FRANCIS BACON

The New Organon

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IT IS CALLED
THE NEW ORGANON
OR
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Preface

Those who have presumed to make pronouncements about nature as if it were a closed subject, whether they were speaking from simple confidence or from motives of ambition and academical habits, have done very great damage to philosophy and the sciences. They have been successful in getting themselves believed and effective in terminating and extinguishing investigation. They have not done so much good by their own abilities as they have done harm by spoiling and wasting the abilities of others. Those who have gone the opposite way and claimed that nothing at all can be known, whether they have reached this opinion from dislike of the ancient sophists or through a habit of vacillation or from a kind of surfeit of learning, have certainly brought good arguments to support their position. Yet they have not drawn their view from true starting points, but have been carried away by a kind of enthusiasm and artificial passion, and have gone beyond all measure. The earlier Greeks however (whose writings have perished) took a more judicious stance between the ostentation of dogmatic pronouncements and the despair of *lack of conviction (acatalepsia)*;[20] and though they frequently complained and indignantly deplored the difficulty of investigation and the obscurity of things, like horses champing at the bit they kept on pursuing their design and engaging with nature; thinking it appropriate (it seems) not to argue the point (whether anything can be known), but to try it by experience. And yet they too, relying only on the impulse of the intellect, failed to apply rules, and staked everything on the mind's endless and aimless activity.

[20] See I.37 and note.

Our method, though difficult to practise, is easy to formulate. It is to establish degrees of certainty, to preserve sensation by putting a kind of restraint on it, but to reject in general the work of the mind that follows sensation; and rather to open and construct a new and certain road for the mind from the actual perceptions of the senses. This was certainly seen also by those who have given such an important role to logic. Clearly they sought assistance for the understanding and distrusted natural and spontaneous movements of the mind. But this remedy was applied too late, when the situation was quite hopeless, after daily habits of life had let the mind be hooked by hearsay and debased doctrine, and occupied by thoroughly empty *illusions*.[21] And so the art of logic took its precautions too late, and altogether failed to restore the situation; and has had the effect of fixing errors rather than of revealing truth. There remains one hope of salvation, one way to good health: that the entire work of the mind be started over again; and from the very start the mind should not be left to itself, but be constantly controlled; and the business done (if I may put it this way) by machines. If men had tackled mechanical tasks with their bare hands and without the help and power of tools, as they have not hesitated to handle intellectual tasks with little but the bare force of their intellects, there would surely be very few things indeed which they could move and overcome, no matter how strenuous and united their efforts. And if we might pause for a moment and look at an example, as if we were looking into a mirror, we might (if you please) ask the following: if an exceptionally heavy obelisk had to be moved to decorate a triumph or some such magnificent show, and men tackled it with their bare hands, would not a sensible spectator regard it as an act of utter lunacy? And all the more so if they increased the number of workers thinking that that would do it? Would he not say they were still more seriously demented if they proceeded to make a selection, and set aside the weaker men and took only the young and the strong, and expected to achieve their ambition that way? And if not satisfied even with this, they decided to have recourse to the art of athletics, and gave orders that everyone should turn up with hands, arms and muscles properly oiled and massaged according to the rules of the art, would he not protest that what they were doing was simply a systematic and methodical act of insanity? And yet in intellectual tasks men are motivated by a similarly insane impulse and an equally ineffective

[21] *idola*: for the translation of this term see 'Plan of the Work', n.13, and 1.39n.

enterprise when they expect much from either a cooperation of many minds or simple brilliance and high intelligence, or even when they improve the force of their minds with logic (which may be thought of as a kind of athletic art); and all the time, however much effort and energy they put into it (if one looks at it from a proper perspective), they are using nothing but the naked intellect. Yet it is utterly obvious that in any major work that the human hand undertakes, the strength of individuals cannot be increased nor the forces of all united without the aid of tools and machines.

From the premises given, we conclude that there are two things which we should like to bring to men's attention, so that they do not escape them or pass unnoticed. The first is this: by a happy chance (as we suppose) that tends to deflect and extinguish conceit and the spirit of contradiction, it is the case that we may carry out our design without touching or diminishing the honour and reverence due to the ancients, and still gather the fruit of our modesty. For if we maintained that we achieve better results than the ancients while following the same road as they, we should not by any skill with words be able to avoid setting up a comparison or contest in intellectual capacity or excellence. This by itself might not be wrong or unprecedented; for why might we not in our own right (which is the same right that everyone has) criticise or condemn anything which they have observed or assumed wrongly? And yet however justified or legitimate, the contest itself would still have been unequal because of the limitations of our resources. But since our concern is to open up a completely different way to the intellect, unknown and untried by the ancients, the situation is quite different; parties and partisanship are out; our role is merely that of a guide, and this surely carries little authority, and depends on fortune rather than on ability and excellence. And this kind of remark applies to persons; the following one to things themselves.

We have no intention of dethroning the prevailing philosophy, or any other now or in the future that may be more correct or complete. Nor do we want to stop this accepted philosophy and others of its kind from fuelling disputations, adorning discourses and being successfully employed in academic instruction and handbooks of civil life. In fact we frankly admit and declare that the philosophy which we are introducing will be quite useless for those purposes. It is not easy to get hold of, it cannot be picked up in passing, it does not flatter intellectual prejudices, it

will not adapt itself to the common understanding except in its utility and effects.

Let there be two sources of learning therefore, and two means of dissemination (and may this be good and fortunate for both of them). Let there likewise be two clans or families of thinkers or philosophers; and let them not be hostile or alienated from each other, but allies bound together by ties of mutual assistance. And above all let there be one method for cultivating the sciences and a different method for discovering them. Those to whom the first method is preferable and more acceptable, whether because of their haste or for reasons of civil life, or because they lack the intellectual capacity to grasp and master the other method, we pray that their activities go well for them and as they desire, and that they get what they are after. But any man whose care and concern is not merely to be content with what has been discovered and make use of it, but to penetrate further; and not to defeat an opponent in argument but to conquer nature by action; and not to have nice, plausible opinions about things but sure, demonstrable knowledge; let such men (if they please), as true sons of the sciences, join with me, so that we may pass the antechambers of nature which innumerable others have trod, and eventually open up access to the inner rooms. For better understanding, and to make what we mean more familiar by assigning names, we have chosen to call the one way or method the *Anticipation of the Mind*[22] and the other the *Interpretation of Nature.*

There is also a request which it seems we must make. We have thought hard and taken care that our proposals should not only be true but should enter men's minds easily and smoothly (occupied and blocked as they are in different ways). But it is reasonable for us to request (especially in such a renewal of learning and the sciences) that no one who wishes to judge or reflect upon these our thoughts, whether of his own sense or with a host of authorities or by the forms of demonstration (which have the authority at present of judicial rules), should expect to be able to do this casually or while he is about something else, but should get to know the subject properly; should himself try a little the road which we are designing and building; should get used to the subtlety of things which experience suggests; should finally correct, within a fair and reasonable time, the bad mental habits which are so deeply ingrained; and then and only then (if he so

[22] On 'anticipation of nature' see I.26ff.

please), after he has grown up and become his own master, let him use his own judgement.

THERE FOLLOWS
THE SUMMARY OF THE SECOND PART
DIGESTED INTO
APHORISMS

XLVIII

The human understanding is ceaselessly active, and cannot stop or rest, and seeks to go further; but in vain. Therefore it is unthinkable that there is some boundary or farthest point of the world; it always appears, almost by necessity, that there is something beyond. Again it cannot be conceived how eternity has come down to this day; since the distinction which is commonly accepted that there is *an infinity of the past and an infinity of the future* can no way stand, because it would follow that there is one infinity which is greater than another infinity, and that infinity is being consumed and tends towards the finite. There is a similar subtlety about ever divisible lines, from thought's lack of restraint. This indiscipline of the mind works with greater damage on the discovery of causes: for though the most universal things in nature must be brute facts,[12] which are just as they are found, and are not themselves truly causable, the human understanding, not knowing how to rest, still seeks things better known.[13] And then as it strives to go further, it falls back on things that are more familiar, namely final causes, which are plainly derived from the nature of man rather than of the universe, and from this origin have wonderfully corrupted philosophy. It is as much a mark of an inept and superficial thinker to look for a cause in the most universal cases as not to feel the need of a cause in subordinate and derivative cases.

XLIX

The human understanding is not composed of dry light,[14] but is subject to influence from the will and the emotions, a fact that creates fanciful knowledge; man prefers to believe what he wants to be true. He rejects what is difficult because he is too impatient to make the investigation; he rejects sensible ideas, because they limit his hopes; he rejects the deeper truths of nature because of superstition; he rejects the light of experience, because he is arrogant and fastidious, believing that the mind should not be seen to be spending its time on mean, unstable things; and he rejects anything unorthodox because of common opinion. In short, emotion marks and

[12] *positiva*: cf. II.48 (14) on some things which 'should be accepted on the basis of experience and as brute facts'.
[13] *notiora*, perhaps equivalent to *natura notiora*, 'better known in nature'.
[14] Cf. Heraclitus, fr. 118.

stains the understanding in countless ways which are sometimes impossible to perceive.

L

But much the greatest obstacle and distortion of human understanding comes from the dullness, limitations and deceptions of the senses; so that things that strike the senses have greater influence than even powerful things which do not directly strike the senses. And therefore thought virtually stops at sight; so that there is little or no notice taken of things that cannot be seen. And so all operation of spirits enclosed in tangible bodies remains hidden and escapes men's notice. And all the more subtle structural change[15] in the parts of dense objects (which is commonly called alteration, although in truth it is movement of particles) is similarly hidden. Yet unless the two things mentioned are investigated and brought to the light, nothing important can be done in nature as far as results are concerned. Again, the very nature of the common air and of all the bodies which surpass air in rarity (of which there are many) is virtually unknown. For by itself sense is weak and prone to error, nor do instruments for amplifying and sharpening the senses do very much. And yet every interpretation of nature which has a chance to be true is achieved by instances, and suitable and relevant experiments, in which sense only gives a judgement on the experiment, while the experiment gives a judgement on nature and the thing itself.

LI

The human understanding is carried away to abstractions by its own nature, and pretends that things which are in flux are unchanging. But it is better to dissect nature than to abstract; as the school of Democritus[16] did, which penetrated more deeply into nature than the others. We should study matter, and its structure (*schematismus*), and structural change (*meta-schematismus*), and pure act, and the law of act or motion; for *forms* are figments of the human mind, unless one chooses to give the name of *forms* to these laws of act.

[15] *meta-schematismus*
[16] Democritus of Abdera, Greek atomist philosopher of the fifth century BC.

CXXVII

It may also be doubted (rather than objected) whether we are speaking of perfecting only Natural Philosophy by our method or also the other sciences, Logic, Ethics and Politics. We certainly mean all that we have said to apply to all of them; and just as common logic, which governs things by means of the syllogism, is applicable not only to the natural sciences but to all the sciences, so also our science, which proceeds by *induction*, covers all. For we are making a history and tables of discovery about anger, fear, shame and so on; and also about instances of political affairs; and equally about the mental motions of memory, composition and division, of judgement and the rest, no less than of heat and cold, or light, or vegetative growth, and so on. However, since our method of *interpretation*, after a history has been collected and organised, looks not only at the motions and activities of the mind (as the common logic does), but also at the nature of things we so govern the mind that it may apply itself to the nature of things, in ways that are suitable to all things. And therefore we give many different instructions in our teaching of *interpretation* which in some degree adapt the method of discovery to the quality and condition of the subject of inquiry.

CXXVIII

But it would be wrong even to entertain a doubt about whether we desire to destroy and abolish the philosophy, the arts and the sciences which we use; on the contrary, we happily embrace their use, their cultivation and their rewards. We do not in any way discourage these traditional subjects from generating disputations, enlivening discourse and being widely applied to professional use and the benefit of civil life, and from being accepted by general agreement as a kind of currency. Furthermore, we freely admit that our new proposals will not be very useful for those purposes, since there is no way that they can be brought down to the common understanding, except through their results and effects. But our published writings (and especially the books *On the Advancement of Learning*) testify how sincerely we mean what we say of our affection and goodwill towards the accepted sciences. And so we shall not try further to convince with words. In the meantime we give this constant and explicit warning: no great progress can be made in the doctrines and thinking

of the sciences, nor can they be applied to a wide range of works, by the methods commonly in use.

CXXIX

It remains to say a few things about the excellence of the Purpose. If we had said these things before, they would have seemed like mere wishes, but now that hope has been given, and unwarranted prejudices removed, they will perhaps have more weight. And if we had completed and quite finished the whole thing, if we were not inviting others to play a part from now on and take a share in our labours, then too we would have refrained from words of this kind, in case they should be taken as a proclamation of our own merit. But since we have to excite the industry of others and stir their hearts and set them on fire, it is appropriate to recall certain things to men's minds.

First therefore, the introduction of remarkable discoveries holds by far the first place among human actions; as the ancients judged. For they ascribed divine honours to discoverers of things; but to those who had made great achievements in political matters (such as founders of cities and empires, legislators, liberators of their countries from long-standing evils, conquerors of tyrants and so on) they decreed only the honours of heroes. And anyone who duly compares them will find this judgement of antiquity correct. For the benefits of discoveries may extend to the whole human race, political benefits only to specific areas; and political benefits last no more than a few years, the benefits of discoveries for virtually all time. The improvement of a political condition usually entails violence and disturbance; but discoveries make men happy, and bring benefit without hurt or sorrow to anyone.

Again, discoveries are like new creations, and imitations of divine works; as the poet well said:

> Athens, of glorious name, was once the first to give fruitful crops to men in their misery, and RECREATED their life, and made them laws.[65]

And it seems worthy of note in Solomon, that though he abounded in power, gold, magnificent works, courtiers, servants, in naval power too, and

[65] Lucretius, *On the Nature of Things*, VI.1–3. In the edition of Cyril Bailey (Oxford Classical Texts, 2nd edn, Oxford, 1922) the lines are printed as 'Primae frugiparos fetus mortalibus aegris/ dididerunt quondam praeclaro nomine Athenae/et recreaverunt vitam legesque rogarunt.'

the fame of his name and unparalleled human admiration, yet he selected none of these things as his glory, but declared as follows: 'the glory of God is to conceal a thing; the glory of a king is to find out a thing'.[66]

Again (if you please), let anyone reflect how great is the difference between the life of men in any of the most civilised provinces of Europe and in the most savage and barbarous region of New India; and he will judge that they differ so much that deservedly it may be said that 'man is a God to man',[67] not only for help and benefit, but also in the contrast between their conditions. And this is due not to soil, climate or bodily qualities, but to Arts.

Again, it helps to notice the force, power and consequences of discoveries, which appear at their clearest in three things that were unknown to antiquity, and whose origins, though recent, are obscure and unsung: namely the art of printing, gunpowder and the nautical compass. In fact these three things have changed the face and condition of things all over the globe: the first in literature; the second in the art of war; the third in navigation; and innumerable changes have followed; so that no empire or sect or star seems to have exercised a greater power and influence on human affairs than those mechanical things.

And it would not be irrelevant to distinguish three kinds and degrees of human ambition. The first is the ambition of those who are greedy to increase their personal power in their own country; which is common and base. The second is the ambition of those who strive to extend the power and empire of their country among the human race; this surely has more dignity, but no less greed. But if anyone attempts to renew and extend the power and empire of the human race itself over the universe of things, his ambition (if it should so be called) is without a doubt both more sensible and more majestic than the others'. And the empire of man over things lies solely in the arts and sciences. For one does not have empire over nature except by obeying her.

Besides, if the usefulness of any one particular discovery has moved men to regard anyone who could confer such a benefit on the whole human race as more than a man, how much nobler will it appear to make a discovery which may speedily lead to the discovery of all other things? And yet (simply to tell the truth) just as we owe much gratitude to light, because we in turn can see by it to find our way, practise the arts, read and recognise

[66] Proverbs 25:2.
[67] A saying attributed to Caecilius Comicus.

each other, and yet the actual seeing of light is a more excellent and finer thing than its many uses, so surely the very contemplation of things as they are, without superstition or deceit, error or confusion, is more valuable in itself than all the fruits of discoveries.

Finally, if anyone objects that the sciences and arts have been perverted to evil and luxury and such like, the objection should convince no one. The same may be said of all earthly goods, intelligence, courage, strength, beauty, wealth, the light itself and all the rest. Just let man recover the right over nature which belongs to him by God's gift, and give it scope; right reason and sound religion will govern its use.

CXXX

And now it is time to lay out the actual art of Interpreting Nature. Though we believe that what we teach here is what is truest and most useful, still we do not say that it is absolutely essential (as if nothing could be done without it) or even totally complete. For it is our opinion that men could hit upon our form of interpretation simply by their own native force of intelligence, without any other art, if they had available a good history of nature and experience, and worked carefully on it, and were able to give themselves two commands: one, to lay aside received opinions and notions; the other, to restrain their minds for the time being from the most general principles and the next most general. For *interpretation* is the true and natural work of the mind once the obstacles are removed; but still everything will certainly be more in readiness because of our instructions, and much more secure.

Yet we are not claiming that nothing could be added to them. On the contrary, we who look at the mind not only in its own native ability, but also in its union with things, must take the position that the art of discovery may improve with discoveries.

APHORISMS
ON
THE INTERPRETATION OF NATURE
OR ON
THE KINGDOM OF MAN
[BOOK II]

Aphorism I

The task and purpose of human Power is to generate and superinduce on a given body a new nature or new natures. The task and purpose of human Science is to find for a given nature its Form, or true difference, or causative nature or the source of its coming-to-be (these are the words we have that come closest to describing the thing). Subordinate to these primary tasks are two other tasks which are secondary and of less importance: to the first is subordinate the transformation of concrete bodies from one thing into another within the bounds of the *Possible*; to the latter is subordinate the discovery, in every generation and motion, of the continuous *hidden process* from the manifest Efficient cause and the observable matter to the acquired Form; and similarly, the discovery, in bodies at rest and not in motion, of the latent structure.

II

The sorry state of current human knowledge is clear even from common expressions. It is right to lay down: 'to know truly is to know by causes'. It is also not bad to distinguish four causes: Material, Formal, Efficient and Final. But of these the Final is a long way from being useful; in fact it actually distorts the sciences except in the case of human actions. Discovery of Form is regarded as hopeless. And the Efficient and Material causes (as they are commonly sought and accepted, i.e. in themselves and apart from the *latent process* which leads to the Form) are perfunctory, superficial things, of almost no value for true, active knowledge. Nor have we forgot-

ten that earlier we criticised and corrected the error of the human mind in assigning to Forms the principal role in being.[1] For though nothing exists in nature except individual bodies which exhibit pure individual acts in accordance with law, in philosophical doctrine, that law itself, and the investigation, discovery and explanation of it, are taken as the foundation both of knowing and doing. It is this *law* and its *clauses*[2] which we understand by the term Forms, especially as this word has become established and is in common use.

III

He who knows the cause of a nature (as of white or of heat) only in certain subjects has an imperfect Knowledge of it; and he who can produce an effect only on some of the susceptible materials has a Power which is equally imperfect. And he who knows only the Efficient and Material causes (causes which are variable, and merely vehicles and capable of conveying forms in some things only) may achieve new discoveries in material which is fairly similar and previously prepared, but does not touch the deeply rooted ends of things. But he who knows forms comprehends the unity of nature in very different materials. And so he can uncover and bring forth things which have never been achieved, such as neither the vicissitudes of nature nor experimental efforts nor even chance have ever brought into being and which were unlikely ever to enter men's minds. Hence true Thought and free Operation result from the discovery of Forms.

IV

Although the road to human knowledge and the road to human power are very close and almost the same, yet because of the destructive and inveterate habit of losing oneself in abstraction, it is altogether safer to raise the sciences from the beginning on foundations which have an active tendency, and let the active tendency itself mark and set bounds to the contemplative part. And therefore when we think about generating and superinducing a nature on a given body, we must consider what sort of instruction and what

[1] *primas essentiae*: cf. 1.51 and 1.65.
[2] Bacon seems to have in mind the analogy of statute law, which was structured as a single (very long) sentence with paragraph-shaped clauses.

sort of direction or guidance one would most want; and we should do it in simple, not abstruse, language.

For example: if one wants to superinduce on silver the tawny colour of gold, or an increase of weight (with respect for the laws of the substance), or transparency on non-transparent stone, or strength on glass, or the ability to grow on something which is not vegetable, one must consider (I say) what sort of instruction or guidance a person would most wish to be given. And in the first place, he will certainly want to be shown something which would not fail in effect or disappoint in experiment. Secondly, he will desire to be prescribed something which would not force and confine him to certain ways and means of operating. For perhaps he will not have these particular means, and not have the opportunity of easily getting and procuring them. If there are other means and other ways (apart from this instruction) of producing such a nature, perhaps they will be within the power of the operator, but he will be prevented from using them because his instructions are too narrow, and he will get no results. Thirdly, he will want to be shown something which is not as difficult as the operation which he is investigating, but which comes closer to practice.

This then will have to be our declaration on the true and perfect precept of operation: *it should be certain, free and favourable to, or tending towards, action*. And this is the same as the discovery of true Form. For the form of a nature is such that if it is there, the given nature inevitably follows. Hence it is always present when the nature is present; it universally affirms it, and is in the whole of it. The same form is such that when it is taken away, the given nature inevitably disappears. And therefore it is always absent when that nature is absent, and its absence always implies the absence of that nature, and it exists only in that nature. Finally, a true form is such that it derives a given nature from the source of an essence which exists in several subjects, and which is better known to nature (as they say)[3] than the Form itself. And so our declaration and precept about the true and perfect axiom of knowledge is this: *find another nature that is convertible with a given nature, and yet is a limitation of a better-known nature*, as of *a true genus*. These two pronouncements, the active and the contemplative, are one and the same; and what is most useful in operating is truest in knowing.

[3] *notior naturae*, expressed also by Bacon as *natura notior*, and referring to what is more general. See, for example, I.22.

V

The precept or axiom of the transformation of bodies is of two kinds. The first looks at the body as a company or combination of simple natures. For example, the following things are all found together in gold; it is tawny-coloured; it is heavy with a certain weight; it is malleable or ductile to a certain degree; it is not volatile, and loses none of its quantity in fire; it melts with a certain fluidity; it is separated and dissolved in certain ways; and so on for the rest of the natures which are found together in gold. Thus this kind of axiom derives the object from the forms of simple natures. For he who knows the forms and methods of superinducing tawny colour, weight, ductility, stability, melting, solution and so on, and their degrees and manners, will take pains to try to unite them in some body, and from this follows the transformation into gold. This kind of operation is a primary action. For it is the same method to generate some one simple nature as several, except that there is more constraint and restriction in operating if several are required, because of the difficulty of uniting so many natures, which are not easily brought together except by the common, ordinary ways of nature. It must in any case be said however that this mode of operation (which looks at simple natures, albeit in a compound body) proceeds from what is constant, eternal and universal in nature, and affords vast opportunities to human power, such as human thought (as things are now) can scarcely conceive or imagine.

But the second kind of axiom (which depends on the discovery of the *latent process*) does not proceed by simple natures, but by compound bodies as they are found in nature in the ordinary course of things. This is so, for example, in the case where one is investigating the origins, means and process by which gold or any other metal or stone is generated from their base substances or elements to the perfect mineral; or similarly the process by which plants are generated, from the first solidifying of the sap in the soil, or from seeds, up to the formed plant, with constant succession of motion, and with diverse yet continuous efforts of nature; likewise, of the orderly progress of the generation of animals from conception to birth; and similarly of other bodies.

For this investigation looks not only at the generation of bodies, but also at other movements and workings of nature. For example, it looks at the case where the inquiry is about the universal process and continuous action of nutrition, from the first ingestion of food to its perfect assimilation; or