THE TWO BACONS.

BY ERNST DÜHRING.¹

In contrast to the standpoint of scholasticism the figure of Roger Bacon comes before us as a surprise. In a century of darkness it bears the clear and luminous features of later times, but on account of this very circumstance it failed at first to produce any definite demonstrable effect. It has been rightly said of Roger Bacon that he has been unwarrantably thrown in the shade in favor of his less worthy namesake, Sir Francis Bacon, who stands upon the threshold of the modern era. It is also said with equal justice that the earlier Bacon’s energy and judgments in the line of experimental research greatly exceeded those of the author of the Novum organon, and that it was only the ill favor of time, which he far outran, that permitted his courage to remain for a while without any effect.

A British monk of the thirteenth century who specialized in the study of mathematics, mechanics and other natural science, as far as these could be acquired from good sources, namely from Arabic and Greek writings, and, unsatisfied with what he was able to learn in this way, applied himself to the best possible source, nature, was indeed an anachronism. He was the greater anachronism that he did not stop at mere recommendations of the empirical method like the Bacon of the sixteenth century, but actually obtained results, among which the best known are his discoveries in the realm of optics. His Opus majus (“Greater Work”) contains treatises which offer better material then the Chancellor—who, by the way, paraded with more than merely his predecessor’s name—was able to offer three centuries later. Moreover history need hardly add what can confidently be assumed from common experience and

¹ Translated by Lydia G. Robinson from the author’s Kritische Geschichte der Philosophie. Dr. Dühring is known for his clear-sighted views and his trenchant style, bringing out weak points to the very limit of fairness.—Ed.
intrinsic necessity, namely that Roger Bacon was the victim of the worst possible persecutions, and even in his last years was compelled to undergo a ten year imprisonment. It is not even known positively whether he was freed from prison a short time before his death, which took place about in his seventy-eighth year (1292), or whether he died in prison.

As we have already said, Roger Bacon was not able to bring about all at once a revolution in what to him was most important of all, but in a negative way he succeeded in undermining scholasticism to a considerable extent apparently even in the eyes of his contemporaries, and at the same time directed a blow against the wavering structure which provided an important precedent for its later collapse.

Roger Bacon had studied and investigated for twenty years before he wrote down his now famous extensive works. That he wrote them down at all was due to an external inducement, namely a commission from Pope Clement IV. This order of the year 1266 is the only positive favor fate ever bestowed on this man, who was annoyed by those immediately above him in position and soon afterwards directly persecuted by later popes. He had despaired of ever being able to hand down to posterity the results of his studies and therefore he seized this opportunity with revived enthusiasm because it promised his labors a greater consideration from without, and at the same time, as he was well aware, a secure route to later generations.

Under the name of the "Greater Work" (Opus majus) he arranged in systematic order a number of highly important and comprehensive treatises. He began with excursions on the "obstacles of knowledge," described the inaccessibility of the means of research, and presented all the single results which he had attained in the realm of the various special sciences. Reforms in theoretical and practical optics, as well as in chronology and the calendar, played a leading part in his investigations. Besides the Opus majus he composed at the same time a "Smaller Work" (Opus minus) and a "Third Work" (Opus tertium) by means of which he intended partly to promote the clearness of the greater work and partly to fill up gaps in it. Much that he left out in the first place and only succeeded in formulating properly during the progress of the newer work was in this way included in the two later writings.

Until 1859 only the Opus majus was accessible in print, but in that year the manuscripts of the two other works were edited in the official collection of writings important for the medieval history
of England (Rogeri Bacon opera quaedam hactenus inedita edited by J. S. Brewer, London, 1859). For a view of the author himself the Opus tertium, contained in the first volume of this edition, ought to be the first considered, since the Opus minus can not be regarded as authoritative because the manuscript upon which it is based has been greatly corrupted by the copyist. All three writings were begun and completed within less than a year and a half (1266-1267), a fact which if it were not positively confirmed in many quarters would surely be doubted by all who can not conceive how the preparation of an entire life must indeed have enabled a man of Roger Bacon’s caliber to present with great rapidity the range of his thought and the substance of his knowledge.

This phase of his achievements is certainly conclusive evidence of his power, and indeed the more so since one who had studied and reflected so long without putting his thoughts on paper can not be suspected of any inordinate love of writing. To him the thing of greatest importance was to obtain a particular knowledge peculiarly his own, and he did not apply himself to authorship until he could have before his eyes with good reason the prospect of an actual medium of communication.

He exhausted his money in the pursuit of his studies, and, as he himself relates in the Opus tertium, spent two thousand pounds—an enormous sum for that day—on instruments, books, tables and apparatus. Such scientific conduct was indeed an anomaly in those days. One might obtain wisdom with less trouble and money if he would move in circles of scholastic argument, or, what would be really worse, tuned the strings of emotion to mysticism and wound them a little too tight.

Roger Bacon occupies an isolated position, but he is the only one in the middle ages who deserves the name of philosopher. The fact that in the year 1267, almost six and a half centuries ago, a Franciscan monk at Oxford was able in from fifteen to eighteen months to outline in three simultaneous works a comprehensive picture of the scientific defects of his day, of the needs for an actual reform, and of his contemplations and knowledge which were far in advance of his time, and in this work to betray a power and scope of mind to which every age can point with satisfaction—this isolated fact we must regard as a signpost to the modern era, and is alone suited to represent criticism of the middle ages on its own ground. No nominalism ever reached so far as the actual craving for knowledge of this indefatigable student and thinker. In language not overburdened with imagery, like that of the second
Bacon, but the simplest which most naturally belongs to interest in a definite purpose, Roger Bacon developed in his three mutually explanatory works the opinions and knowledge which he regarded as the preliminary conditions of a scientific reform and offered as the fruits of his twenty years of study.

Bacon rightly appreciated the contrast between realism and nominalism since he perceived that there was only a difference of terms in this most celebrated point of controversy in the so-called philosophy of the middle ages. In general he treated with the most decided contempt the logic in use which in his time formed the pride of scholasticism. He regarded it as absolutely barren. On the other hand he never tired of recommending mathematics as the basis of all positive knowledge, and as the true organon of knowledge. In this respect he hit exactly upon a truth which even after three more centuries the second Bacon missed altogether.

We can not here discuss in detail the discoveries and theories of natural science, especially in optics, at which Roger Bacon arrived by his own application of those principles which he recommended to the rest of the world as the correct method. The way in which he conceived the transmission of light in different substances, and especially the general theories on the communication and mode of operation of natural forces in space which he perfected bear witness even to-day to the depth and keenness of his intellect and in many directions yet untried offer better stimulus to investigation and thought than all the speculative, or rather fantastic, so-called nature philosophy of Schelling, Hegel, and others of their kind. Roger Bacon evidently possessed in almost equal measure the faculty for observation and experiment on the one hand, and for deductive thought on the other. Nor did he by any means ignore the thought of the past for the sake of an exclusive observation of nature, but by means of a fundamental use of classical literature laid down the program of the revival of a better knowledge which was actually carried out afterwards in the course of history.

The languages were to him next in importance to mathematics as means for obtaining knowledge, and he entertained the highest hopes of replacing, if possible, by an adequate understanding of the original works the bad translations whose worthlessness he depicts in interesting detail. He had long applied himself to the attainment of a number of languages and to the construction of their grammar. His use of Aristotle's Physics, which in his day became accessible for the first time, proves among many other
things that he not merely had recommended the study and understanding of the sources in their purest form as the means of salvation from medieval ignorance and superficiality, but had himself first made use of all the means at his disposal.

The view that has been praised in recent times as a high degree of philological wisdom, namely, that the corrupted texts and worthless translations of the middle ages had prevented the world from obtaining proper profit from the ancient traditions, and especially from Aristotle, has perhaps never been represented with such zeal as by Roger Bacon himself for whom an opinion of this kind was well founded. For since he observed how many superficialities in the thought of his time could be removed merely by obtaining the proper meaning from ancient authors, especially from Aristotle, he was not wrong in expecting important elucidations from the better philological treatment of the scientific literature of the past.

On the other hand he must have discovered from his own experience and proved by his own example how comparatively poorly a better understanding of Aristotle would succeed in scattering the scholastic mists. Indeed, Roger Bacon’s attitude towards Aristotle furnishes a silent and unconscious critique of the position of the entire middle ages with regard to the Stagirithe.

In spite of his ready recognition of the esteem which Aristotle enjoyed, yea, even in spite of positive efforts to gain something useful from that author’s writings on the philosophy of nature, still Roger Bacon had not the slightest hesitation to theorize with entire freedom according to his own observations and experiments and to bring counter evidence against the principal fundamental ideas of Aristotle. There was no question of a real authority, in the meaning of the word then current, and the rejection of syllogistic logic as an entirely superfluous framework for the attainment of knowledge also bore witness to but a slight dependence on Aristotle.

The reason for this free and independent attitude was the circumstance that the same force dominated Roger Bacon which later became the firmest support of modern scholarship and even to-day provides the most certain guarantee of the triumph over the last medieval mode of thought. The spirit of scientific research, yes in a certain sense even a scientific mode of thought, formed a nucleus for the endeavor of that Bacon of the thirteenth century, and it was only because of this that he was able with few exceptions to tower above the prejudices of his time, to become a true critic.
of its principal shortcomings, and to prophesy correctly the means
by which the future would triumph over the prevailing ignorance.
The modern revival of the scientific spirit has indeed advanced
along the two highways whereon Roger Bacon had done everything
for himself and had attained all that could possibly be hoped for
from the strength of one genius relying solely upon himself.

THE SECOND BACON.

It was once a universally accepted view, although it is now
strongly contested in the circles of natural science, that Lord Bacon
of Verulam was the pioneer in modern scientific method and natural
science. Since he was at the head of English philosophy and a
generation earlier than Descartes—who on the continent is usually
placed beside him—he was even regarded as the founder of mod-
ern philosophy. Fortunately, however, even before it was actually
rejected, this view was moderated by a contradictory claim in its
consequences. Although the questionable rôle of Bacon remained
unchallenged until very recently, yet speculative philosophers who
did not favor empirical knowledge clung firmly to the view that
Descartes was the founder of their method, and from this point
of view they chose to represent him as the father of modern philos-
ophy, so to speak. On this point authorities were divided and the
notion became generally current, and is still held in many quar-
ters, that Bacon was to be looked upon as the originator of modern
empiricism and Descartes as the first representative of the modern
style of speculative philosophy. Historians decided according to
their own preferences for the one or the other line of thought,
which of the two men should be regarded as beginning the modern
era. The difference of a generation by which Bacon preceded
his continental rival might indeed strengthen the claims of his
own adherents but was not great enough to prevent the policy of
the opponents of this standpoint.

From the standpoint of present-day criticism Bacon must be
regarded as having inspired an increase of useful knowledge and a
kind of research directed towards the rougher part of natural
science. In this connection the Briton has brought to definite ex-
pression the specifically English tendency to the hard and tangible,
and in this respect he forms the most pronounced contrast to the
nature of the criticism which later grew up also on British ground,
but which, as may well be taken into account, appears in its finest
results as the fruit of the Scottish and not the specifically English intellect.

Francis Bacon of London (1561-1626) was a younger son and hence was obliged to make up in a career what he lacked in inheritance. In fact after a juridical preparation he finally brought it about by the ruthless pursuit of his purpose that he was made Keeper of the Great Seal and Lord Chancellor. Of more service to him than his birth, which was in the same rank, or than the circumstance that his father had been Keeper of the Great Seal before him, was the passion with which he himself pursued these offices and the money connected with them. He had to contend against great obstacles, and his successes did not begin until James I ascended the throne, but after that they increased with extraordinary rapidity and finally changed to an abrupt fall from the greatest height which left him no recourse but to spend five years in scientific leisure.

He entered Trinity College, Cambridge, at the age of thirteen. After studying three and a half years he accompanied the ambassador Paulet to France to get some training in affairs. The death of his father in 1580 obliged him to return. Then, when about twenty years of age, he applied to the government to furnish him with resources in the form of a definite capital, that he might be able to devote himself undisturbed to literature and politics. The failure of his suit obliged him to enter upon the practice of law, and he is said to have been not altogether unsuccessful as an attorney. What most prevented him from rising in his profession seems to have been the disfavor of Burleigh, whereas the Earl of Essex advanced his cause in the friendliest way and took his side at every opportunity. He gave him material support and even presented him with an estate. Bacon later rewarded all these benefits in a very singular and dubious fashion. When Essex's affairs likewise were in a bad way Bacon took an interest in them. Essex too had previously taken an interest in his. In this particular everything corresponds exactly. Only there is a certain difference which the most well-disposed historians and biographers have not been able to regard as insignificant, for Bacon had taken such an interest in the affairs of his noble and high-minded friend, that when he saw him in disfavor and in danger he drew up the accusation against him, performed the services of an attorney in this regard, smoothed the path of the noble man to the scaffold to the best of his ability, and finally undertook to defame his memory as an author.
Those who still try to palliate to some extent Bacon's behavior on this occasion, cannot bring forward any argument but the fact that he was naturally good natured and could not have practised such treachery except from weakness. We do not think that the color of the blot is changed materially by this means. At all events that kind of morals which combines a certain sort of good nature with the ability to treat others in the meanest and lowest way is a very familiar phenomenon. In the meantime we may well reflect whether evil which has its origin in power and the will directed with definite consciousness towards obtaining power, bears any less contemptible a stamp than an act of selfish baseness resulting from weakness. The complete contrast in every sense to what is noble or great in conduct towards man—this contrast in the direct form of behavior which the people unhesitatingly called infamous has been determined in Bacon's character for all time, and even the comparatively favorable way in which a Macauley treats him in his well-known essay cannot avoid an accusing judgment. All that can be attempted to save Bacon's name is simply to let the life of the man withdraw behind his scientific accomplishments.

The dishonor which Bacon morally heaped upon himself by his behavior towards Essex, but which seemed to have been the first step towards really dedicating him to the achievements of a career, was followed, so to speak—though not until late—by an avenging punishment which was the more grievous to a rougher temperament. At first, however, the different promotions up to viscount and the attainment of influential official positions up to those previously mentioned of keeper of the great seal and lord chancellor followed rapidly upon each other after 1603. All these successes are readily accounted for by his unconditional pliancy towards Buckingham, the flippant and unprincipled favorite who well knew how to reward his creatures. Nevertheless parliament took advantage of a favorable opportunity (1621) to give expression to the universal disapproval of the Lord Chancellor and to bring about through the Upper House his conviction for many corrupt practices.

To be sure the sentence was for the most part merely nominal. The enormous fine of forty thousand pounds was at once remitted by an act of clemency. His imprisonment in the Tower, to which he was condemned as long as it should be the king's pleasure, is said to have lasted two days as a matter of form. Hence all that continued in effect was the loss of offices and dignity and expulsion from parliament, and he was also forbidden to appear at court.
But even in these points he was for the most part gradually reinstated and was granted a pension. Nevertheless the stroke had been too heavy, and Bacon made no further attempt to appear again on the external stage but continued to give as much rein as possible to his fondness for ostentatious splendor in domestic affairs.

The corruption in which he had been implicated finds its explanation in his avarice which had been greatly augmented by his excessive extravagance. His financial affairs were never in order because, whether he occupied an official position or not, he sought from the start to keep up a degree of splendor out of all proportion to his resources not only when his income was meager but even at the zenith of his prosperity. At any rate there is not the slightest doubt about his heavy indebtedness, since he himself admitted it as a matter of course in order to prevent discussion of the single scandalous details.

He was as boastful in scientific matters (and often very clumsily so) as he was ostentatious in his domestic affairs. The pompous title which he gave to his first youthful sketch on the transformation of knowledge, which according to his own date he wrote when about twenty-six years of age, looks more like vanity than pride. He called it "The Greatest Birth of Time" (Temporis partus maximus, not masculus as the title of one of the essays in the published editions reads).

In this respect he ended as he had begun. When ill and conscious of his approaching death he declared in a letter that he was dying as a martyr to science, like Pliny the elder. And yet he had not in the least exposed himself consciously to a great danger as Pliny had done, but very accidentally contracted a severe cold when stuffing a hen with snow in order to discover what effect that would have in retarding decomposition. Moreover he had already reached his sixty-sixth year and had had earlier in life a better opportunity to suffer martyrdom for science by very humble actions, for instance by sacrificing his fondness for luxury and by abandoning the advantages of a more than thankless and corrupt conduct.

Bacon's first publication, which at once established him as an author, was his Essays (1597). They are popularly written and contain an excellent philosophy of life, and are read in England at the present time and continue to be reprinted in new editions. In the Latin translation made by Bacon himself they bear the title "Sermons of a Believer" (Sermones fideles). The treatise on the dignity and increase of the sciences (1623) had a predecessor in
the English language (1605) with the title *The Advancement of Learning.*

As a rule Bacon seems to have usually worked things out in English and then translated or provided for a translation by his friends. On the other hand *Cogitata et visa,* published as early as 1612, seems to have been the basis for the *Novum organon,* the other main work of the *Instauratio magna,* which appeared in 1620. The *Novum organon* itself is said to have been worked over twelve times before it appeared. It forms the most important work from a scientific standpoint, and of all Bacon's writings it is equalled in general significance and effectiveness only by the above-mentioned popular *Essays.*

We need say nothing here of his publications on law and history. It would be an equally fruitless and tedious waste of space to undertake, as many do, to go through Bacon's very indifferent encyclopedic classifications and divisions of knowledge, but we will only indicate the contents and the interconnections of his main works so far as is necessary.

The ardor, we may as well say the violence, with which Bacon had entered upon the external tasks of his life, is reflected in the style and contents of his writings. Even in the realm of logic and scientific methods his language abounds in figures and expressions of poetic color and warmth. It would fain enchant, but usually degenerates into too great an exuberance. It obeys the rein of fancy and of inflated emotion, even where a moderation of such profusion is demanded by the nature of the subject.

Perhaps a large part of the influence which Bacon acquired over the minds of men and especially outside of his own country may be charged to the fascinating style of his effusions. Nevertheless we must not overlook the comparatively unnatural affectation of this manner which puts on the color very thickly and in so far at any rate corresponds to the crude and clumsy object whose picture is to be drawn. But this intrinsic harmony between the vain man and his highest purpose on the one hand and the appearance of his literary garb on the other must not deceive us with regard to the discord in which both stand with the nobler type of what is true and in accordance with nature.

Useful knowledge is to be increased by observation and experiment and thus the power and dignity of mankind will be enhanced. The fundamental idea which guides the philosopher in this respect is in fact the same as that with which the British nation has been imbued up to the present day. It is an idea which arises
quite automatically whenever material considerations are dominant and is never lacking where the force and magnitude of external life preserve the balance over all other interests by means of cultural relations. In the face of this principle, the scientific method is not the thing of first importance, but merely a consequence of the main factor. The technical and practical triumph is the end in view, and man's impulse to increase his power over nature and his fellow beings is the motive cause.

This explains both facts and theories. It is the pivot around which Bacon's imagination constantly turned. In life he strove after power for himself and practised the arts by which the higher offices could be procured. In science he felt obliged to preach to the human race a similar line of conduct, namely to follow the grossest means of research with absolute disregard of all the nobler motives for acquiring knowledge. He cared nothing for relations with more ideal interests. He assumed that men would have to waive the incontestable consciousness of intellectual supremacy in favor of the material extension of power. He gave little heed to all the ideas about life and the universe, or rather in his opinion they shrivelled up into an arena for the great art of the "useful," in the coarser sense of the word.

When we read his vigorous aphorisms and comprehend his expressions on the lamentable condition of his time we may deceive ourselves for a moment with regard to their true meaning and scope. All knowledge, he says derisively, rested hitherto on about six brainlets (in sex hominum cerebellis). The only hope, we read in one of his best known utterances, is to be placed in true induction. Who to-day would not fully agree with the general import of such an idea? And yet what a narrow interpretation the fundamental principle just quoted bears in the mind of the author of the Novum organon!

The history of science has for several centuries endorsed the notion that the expansion of the human horizon must proceed from the inductive method, and in certain unprogressive domains it is even to-day looking for decisive results from the application of this truth. Yet the method in which Bacon thought he had pointed out the way and the means for the increase of knowledge has only a very remote and superficial similarity to the inductive method from which the results of modern science are derived.

The "New Organon," as its title indicates, was to accomplish what men had striven in vain for a number of centuries to attain by the aid of the old organon, i. e., the logical writings of Aristotle.
An instrument of knowledge was to be constructed which would bear better fruit than the conceptual fabric of the scholastics and their ancient masters which revolved in a circle and was despised by all the world. The barren syllogistic of Aristotle was to give place to systematic methods in which experimental research would have to proceed. This in itself was a great task—so great that to the present time only a very small part can be regarded as settled. But the solution Bacon originated is coming more and more to be definitely recognized as a mistake which soon could no longer count as anything positive.

Nevertheless in the face of these facts which we regard as undoubted indications of error and inadequacy, we must be just to the merits of Bacon's works which lie in a different direction. Wherever the actually deplorable condition of learning and the causes by which the attainment of positive knowledge is hindered are to be described, there Francis Bacon has found his proper place. The feeling of the impotence of previous scholarship and of the consequent human degradation was so strong and vivid in him that it lent a great charm to his presentation of the idola which hinder progress. He took this stand in the first parts of the Novum organon as directed against a vast number of prejudices and customs among which the errors of learning are also suitably treated. Pedantry is condemned with fine scorn, and the single expression "professional habit" (mos professorius) means at least as much in the mouth of the man of the world or of business as the pertinent characterization of idola, especially the so-called shadow pictures of the cave (idolon specus sive cavernae). By the latter very obvious expression Bacon sums up in this case all the individual limitations originating partly from submersion in the narrowness of an isolated vocational life hemmed in by an ignorant tradition.

Different classes of idols are here displayed, and the theory of these illusive forces and these idols whose cult hinders the progress of true science is well worth reading and taking to heart to-day. Likewise where Bacon turns upon the prevalent metaphysics, the daring of his conceptions deserves our sympathy even to-day whenever he points prophetically to the vain and futile systems which would be proposed in the remotest future. The perusal of the brief portion of the Novum organon devoted to general conceptions might still serve in certain quarters as means towards intellectual liberation. Just because we are separated from the author by several centuries, the stimulating effect of his general

²Compare Plato's Republic, VII.—Ed.
descriptions is often all the greater. In these characteristics there lies something of the restless impulse which is manifest in our own century.

In Bacon's eyes printing, gunpowder and the mariner's compass had already pointed the way to goals of modern power and greatness. He would have naught to do with those dry controversies which bore no fruit for human mastery over things but only for the position and purse of the professors. For this reason he rejected the syllogistics of Aristotle as totally barren, and opposed authority in general, which is wrongly conceded to the traditions of antiquity. On the river of time it is likewise the lesser weight which floats on top of the water, and so it is exactly the lighter and less valuable material which has been washed up while the heavier and more significant has gone to the bottom. The works of an Aristotle are preserved, while those of a Democritus and Empedocles and others who were occupied with the true knowledge of nature have been lost. The great significance which is generally attributed to the accomplishments of the past is one of the chief reasons for the impotence of the present.

Lord Bacon conceived the idea of a reformation of science as a whole, and in later years he liked to regard it as "a strange sort of fate" that although he "had labored for the sciences more than for all else, yet he had been torn away to business matters and a public life."

A certain encyclopedic current in those times need not surprise us. In the comparatively narrow limits of the science of those days universal combinations of the whole domain do not yet appear as unsolvable tasks. Therefore we need not wonder that the possessor of that proud consciousness of his own calling devoted the work of the 

\textit{Instauratio magna} not only to present the actual condition of knowledge in all quarters but also actually to blaze a new path and to show not only the method recommended but also its results.

The complete work, of which the \textit{Novum organon} is only one part, has remained, it is true, without a conclusion. Even the title of the main part which appeared first, "On the Dignity and Enhancement of the Sciences" (\textit{De dignitate et augmentis scientiarum}) is characteristic. Nevertheless the \textit{Novum organon}, which follows as the methodological basis, must be looked upon as the work properly representing Bacon's philosophy. It is not the universal scholar and his encyclopedic effort that we are interested in, but the methodizer and the impulses towards empiricism that he originated.

As previously indicated, Bacon's epistemology is of far greater
negative than positive significance. He formulates correctly the contrast between the Aristotelian method and the requirements of a genuine increase of knowledge. In this connection he gives expression strikingly and drastically to what the approach of the modern era had made perceptible before his time in the most diverse quarters and to what Telesius Cosenza (1508-1588), for instance, whom Bacon valued highly, had really represented.

Nevertheless his struggle against Aristotelian logic does not agree entirely with the general conflict in which at that time the progressive party of the scholars and philosophers engaged against the validity of that authority. Bacon directed his attention with good effect against the two chief failings of the Stagirite. He explained as unavailing the syllogistic connection of thoughts on the one hand, and on the other the explanation of nature by the introduction of the concept of purpose. The kind of observation which took pleasure in searching after the purposes and intentions of nature's operations he compared to a divinely consecrated virgin who does not give birth to a child. However, he thought that what is met with in Aristotle as so-called induction is not at all rational as true induction; that it refers only to the enumeration of cases and therefore may be found in the crudest beginnings.

The positive part of the Novum organon presents the several ways in which according to Bacon's idea research must be reformed in order to obtain results scientifically. And yet his enumeration of a large number of possible situations and applications of analytical thought is itself neither methodic nor adequate. The cases for and against the combination of two properties or phenomena are for instance to be brought together in order to be able to pronounce judgment for or against the affinity (e. g., of light and warmth) according to the overwhelming accumulation of data. If one can not deny that the whole systematization is able to exert a stimulating effect in many directions yet the actual result is almost nothing. The very thing that is most important in the strict science of to-day is not even taken into consideration. That there can be such a thing as an experiment possible only on the basis of genuine speculation is not recognized in the least.

If we seek a reason for these errors we are confronted with two possibilities. On the one hand there is even yet no separate theory of inquiry in which authoritative schemata for the intellectual function would be proposed in such a way as to be recognized by naturalists as adequate and useful, and by logicians as rational and systematic. On the other hand the assumption is most widespread
among the positivists that such a theory of inquiry could not accomplish anything aside from the quite general ideas of observation and experiment. It is not possible, they say with some reason, to replace the practical foresight of the thinker and student once for all by a collection of universal applications and formulas. Now those who proceed from this hypothesis will find the errors of the positive attempts of the Novum organum quite in order. They will prophesy a like failure for the efforts of every one who to-day would undertake a similar task.

But now it will be urged against this that within strict science itself—although in the garb of typical instances—scientific principles and applications of the most general interpretation have been laid down, and that it only requires a similar genius to create an adequate and useful theory of inquiry upon the basis of these partly concealed elements.

It is true that but few instances of this kind were at Bacon's command. and, what is worse, these he could not utilize with his type of mind and his knowledge. Since he had not the slightest comprehension of the rôle and scope of mathematics in generating knowledge he was compelled to remain behind even that which the first Bacon three centuries before him had recognized as a scientific necessity and had applied successfully. In this defect in mathematical and mechanical thought the man who presumed to point out the paths of the future by his own method completely misunderstood the greatest attainments of the past. He ridiculed as a manifest folly the Copernican system which had been made public a few decades before his birth. He represented the falsest notions in mechanics, and even ignored Archimedes's law of the lever at the very time when the foundations of modern dynamics were being laid by the almost contemporaneous Galilei.

But what Lord Bacon could not accomplish and what no one will be able to do in the future who does not recognize positively the significant part played by mathematical and quantitatively determined calculations and who does not regard them as a universally authoritative principle, was the discovery of the true scientific principles and the most efficient means of extending positive and fruitful knowledge. He also lacked the slightest conception of that kind of genuine naturalistic speculation which led a Galilei to recognize the law of falling bodies, and without which observations and experiments would not be able to accomplish anything of importance.

Just those anticipations which Bacon rejected are in a certain
sense the first and most powerful means by which the understanding penetrates the secrets of nature and marks out the direction in which the decisive questions should be formulated, and wherever possible to have them answered by nature itself by means of artificially arranged experiments. The best part of the theory must in most cases be present before one succeeds in presupposing in a general way facts of a determining kind. Now to be sure mathematical thought is not the only source, though it is the most original source, of all genuine anticipations. Whoever can not appreciate this basis of a safe orientation must misunderstand still more every other class of intrinsically authoritative forces of cognition. The understanding with its power to make a priori determinations must remain concealed from him and thus it is easy enough to explain why the Novum Organon failed in its positive task. Indeed this explanation presupposes in the one for whom it is intended to have any weight certain ideas of the content of strict science and of those intellectual powers by which it has actually become great.

Our account of the causes which prevented Bacon from attaining his main purpose even in the slightest respect is confirmed by the recollection especially of the difference between him and the genius of the same name who preceded him by three centuries in a similar attempt.

Both Bacons took their point of departure from the utter inaccessibility of what science there was and inadequacy of the prevalent methods. Both led discussions on the obstacles which hindered more perfect knowledge. Both attempted a comprehensive encyclopedia of the objects of knowledge but the first Bacon was a positive thinker along mathematical lines who attained incontestable results. He was impelled by a genuine love of knowledge; vanity and ostentation were entirely foreign to him. The practical results of this method can not be disputed. At least in optics and particularly the theory of refraction he made decided progress. He also discovered the combination of gunpowder itself, or at least of something similar to it, as well as the application of such an explosive substance to the ejection of bodies from a tube. But we can not bring up the slightest evidence in this direction with regard to the second Bacon. He did not succeed in making a single discovery, nor has a single application of his method elsewhere led him to any attainment worth mentioning.

Then too if we compare the relative position which both occupied to the centuries in which they lived and worked, there can not be the slightest doubt to-day that that lonesome student of the
thirteenth century far outshone the self-satisfied chancellor in this point also. Even those, who, like Hallam, the English historian and expert of the middle ages, value the second Bacon more highly than he deserves have not a moment’s hesitancy in recognizing Roger Bacon as the first author of his century. Now no one to-day would make the same claim for the second Bacon, and yet that estimation of his predecessor is far below the truth.

Roger Bacon was not only in advance of his own century but in the most important respect far beyond the entire middle ages, and in some directions, as far as his type of mind is concerned, he even stood on those heights which every era possesses, and on which in all ages only geniuses of the first rank meet and understand each other. Hence he shared in that which towers above the middle level of every era and belongs to that region in which mankind as such, and not merely this or that generation, seeks nobler and truer standards. Whatever pains we may take to praise the scientific Lord Chancellor we shall not be able to win for him so high a position. We must be satisfied if in the face of the nature of his works, which we are now fortunate enough to be able to study more closely, we may claim for him a certain power to stimulate to empirical methods. Even his assault upon the old methods has a negative value, nor can we refuse him the credit of having systematically and extensively classified and exposed certain obstacles and absurdities of human knowledge. Yet in this respect as well he may have been but the imitator of his predecessor. Still the opinions of those who accuse him of directly borrowing from the manuscripts of the first Bacon, and, as for instance Charles Forster, have even printed parallel passages side by side, cannot be considered here. It is known that others also have stolen from Roger Bacon without giving him credit and have even honored him by making literal excerpts. One such passage, for instance, made a deep impression on Columbus and determined his decision without the future discoverer of the new world knowing what genius he had, so to speak, come into contact, and from what century he had received confirmation of his views with regard to a western passage.

Roger Bacon stands too high, and Francis Bacon is of comparatively too little significance for it not to be better to regard the loan question in this case as pretty subordinate, and to save the time which might be spent in exposing plagiarisms for really important theories and considerations.

At any rate the second Bacon did not use his predecessor to the
best advantage in the most important point, namely with respect to mathematical and mechanical modes of thought and the corresponding basis of the sciences. A skilful borrower who would have taken up the matter from this side would evidently have made himself more useful to the world than the second Bacon with his *Novum organon*, the alleged instrument of science, in whose construction unfortunately the finest instrument and most powerful medium of knowledge which the human mind possesses remained unconsidered. Nevertheless the Baron of Verulam would fain have lifted the scientific world off its hinges without knowing the law of the lever.