;" he did try. Ten years after, he disclosed his now well grounded hopes to his friend Edward Gardiner, and in 1798, after an interval of twenty-eight years of labor, he published his pamphlet, and announced to the world his theory and its proof.\*

It is useless to multiply instances. Every great discovery in science is preceded by a theory, a definite form of belief, a proposition, which facts afterwards disprove or verify. Not only is this hypothesis constructed; but all lawful means are used to prove it true, and to reconcile discrepancies. In his investigations of the orbit of the planet Mars, Kepler labored thus, to reconcile two theories. As he said of himself, "I considered and reflected, till I was almost mad," not perhaps without reason; for how intricate to the unastronomical is that confusion, which, resolved into well-ordered truth, led Kepler to exclaim, "How ridiculous in me! as if libration in the diameter might not be a way to the ellipse!"† It reminds one of the German authoress, who exclaims in equal perplexity, "A thought has almost hammered my head in two; namely, that the future does not come towards us, does not lie before us, but streams from behind, over our heads."

But facts are not to be perverted. Their use is to test, to prove or disprove, not to confirm theory. The error of former science, the error of recent medicine, was not that hypotheses were made, but that they were constructed to be proved; that truth was warped and misapplied; that facts were prostituted in the cause of ignorance and prejudice. Philosophers made a show of

\* Baron's Life of Jenner, vol. 1, chap. 4

† Kepler. Astron. Nov. Plurium annorum pertinaci studio elaborata Pragæ. 1609; p. 285.



listening to the evidence of nature, while they aimed to prove a verdict, which was signed and sealed before the trial. Such, in our science, were the 'inflammation' of Broussais, the febrile theory of Cullen, the stimulating system of Rasori, and many other theories, which first stated a proposition, and then collected facts to support and confirm, not to test it.

And is there any evidence that great discoverers have rejected their own elaborate hypotheses, because they were false? When Newton first calculated the force of gravity upon the moon, he found that his results placed this body about two feet from its actual position at the end of every minute, and for this difference of two feet in the immensity of space, he at once sacrificed his cherished theory. Years after, when it was mentioned at the Royal Society, that Picart had proved a slight error in the estimated length of a degree of latitude, Newton was present. "He went home, took out his old papers, and resumed his calculations. As they drew to a close, he was so much agitated, that he was obliged to desire a friend to finish them. His former conjecture was now found to agree with the phenomena, with the utmost precision."\* His hopes were at last confirmed, and his hypothesis became a truth.

An inextinguishable love of truth led Kepler again and again to remodel his hypotheses, when they failed to satisfy the results of observation. In his own figurative words, "While I thus triumph over the motions of Mars, and prepare for him, as for one conquered, the prisons of the tables, and fetters of equations, it is rumored here and there that victory is of no avail, and that war has broken out in full force. For the enemy, left at home as a despised captive, has broken all the bonds of the equations, and the prisons of the tables. The fugitive

\* Robison's *Mechan. Phil.* p. 94. — *Astron.*



would have leagued with his rebels, and driven me to desperation, had I not, when the veterans were routed and dispersed, at once sent into the field new forces of physical reasonings; and having diligently learned where the captive had concealed himself, put myself without delay upon his track."\*

Thus did he elaborate no less than six hypotheses upon the motions of the planet Mars, each rejected after tedious calculation, before he hit upon the assumption which accorded with the observations. And such were the attempts which led to Kepler's laws, the great discovery of the age; repeated suppositions made, to be compared with facts; at once abandoned when their fallacy was shown.

Kepler is not alone in his theorizing tendencies. Singularly communicative, he has given us the story of his struggles after true conceptions. He says, "If we not only pardon Christopher Columbus, Magellan, and the Portuguese, when they narrate the wanderings in which they made their discoveries, but should lose much pleasure in reading were these omitted, let me not be blamed for following the same course in this work."† But such mental efforts precede the discovery of every law in science. Every discoverer forms his hypothesis, and tests it by the truth; if the facts are numerous, the inductive method, with its tabulating machinery, offers the surest and the shortest test; if, on the other hand, the facts are few in number, especially if a law of cause is being tested by laws of phenomena, which then bear to it the relation of simple facts, I doubt if philosophers commonly have recourse to Bacon's tables; but the process still embodies the soul of the inductive method. It is induction with its tablets in the memory, an analysis far more sub-

\* Astron. Nov. p. 247.

† Argum. Sing. Capit. Astron. Nov.



tle than the gross elaborations of material tables, but subject to the imperfections of the memory. In proportion as the facts are numerous, or extended through a long period of time, impressions are distorted and effaced, and results become inaccurate. It is this induction of the mind which accumulates what is called medical 'experience'; and it is the multiplicity of facts which makes it so inaccurate. Apart from the results derived from the experience of others, medical experience is preceded by hypothesis. Unless the observer has no aim or object in his experiments, he wishes to ascertain something; the frequency of a symptom, or the effects of a remedy. His first few experiments give him a leaning to one side or the other, inappreciable though it be, or even disowned by himself. This is his hypothesis, and he goes on to correct or verify it.

All individual experience in life is summed up in hypotheses of future probabilities. By original experience I mean that which is not communicated to us by others; the philosopher has his hypothesis of the laws of the mind; the burnt child has his equally stringent hypothesis of the action of caloric.

In a word, hypothesis in its wide sense is based upon experience; it is the sum of past knowledge aggregated, with a view to its bearing upon future knowledge. From the wildest theories of Kepler, to which he was pointed by some hand invisible to other eyes, down to the most inevitable results of accumulated facts, all is hypothesis in its bearings upon the future and the unknown. I am aware that such a view leads to the acknowledgment of an hypothesis of cause based upon experience; but if we are sure of anything, if we know that a material mass will feel the influence of gravitation, are we not infinitely more certain of the truth founded upon all we know of



constant, and seemingly necessary precedence in the material and the immaterial world. \*

Hypothesis is drawn from few facts, and applied to many. It is experience of the past pointing to the future. But as there are some men who buy their experience in life dearly ; who can take no hint ; whose unyielding intellects are not impressed by the contact of occasional or inconsiderable truth, so there are minds in science whom no flash of revelation can arouse. The ability to detect scientific truth upon slight indications, marks the genius of the observer. Dullness may detect truth, as the uneducated peasant stumbles upon a rich vein of ore ; but the true discoverer studies the dip and succession of the strata ; his quick eye detects the 'lead blossom' which the metallic salts have nourished ; and he sinks his shaft upon the mineral.

\* Does hypothesis form any part of science ? An obvious comparison of those who are ready to admit its value in the construction of science, but would reject it from science itself, likens hypothesis to a *scaffolding*, which aids in the construction, but is no part of the edifice. A simile which seems to me to touch the truth at a greater number of points, makes hypothesis the *cement* of the structure. It must be of a certain sort to unite the facts, and with it the structure stands. Broussais, or any other philosopher who laid his facts in weak or bad hypothesis, insured the integrity of his tower only so long as he could strengthen its weak points, avert external force, or conceal its defects ; it was Broussais and not the cement that held the materials together, and in time they fell. But adequate hypothesis binds the facts, and the structure stands in the impregnable strength of truth ; the hypothesis then becomes part and parcel of the scientific edifice. More than this, the mind may take cognizance of the law of gravitation, or of refraction, abstractly, as the more important element of science, just as in the walls of Rome, the eye is here and there arrested by the imperishable cement which projects from the wall, and seems to be its chief material, while the bricks have been honeycombed from its interstices by the corroding wear of time. When a late suspicious hypothesis thus appears in the respectable character of science, writers do not commonly feel called upon to constitute themselves a scientific police, and exercise the ungrateful prerogative of detection. They are often content to publish in general terms the doubtful character and false pretensions of ' hypothesis ; ' which, however, then much resembles ' treason ' in the epigram,—

" Treason does never prosper — what's the reason,  
Why, when it prospers, none dare call it treason."



Do not suppose a mind like Louis' ever piled up medical facts, unless to instruct his followers, without some intention, expressed or unexpressed, of investigating them in some especial point of view; and even had he thus amassed ten accurate cases of typhoid fever, is it possible the common lesion should have escaped his notice? No; it became in his mind the hypothesis, which the tables of Bacon then tested and confirmed. In observation of details, hypothetic laws of phenomena, or cause, are thus forced upon our notice. It is the nature of the mind to recognise them. If they are imaginary, subsequent induction will demonstrate their fallacy. And while the perception of these simpler laws is inevitable, I would ask whether, in the discovery of more complex laws, the paucity of facts does not compel the assumption of tentative hypotheses, based upon slender evidence? Could the laws of Kepler of the theory of gravitation, or of luminous undulations, have been evolved by the machinery of any set of tables? I think not. There were not facts enough to accumulate the common element in quantity sufficient to make it obvious. Its nature was only suspected; it was taken from elsewhere; it was supplied by the mind; its powers were tested, and it was found to account for the phenomena.

The ready detection of this common element, it has been said, distinguishes the genius of the observer. It is talent of a high order. It is a power which at one effort embraces a wide range of knowledge; whose glance takes in the whole; it has a breadth of view which seizes and distributes details in all their vastness; it perceives similarities in the remotest facts; it intuitively grasps their hitherto unknown relations, and unites them in the bonds of obvious, though startling truth. It is the true wit of science, akin to one of the high character-



istics of active intellect, which sees and combines dissimilar ideas in new and sudden relations.

All great observers have possessed this talent for the perception of remote analogies. Of Bacon, who probably did not appreciate its value, Macaulay has said: "He possessed this faculty, or rather this faculty possessed him, to a morbid degree. When he abandoned himself to it without reserve, as he did in the '*Sapientia Veterum*,' and at the end of the second book of the *de Augmentis*, the feats which he performed were not merely admirable, but portentous, and almost shocking. On those occasions we marvel at him, as clowns on a fair-day marvel at a juggler, and can hardly help thinking that the devil must be in him." \*

The mind of Newton, sensitively alive to the slightest suggestion of nature, endowed with an exquisite scientific tact, seized and followed up her merest intimations. Through long ages she had hinted to philosophers in the falling leaves of autumn; in despair she had cried to them in the tumbling rocks and roaring waterfall; but, toiling with the barren abstractions of theory, they heeded not her voice. In the falling apple Newton read her wish, and said;

"Malo me — petit — puella

Et fugit ad salices, et se cupit ante videri; " †

and he followed her and knew her mystery.

There is another faculty which contributes to that of detecting relations, and is perhaps necessary to it. It is that of forming in the mind distinct conceptions. Men of sci-

\* Macaulay's Essays. Philad. p. 285.

† Kepler quotes these lines, and adds: "I apply to nature these lines from the song of Virgil. For, as I approach her, she plays her wanton freaks, and steals away as I am upon the point of seizing her, and eludes my very grasp; yet never ceases to invite me to possess her, as if delighted by my embarrassment."—Astr. Nov. p. 233.



entific genius have been often noted for their powers of invention in the immaterial and material world. Discoverers in physical science have not unfrequently betrayed in their youth poetical or mechanical tastes. And there seems to be something more than a fanciful analogy between these apparently remote attributes. Both call new powers into being; poetry embodies sentiment; both animate matter. Both are gifts of nature, and are characterized by a power of combining material representatives of abstract ideas. By mechanical taste, I do not mean a taste for the use of the implements of art, but true mechanical genius, which is often impatient of the drudgery of manual labor. It makes its combinations in the mind, for the pleasure of the effort, and passes from one to another, perhaps regardless of their ever attaining perfection in a material form. Herschel has said, that "almost all the great combinations of modern mechanism, and many of its refinements and nicer improvements, are creations of pure intellect, grounding its exertion upon a moderate number of very elementary propositions in theoretical mechanics and geometry."\* The mind of the inventor, as it combines the cams and levers, suggests on a small scale as many new relations, and rejects as many useless combinations as that of the discoverer of the great laws of the universe. Such genius has a facility in placing conceptions distinctly before the mind. Kepler says, "In the year 1595, I brooded with the whole energy of my mind on the subject of the Copernican system." Newton said he made his discoveries "by always thinking about them." "I keep the subject of my inquiry constantly before me, and wait till the first dawning opens gradually, by little and little, into a full and clear light." But there is an active process going on in such a mind. It separates at a glance a complicated union into its ele-

\* Discourse on the Study of Nat. Phil. Part I.



ments, perceives what is essential to it, and again unites these elements, arranging what is necessary and rejecting what is useless to the new fabric. It is the struggle for clear conceptions, the tendency to embody abstraction, the effort to associate ideal relations with some probable material form, that leads such a mind to new combinations and new discovery.

I have tried to show that it is not the ability to sum up the common elements of facts arranged in tables, nor to verify hypotheses, that adapts a mind for observation. I will add, that it is not the mere power to make a theory. The theory must be of a certain quality ; a probable, if not a successful one. And it is remarkable, that discoverers have been convinced of this probability by the cogency of their own reasonings, when they were unable to impress their convictions upon others. Columbus was as sure that he could discover a new world, as that he knew how to poise the egg upon its apex. The subject of vaccination was so distasteful to the companions of Jenner, that they actually threatened to expel him from their medical society if he continued to harass them with so unprofitable a subject.\* Who but the inventor of the atmospheric railway, would have supposed it possible for a running engine to seal hermetically a wide crack in a two foot tube, forty miles in an hour, with tallow ? McAdam found it far more easy to grind his broken rock into the road than his convictions into the public mind. Such facts led Sidney Smith to say, that " that man is not the discoverer of any art who first says the thing, but he who says it so long, and so loud, and so clearly, that he compels mankind to hear him ! " †

But while facility in forming probable theory is distinctive of scientific genius in the mind of the true philosopher, the love of truth is steadfast and predominant. No inge-

\* Baron's Life of Jenner, I. p. 48.

† Ed. Rev. 1826.



nuity of reasoning, no parental affection for theory, no human passion, turns it from the contemplation of reality. It never shrinks from the untold labor of investigation ; it is hard upon the tracks of truth, and staunch in its pursuit.

Bacon's tables and notes lead to the construction of hypothesis, but are more frequently the machinery by which its accuracy is tested. In either light the inductive method is a routine process, and does not require the hand of the master. Bacon himself knew that no high order of intellect was required to apply his system. He warned men "that it was such as to leave little to the acuteness and strength of wit, and indeed rather to level wit and intellect."\* And in another place "that it leaves little to their superiority, since it achieves every thing by the most certain rules and demonstrations."† The intellectual effort lies in making the hypothesis. Truth is hid in the facts, like the fossil in the solid rock. Cuvier detects its existence and knows its value ; some Laurillard chips away the stone and exposes it. ‡

Let me not be misunderstood in this attempt to place theory and facts in what I conceive to be their true relations. Medical science is a science of phenomena, and laws of phenomena, which in the progress of knowledge always precede laws of cause must be accumulated gradually.§ This accumulation is the work of the inductive

\* Nov. Org. B. I. Aph. 61.

† Nov. Org. B. I. Aph. 122.

‡ See Appendix B.

§ Medicine perhaps resembles in its present scientific position the science of animal organization, thus alluded to by Cuvier. "Speaking of theories in general, he said, a little before his death, 'I have sought, I have set up some myself, but I have not made them known, because I have ascertained that they were false, as are all those which have been published up to this day. I affirm still more ; for I say, that, *in the present state of science, it is impossible to discover any*, and that is why I continue to observe, and why I openly proclaim my observations. This alone can lead an author to the discovery of that fact on which he can build a true and general theory...This fact,' added he, 'is perhaps of little importance in itself ; but, with regard to theory, it will become the principal fact, the key-stone to the arch. Therefore it must be sought, science must march ;



method. Intellect, if it could not be invested in the mechanical labor of induction, will always find its occupation in guiding and directing this process ; in laying out the road and pointing to the truth. But in many sciences, the labor of direction and the labor of experiment fall upon the same individual ; the head and the hand belong to the same person. In medicine especially, it must be so. The astronomer and chemist have their degrees of space and quantity. The rude workman gauges his straight line by a ray of light, but we have no standard of the fulness or the hardness of a pulse, the color of a tongue, or the force of vesicular expansion. It is only by long study, that the student can establish in his mind the unit of comparison, the accuracy of which qualifies him to interpret what he sees and hears. Observation alone qualifies him to observe ; observation alone qualifies him to theorize.

Nor do I underrate the value of facts, as such. A large proportion of our science is made up of facts, as unexplained as the action of mercury or of quinine, and we must accept them as they are. Such knowledge is essential to bring us to the point from which Harvey and Bell, and Laennec and Louis took their flight into unexplored regions. These men were as familiar with medicine as Newton and Kepler with astronomy. But facts are not the end of science, and you are not to amass them blindly. Have a purpose in your investigations ; let it be either of self-education, of verifying for yourselves what is already established, of forming an hypothesis, or of testing one.

but we must take care that she does not march in a retrograde direction, as she has sometimes done, and as some naturalists lead her at present. We ought to labor, not with the object of supporting a theory,— because, then, the mind being pre-occupied, will only perceive that which favors its own views,— but with the object of discovering the truth ; because the truth will be deduced from true theories, and true philosophical principles ; the truth being, in itself alone, the whole of philosophy.'— *Mem. of Cuvier by Mrs. Lee. N. Y. 1833, p. 145.*



Do not think that impartiality in observation requires that a fact should stand alone ; should offer no indication of the existence of any other fact. Rather endeavor to find some true relation between a symptom and its immediate cause, between a sign and any alterations of structure or of function, between one disease or lesion and another. Here, if I may say it, there seems to me to be a difference in the tendencies of medical knowledge in this place and in the French school.\* The connection of medical phenomena is there, if possible, determined. Every fact is labelled with its scientific value. There, a true relation is, if possible, indicated ; here, if possible, it is evaded. The details of a medical case may be narrated or recorded promiscuously and without order, or methodically, to illustrate its bearings upon certain points. Either history will embrace all the facts ; but while one supplies only the crude material, the other shapes the block and designates its place in the future edifice, and leaves to future science only the labor of adjusting it. The ill digested observation is in fact comparatively useless. Medical discovery has generally been the work of individuals, who had their hypotheses and have analyzed facts in some especial relations, and not of societies, who have collected them indiscriminately. But if any discovery is ever to be thus made, if observations thus accumulated by different individuals are ever to be collected, and studied together, especially when we remember the difficulty and almost impossibility of analyzing a wilderness of medical facts matted and felted together into a dense and tangled mass, let us be ready to advance the labor in our humble spheres, at least in showing what points our observations are intended to illustrate, and in adopting a

\* See Appendix C.



methodical and condensed arrangement which shall facilitate their future comparison.

And is it not probable that some of our common diseases have been as well investigated as they can be by the unaided senses ; and is it worth while to complicate records, in amassing scores of duplicate specimens of typhoid fever and of phthisis? I do not undervalue the wholesome influence upon our profession of a school of rigid science, much less its influence upon the cause of medical education. The latter interest compels the repeated inculcation of the simplest principles ; but let us recognise what is done for the attainment of these ends, and distinguish it from that fulsome repetition of undisputed truth, which satiates interest and deadens zest for science. What more can we know of the pathology of these diseases, unless through the aid of the microscope, of chemical agency, or some other new means? And if some new form of force shall be detected in the animal economy, will not the incompleteness of our tables compel us to observe our facts anew, with reference to relations now unsuspected?

I cannot believe that I am alone in these views. A part, at least, of our medical community will recognize a reaction from false theory, which now, as in the time of Bacon, tends to facts ; to facts repeated ; facts almost independent of their bearing or application. It is sufficient, that facts are accumulated, hoarded in some dusty volume, and the knowledge that we possess them seems to satisfy us. But these facts are not the rare and choice specimens they were in the infancy of the numerical method ; they have often been multiplied, till they are cheap. I question, whether something might not be done to increase their value, and make them more available to medical science.



The possibility of attaching a too exclusive value to facts, does not imply that a wide acquaintance with scientific detail is incompatible with the highest power of generalization. On the contrary, it is essential to its exercise. Only the laborious acquisition of successive groups of facts, enabled such men as Newton and Cuvier to bind and harvest them. But do not content yourselves with their possession. Study their relations, and endeavor to unite them. Science aims at principles, and not phenomena; laws, and not facts. If Bacon condemns the "sublime and discursive" intellect, which "compares even the most delicate and general resemblances," often "catching at shadows," he warns us, in the same sentence, against subtle minds, "the steady and acute disposition which catches at nice distinctions," which "fixes its thoughts, and dwells upon and adheres to a point, through all the refinements of differences."\* Do not lose sight of your great object, in the absorbing interest of details.

Few have the ability and the good fortune to make discoveries in science. Most of us must be content to learn what others have added to it. But we may all contribute our humble share in disseminating what we conceive to be just views, and in assuming for medical science and for ourselves a right position. But let us recognize this position, as it is. Our science is lamentably imperfect. We know next to nothing of cause in medicine; and it may well be asked, if the analysis of cause is not, at present, beyond human power. It is unquestionably difficult. We have few of the facilities enjoyed by the votary of other sciences. Facts must be resolved into their elements, before they can be combined in a new form; in the words of Bacon, "Experi-

\* Nov. Org. B. 1, Aph. 55.



ence must be broken or grinded, and not whole, as it groweth."\* The components of our new fabric, material or immaterial, whether rays or rags, must be separated and disintegrated, before we can unite them into the spotless tablet of truth. In the science of life, every known form of force is inextricably interwoven with forces we either do not recognize, or of whose mode of action we are ignorant. Every fact is a compound fact, of most of whose elements we know nothing. Again, the astronomer's observations yield constant and unvarying results; medical phenomena are ever disturbed by unknown agencies. — The astronomer has his unerring measures of degree; the standards of the medical philosopher are uncertain, and vary with different observers. The astronomer's facts repeat themselves after a determinate interval; the chemist occasions his at will; but the pathologist can only wait for promiscuous phenomena, whose occurrence is often amenable to no known influences.

Have I seemed to limit too narrowly the range of our professional usefulness? Will it be said, that I am treacherous to the cause of medical science, in confirming, by the evidence of an adept, what was already suspected by the uninitiated? The dignity of our science will not be diminished by a recognition of its real abilities. It is its actual condition, and not the avowal of it, that can alone add or detract from its real character. If our science has advanced little, in comparison with some others, it is because it is built upon them, and because its problems are combinations of the most difficult and unexplored of their laws. But if it is among the least advanced, it is among the most important. It wields many of the physical conditions of human existence. It

\* Pref. to Nat. Hist.



has averted physical calamities, which would by this time have anticipated whole ages of aggregated human life. Were it for its single power of controlling sensation, our profession would be necessary to the civilized world. But we can do far more than this. The physician can foretel the duration of most acute diseases; and apart from the accidents of life, he promises health. He alone can judge, from a wide combination of symptoms, of the actual condition of the patient. He condemns without appeal. He can sometimes arrest disease, and can often modify symptoms, or mitigate their severity. In its true form, our science is already indispensable to man.

And here and there a gleam of light penetrates the gloom which enshrouds it, and seems to promise the dawn which is to guide our steps. There is a class of remedies which the philosopher regards with untold satisfaction. They have been called specifics, and are few in number. It may be said, that an emetic mechanically irritates the stomach; but a sudorific carries us a step farther in our sway over the animal function; and when we are able to say, that quinine will prevent the regular recurrence of an intermittent chill and heat, that mercury will dispel the disorganizing pestilence which has invaded every tissue in the system, have we not here a fact in the undoubted effects of material atoms upon inappreciable agencies, which tells us that we are approaching the fountain-head of vital action. Is not this a breach in the barrier, which divides the palpable from the impalpable.

The great philosopher of the seventeenth century informs us that "They have in *Turkey* a *Drink* called *Coffa*, made of a *Berry* of the same name, as black as *Soot* and of a *Strong Sent*; Which they take, beaten



into powder, in *Water* as hot as they can *Drink* it. This *Drink* comforteth the *Brain* and *Heart*, and helpeth *Dis-  
gestion*" \* Two centuries later, the civilized world break-  
fasts upon coffee, and drinks tea ; because, says the great  
chemist of the nineteenth century, " *Theine* and *caffeine*,  
their peculiar principles, are in all respects identical, and  
supply the human system exactly as many atoms of  
nitrogen and carbon, as it requires to manufacture *tau-  
rine*, the essential constituent of bile." †

May we not assert, that this is more than progress ;  
that we have at length struck the path ; and that such  
facts are spots upon the trees, which shall enable us to  
thread this scientific wilderness.

I will detain you but a little while, with a few equally  
general considerations bearing upon medical art.

And first, I would have you take a wide view of med-  
ical science. The distinctions of medicine and surgery,  
and many others, are arbitrary, and there is little in the  
intrinsic character of disease to warrant such dividing  
lines. Surgery, literally, the labor of the hand, in its  
restricted sense, manipulates. It deals with primary ef-  
fects. Medicine deals with secondary effects, the symp-  
toms of obscure and uncertain lesions. And here is a  
superiority of surgical resource, that it applies itself  
directly to the lesion. It wields mechanical force ; the  
form of force with which we are best acquainted. Med-  
icine acts indirectly. It knows little or nothing of the  
forces with which it deals. It often makes its thrusts in  
the dark, and waits for daylight to show whether it has  
disabled its friend or its enemy, the patient or the disease.  
Yet are medicine and surgery not distinct in science. In-  
flammation in its different stages, tubercle and malignant

\* Bacon. Sylva Sylvarum, Cent. viii. 737.

† Liebig, Animal Chemistry.



growth, are intrinsically the same, deep in the viscera, or salient upon the surface. Modified by the tissue they occupy, widely differing in their symptoms, schirrus of the breast and of the pylorus, tubercle of the lung and of the ankle joint, are identical to the pathologist; and I would impress upon you, that it is only by recognizing such pathological unities, that we can advance in our knowledge of morbid action.

Do not identify surgery with the knife; with blood and dashing elegance. Distrust surgical intrepidity and boldness. If such epithets have any meaning, they are in bad taste and tend to give the student a wrong impression of scientific excellence. War has ever respected science; why should the votaries of science themselves disturb its quiet paths by the harsh jargon of the battle field? What are brilliant achievements? The right subclavian artery and the innominata have been often tied with success, and the patient has always died. Boldness in battle implies voluntary exposure of one party, while it threatens danger to the other. In surgery, the bold operator does not hazard his own person, but that of the patient is perhaps not less endangered. Science never hears of the ten or twenty quiet sufferers who fall victims to the publicity of an exceptional escape from surgical intrepidity. There are cavities in the human frame like the chamber in the legend, to open which was death. The mind clings feebly to its human habitation; for the possession of which the immaterial and material world are ever striving. Let the surgeon beware how he hazards the result by officious interference. Surgery is not operative surgery. Its province is to save, and not to destroy; and an operation is an avowal of its own inadequacy.

True boldness is that which a sense of competency



maintains. Weigh your ability, and decide whether you are competent to a responsible position. Do not confound with the question of ability, that feeling of repugnance, which every young man has in undertaking an untried duty. With a well grounded confidence, justice to yourselves demands the sacrifice of vague doubts and nervous hesitation. Endeavor to know in medicine what is to be known; and while you save yourselves much of the embarrassment which arises from a want of confidence, you will spare yourselves the necessity of dissimulating ignorance. There was a time, and that not far distant, when the grave and professorial air was a necessary part of our professional attainment; when an expression of profound sagacity hung as a veil before the mysterious recesses of the mind; and an air of deprecating merit seemed to restrain and to dam up unknown depths of wisdom. A good physician generated an oppressive atmosphere, which stifled vivacity and animation. His speech was oracular and final; and as he listened, his surcharged countenance expressed, like that of the bird of wisdom, a severe and unblenching appreciation.

Such was, and sometimes is, the mask of ignorance; but there was much in the position of bygone generations of physicians which justified pretension. The medical man was surrounded by those who leaned upon his art with blind reliance, and exacted from him superhuman skill; and he assumed the infallibility thus spontaneously offered. Such a false position is not ours. We owe it to those who have prostrated their best energies in our cause, that there is now something to be known, for which a severe and professional demeanor is no longer a substitute. The physician may now discourse on medical subjects honestly, and hopefully; and the offspring of his knowledge, the positive amelioration of man's physical con-



dition, justifies him in avowing the inadequacy of his art, without fear of derogating from its dignity, or of impairing confidence in himself. I well remember my surprise when a medical student, on hearing one who is eminent among us, proclaim in answer to some medical question, that 'he did not know.' It was the ignorance of knowledge. Such downright, avowed medical ignorance, is rare; still it is worth while to learn what is to be learned, if only to avoid the error of those who, rightly believing there is much they do not know, pretend to know much that cannot be known.

It was said by a recent medical journal, in celebrating a late physician, that he possessed "an intuitive knowledge of his science." It may be safely affirmed, that no other physician ever did; and yet some such faculty is popularly attributed to our profession. A man thus endowed by nature will tell you, with decision, that "in his opinion this man will have pneumonia." Another, perhaps less gifted, will say, "Here are combined the season, the exposure, the fever, the chills, and to-morrow we shall probably have the physical signs." Both may have rapidly reviewed the facts, but the knowledge of the first is immeasurably less to be relied on. I do not underrate a peculiar talent possessed by some physicians. A diagnosis is eminently a hypothesis, often built of necessity upon few indications. One mind will elicit, sift and combine the evidence much more rapidly than another; but the power of arranging and communicating, if need be, the steps of the process, does not diminish, on the contrary, it adds to the accuracy of the result. If such a man is unable to state clearly the grounds of his belief, it is because his conceptions are indistinct; and just in this proportion is his diagnosis, based upon the evidence of these conceptions, less sure. But one who thus jumps



to a right or wrong result, shall seem to many, and is likely to suspect himself to be a man of penetration ; of penetration which has the air of divination ; and sometimes not unjustly, in view of the intellectual chaos to be wrought upon. It is a quality which captivates the vulgar, who are fond of paradox. There is a pleasure in wondering ; in seeing a juggler's trick ; a perverseness in the human mind, which delights to believe impossibilities. The actual desire of people to be deceived has become classical ; and to respond to this, in the words of Johnson, " there is in human nature a general inclination to make people stare ; and every wise man has himself to cure of it, and does cure himself." \*

If the admiration of ignorant or weak minds is an object of your ambition, minister to this vitiated and uneducated taste ; encourage credulity ; invest your art with technicalities ; exhibit your results, and studiously hide your methods. But if you desire to place your science upon a level with other sciences, aim with Bacon " to make wonders plain, and not plain things wonders ;" † lay it open to the world, and strip it of the repulsive garb of false pretension. Common expediency at least teaches this. The day is fast going by when the intelligent and the instructed attribute to the physician superhuman sagacity. The physician is now often asked for his premises, by people who think themselves possessed of sufficient logical abilities to follow him to his conclusions ; and it is because the patients of this generation insist upon being told why, and not what, that the despotic sway of our professional ancestors is gradually escaping from our grasp. If you ever acquire in these days a reputation for infallibility, it will be after you have shown how you are infallible. All this is in accordance with the spirit of

\* Boswell 1769.

† Pref. to Nat. Hist.



the age, which rules enlightened reason, and not ignorance, and persuades by the authority of facts, and not by its own authority.

When, therefore, you examine a medical case, neither shake your head with the negation or the affirmation of profundity, nor indicate by your countenance the perplexity of overwhelming thought ; but enter upon your duty with even an unprofessional cheerfulness, content to use the finite powers which God has given you. Spread out the facts ; show which way they point. Do not say what your opinion is, but why it is so ; give the evidence and all its bearings ; push the diagnosis to its full extent ; but remember there is a point at which the imperfection of our knowledge bars advance, and beyond which all is surmise and uncertainty. It is a common error, especially among students, to suppose that the physician must always arrive at some decision with regard to the character of a lesion or disease. It is not so, a diagnosis is often uncertain. The evidence points equally in two directions, and in such a case, ignorance alone asserts impossible knowledge.

Most of you have long since observed that scientific excellence is not always the nucleus of extensive medical practice. As devotion to science insures scientific eminence, so he who omits no opportunity to add to the number of his patients, who makes this the one object of his life, will, if he plays a moderately skilful game, insure to himself a practice entirely disproportioned to his scientific merit. And among the qualities which contribute to this end, I will mention two, both laudable, and neither exclusively applicable to our art. I refer to that general good feeling which obliges people, and to the knowledge of men which rules them. Great eminence in science occasionally dispenses with these qualifications, but is often combined with them.

Science alone, is inadequate to the duties of common medical practice. When the body is diseased, the mind falters, and the invalid looks for sympathy ; for heart as well as head ; for the philanthropist and not the mere philosopher ; and this difference will often condemn the man of science to yield the race, to his inferiors in intellect and attainments. Eminence from this source is not entirely independent of scientific acquisition, and from its nature is little open to abuse. But the power which accrues from a readiness in detecting the vulnerable part of human character, may become in the hands of the unprincipled an engine of incalculable evil. In our art, it is the just vocation of this superiority to secure to its possessor the confidence which is essential to the relations between himself and his patient. But this never requires the physician to pretend to do that which he cannot, to cure incurable diseases, to exaggerate their real gravity ; and when the standard of expediency is no longer the welfare of the patient, but the pockets of one who not devoid of scientific skill, is destitute of moral sense, who does not scruple for money, to disguise truth and fabricate error, the deception strikes at the very foundation of the moral fabric. Law shields society from the violence of brute force, but no law protects it against the encroachments of brute intellect. The medical charlatan approaches his victim under the friendly and familiar mask of a noble art, only to discover the crevice in the armor with which the ceremonies and relations of society invest its members. He alarms or flatters prejudice, or wiles from human weakness some inviolate trust, only to secure his prey, while he extorts the gain which is his one object. And shall opportunity be thus voluntarily ceded to the unprincipled ?

The question is no longer of the sagacity of those who



are deceived ; if law cannot protect society against the insidious approach of ill directed will ; if the unstable arm of public opinion is its sole defence against intellect that knows no moral code, that even fails to give the presumptive pledges of good conduct which in its sober senses society rightly exacts from those who are to lift the sacred curtain of domestic life ; if public sentiment alone guards public safety, it is no negative or passive duty that devolves on individuals. The experiment in therapeutics I choose to try upon myself ; the willingness with which I abandon myself or others to the investigations of one, whose motives must be questioned, no longer concerns me alone. In my humble sphere, and by my example, I am sapping the wall which protects society and private life from the invasion of those of whom we know little but their ability which gives them power, and their disregard of common truth which would make them willing to do infinite mischief, should it serve either their interest or their inclination.

Content to exert a healthful influence within the immediate circle of your art, do not waste your breath in exposing error beyond the limits of real medicine ; in holding up to indignation the heartlessness which supplies straws to the dying man, and tortures him with false hope, until his palsied grasp has yielded its last coin ; — still less in pointing out the fallacy of those medical pseudo-sciences which last a few short years, and die of inanition ; which rapidly replace each other, with nothing in common but their friends, vociferous in their constancy to each in health and strength, but in its waning years quietly deserting it, for some more profitable alliance. These fungous parasites of science are the natural food of weakness and credulity ; a necessary to the vitiated taste of the more cultivated, or a lux-



ury to vanity, which gratifies itself in detecting and appreciating what is obvious only to few. As well might you deprive such believers of their daily sustenance, as displace from their minds their hygienic theory. With the sound and intelligent no such attempt will be needed ; with others none will avail. But in your own immediate art, scrupulously guard the barrier which professional convention has erected against the unsound in morals or in science. You cannot be too cautious in taking measures to advance your individual interest, which may be popularly confounded with those resorted to by the unprincipled. You cannot reprobate too strongly the motives of those who pretend to do what they cannot, who associate the skilful practice of your art with false pretension ; or the still fewer who would keep for their own advantage, what they would be thought to have discovered for the relief of suffering humanity.

Introduce nostrums into every human art, but do not aspire to the notoriety which deals in secrets, and takes out letters-patent for the common offices of Christian charity. Humanity revolts at this shallow artifice of those who cannot gain the eminence ever accorded to superiority. If art is sometimes thus prostituted by those who feel no interest to maintain its dignity, thank God there is an inner temple, beyond whose precincts no sacrilegious selfishness has ever penetrated. Science radiates truth, like light, upon the world. The contemplation of the order and harmony of nature, the intercourse of truth, warms the heart, as it enlarges the intellect, and elevates man into a sphere where self is sacrificed. Great discoverers in science have been ever philanthropic ; that they have shed their knowledge upon the world, as freely as they have devoted their best days to its pursuit, is a fact so universal and infallible. that he who now attempts



to conceal his pretended discovery, exposes to the intelligent, with his own selfishness, the fallacy of his pretensions.

Lastly, do not lose sight of your science in your own intercourse with art. Science is knowledge ; art is its application. Science is of the head ; art is of the hand ; and the physician who obeys the indication of a sign, exercises a faculty possessed in common with the brute. Science is often independent of art ; in the natural order of events art precedes and leads to it, while science in its turn, repays the debt with new applications of established truth. Nor is utility, or immediate subserviency to the well being of man, any test of the character of scientific discovery. High scientific truth is often of limited application, while a gross invention of art, like printing, or an accidental discovery, like the specificity of Peruvian bark, has proved of incalculable benefit to our race. But, were science of no avail to the physical condition of man, while art continued to endow human life with comforts and luxuries, science would still remain an incomparably higher object of pursuit. In its widest sense, knowledge, it is the labor of the intellect ; as far above the crude productions of the artisan, as the mind is above the material masses it inhabits. But the strivings of the philosopher who yearns to serve his fellow man, are not thus paralyzed. The pursuit of science contributes to the physical endowment of the race ; and beyond all other knowledge, beyond all human labor, ours aims at utility, the great end of the philosophy of Bacon. Its experiments are those of "fruit," as well as "light."\*

Art becomes science ; the isolated fact becomes a scientific fact in its relations to the rest of human knowledge. Strive to detect and establish this relation ; and

\* *Experimenta fructifera* \* \* \* *lucifera*. Pref. to Nat. Hist.

possession, as it rewards you, shall confer untold obligation on your fellow man.

You now linger at the starting point of your career ; and as you gaze upon the broad and dim expanse, every feature in the distant landscape dwindles to its just proportion ; but as time rolls on, and you descend into the plain before you, and your horizon narrows, that little object in the distant outline shall stand out in bold relief, and grow upon the sky as you approach it, until it fills your range of vision, and shuts out the view. Indolence, the routine of art, perhaps the demands of hard necessity, shall engross many of us in our narrow spheres, and bend us from the pursuit of knowledge. But in the struggle and turmoil of active life, do not forget your debt to science, which ever toils in quiet, unremittingly ; heedless alike of its own transitory interests, and of the world around ; whose highest aim is, year after year, to add its new contribution to the sum of human knowledge, which promotes by its example the best interests of our profession ; which is content to find its happiness in a tranquil intercourse with the great truths of nature, and the manifestations of unerring sagacity.





## APPENDIX.

### A.

THE power of predicting in science depends, first, upon our belief in the stability of causes now in action. For example, we know that East winds prevail here in April, and we believe that they will continue to do so. Copper crystallizes in four-sided pyramids, and we see no reason why it should not always thus crystallize ;— but we are more certain of the future occurrence of the last phenomenon than of the first ; because the facts on which we base our belief are more rigorous and numerous. This belief is *faith in the constancy of nature, strengthened by cumulative evidence*. It predicts a repetition of phenomena already observed, and of no others.

But there is another sort of knowledge, which predicts phenomena not yet observed, It is *the knowledge, at once, of immediate cause, and of that quality in the material which is essential to the experiment*. Thus when it is shown that a certain *die strikes*, in a malleable mass of copper, a four-sided pyramid, we can foretell that any crystalline form may be impressed upon any malleable metal, by modifying the die ;— so when we know that *gravity attracts* masses inversely as the squares of the distances, or that *refraction bends* the ray according to a ratio of the sines, always constant for the same medium, we are enabled to predict the results of new combinations of different quantities of matter at different distances, or of different rays passing at different angles, through different media.



## B.

“One day, M. Cuvier came to his brother to ask him to disengage a fossil from its surrounding mass, an office he had frequently performed. M. Laurillard was the only person to be found on the spot, and to him M. Cuvier applied in the absence of his brother. Little aware of the value of the specimen confided to his care, he cheerfully set to work, and succeeded in getting the bone entire from its position. M. Cuvier, after a short time, returned for his treasure, and when he saw how perfect it was, his ecstasies became incontrollable ; he danced, he shook his hands, he uttered expressions of delight, till M. Laurillard, in his ignorance both of the importance of what he had done, and of the ardent character of M. Cuvier, thought he was mad. Taking however his fossil foot in one hand, and dragging M. Laurillard’s arm with the other, he led him up-stairs to present him to his wife and sister-in-law, saying ‘I have got my foot, and M. Laurillard found it for me.’ It seems, that this skilful operation confirmed all M. Cuvier’s previous conjectures concerning a foot, the existence and form of which he had already guessed, but for which he had long and vainly sought. So occupied had he been by it, that when he appeared to be particularly absent, his family were wont to accuse him of seeking his fore foot.”—*Mem. of Cuv.* p. 53.

## C.

It is probable, that a large proportion of the Paris medical world would agree with *Rostan*, who says, in a lecture upon *Humorism*,\* “It is a question if the love of rigid induction in modern medical science does not tend to efface really valuable hints, which found their origin in the experience of observing men, because they are unsupported by registered facts.” The rigid “numerical school,” embodies a comparatively small part of French medical philosophers.—In this place, on the contrary, medical science is or has been somewhat imbued with the exaggerated spirit of the statistic school.

\* The writer’s MS. notes of a lecture at Hotel Dieu, in 1842.



The numerical method tends to distract the mind from general laws ; especially in medical science, where facts are complex, and therefore little suggestive of immediate cause. In its exaggerated form, its practical working is to exclude, perhaps by habit, any considerations of cause, or of unproved relations ; it is suspicious of probabilities ; and hesitating to draw the line between real and false analogies, it discards them altogether.

But that many of the disciples of the numerical school are not thus illiberal in their views of science, will, I think, be conceded by those who are familiar with the writings of Barth, Valleix, Grisolles, or Fauvel, or who have had the good fortune to know personally M. Louis.\* It will probably be allowed, that the works of M. Louis, apart from their scientific merit, have, to a certain extent, remodelled the features of modern medical science, in inducing a general recognition of the value of accurate statistic results. But such results do not preclude the use of hypothesis. The act of taking a medical observation implies a succession of hypotheses. "Learn how to observe," I take to imply, besides the necessary education of the senses, "Acquire that medical knowledge that shall enable you to judge *a priori* of the correctness of a patient's statement, in order that you may re-question him, if necessary ;—Learn enough to be able to form, from a few signs and responses, a hypothesis of the disease, that you may direct your inquiries accordingly." The eyebrows, or the color of the hair, may have some relation to the brain or heart ; but this is so improbable, that in the present state of science it is considered unnecessary to study this connexion. We select those relations which a hypothetic belief leads us to suppose the most important ; and it is previous medical education that renders a man competent to form this hypothesis, that makes him competent to observe.

There is, probably, at the present time, no greater pathologist than Louis ; but such men as Andral and Chomel have arrived

\* I find the following in a pamphlet of *M. Castelnau*, who was, in 1842, *interne* of M. Louis, and member of the Soc. Med. d'Observation. "*La statistique* does not forbid either reasoning upon a single fact, or the application of the whole mind to it. *It even counsels it.* But it forbids premature conclusions."

Lettre à M. Trousseau en reponse, &c.



at equal scientific eminence by a different path. What difference would be *popularly* made between their systems? — between the numerical method in its exaggerated form, and that form of scientific belief in general use. If I am not mistaken, it is this. Both collect the crude ore; the locality and general character of which has been determined by previous *theory*. Both expose it for examination; the latter, as is most convenient, rejecting the baser material; the numerical philosopher, in tables, giving the exact proportion of each obvious, though comparatively worthless ingredient; and if any *native metal* in a pure state happens to be thus exposed, it is picked out, and preserved. This is a sort of *mechanical* analysis, and here the numerical method is supposed to stop. But the genius of a discoverer seizes the crude fact at this stage of the process, grinds it to fragments, and with the rapidity of thought applies to it a hundred different reagents, detects the slightest tendency to combination, which he encourages by adding new elements, and extorts by this *chemical* analysis every particle of valuable material.

The numerical philosopher will tell you, truly, that in such a process, the observer will often mistake glittering combinations for the real metal; that he will present you only his own combinations; facts of his own selection. Some one (I think Mr. Lawrence, in the preface to his work upon *Iritis*) very justly remarks, that every *condensed* medical case will be more or less colored by the views of the narrator; obviously, for the same reason. The discoverer will reply, that he is competent to the process only when he is educated to distinguish real from fanciful analogies; — that the demands of science will not be satisfied by the small supply of native metal brought to the surface by the tables.

Whether medical facts in their present state are susceptible of this *chemical* analysis, and whether the numerical method is not adapted to the present requirements of medical science; whether much of the *foundations* of medical hypothesis have not yet to be built, has been discussed elsewhere in this paper. It is my own conviction, that M. Louis would be as ready as any medical philosopher to acknowledge the value of the intellectual power requisite for the higher range of scientific discovery.