announced as early as 1759, by Caspar Friedrich Wolff, in his now deservedly celebrated *Theoria Generationis*, and again, in 1764, in his *Theorie von der Generation*.[1] I shall have to recur to Wolff; at present it need only be noted that even *his* professional authority and remarkable power could not secure the slightest attention from botanists for the morphological theory—a proof that the age was not ripe for its acceptance.

A few of the eminent botanists began, after the lapse of some years, to recognise the discovery. Thus Kieser declared it to be "certainly the vastest conception which vegetable physiology had for a long time known." Voigt expressed his irritation at the blindness of the botanists in refusing to accept it. Nees von Esenbeck, one of the greatest names in the science, wrote in 1818, "Theophrastus is the creator of modern botany. Goethe is its tender father, to whom it will raise looks full of love and gratitude, as soon as it grows out of its infancy, and acquires the sentiment which it owes to him who has raised it to so high a position." And Sprengel, in his History of Botany, frequently mentions the theory. In one place he says, "The *Metamorphoses* had a meaning so profound, joined to such great simplicity, and was so fertile in consequences, that we must not be surprised if it stood in need of multiplied commentaries, and if many botanists failed to see its importance."

It is now, and has been for some years, the custom to insert a chapter on Metamorphosis in every work which pretends to a high scientific character.

"For a half century," says Goethe in the History of the Botanical Studies, "I have been known as a poet in my own country and abroad. No one thinks of refusing me that talent. But it is not generally known, it has not been taken into consideration, that I have also occupied myself seriously through many years with the physical and physiological phenomena of Nature, observing them with the perseverance which passion alone can give. Thus when my essay on the development of plants, published nearly forty years before, fixed the attention of botanists in Switzerland and France, there seemed no expression for the astonishment at the fact of a poet thus going out of his route to make a discovery so

[1] I have only been able to procure this latter work, which is a more popular and excursive exposition of the principles maintained in the Inaugural Dissertation of 1759.

important. It is to combat this false notion that I have written the history of my studies, to show that a great part of my life has been devoted to Natural History, for which I had a passion. It is by no sudden and unexpected inspiration of genius, but through long prosecuted studies, I arrived at my results. I might doubtless have accepted the honour which men wished to pay my sagacity, and in secret rejoiced in it. But as it is equally pernicious in science to keep exclusively to facts, or exclusively to abstract theories, I have deemed it my duty to write, for serious men, the detailed history of my studies."

He was not *much* hurt at the reception of his work. He knew how unwilling men are to accord praise to any one who aims at success in different spheres, and found it perfectly natural they should be so unwilling; adding, however, that "an energetic nature feels itself brought into the world for *its own development, and not for the approbation of the public.*"

We shall have occasion to consider his theory of Metamorphosis hereafter; at present let us follow the biographical path, and note his confession that some of the happiest moments of his life were those devoted to his botanical studies. "They have acquired an inestimable value in my eyes," he says, "because to them I owe the most beautiful of all the relations which my lucky star shone on. To them I owe the friendship of Schiller."

Side by side with botanical and anatomical studies must be placed his optical studies. A more illustrative contrast can scarcely be found than is afforded by the history of his efforts in these two directions. They throw light upon scientific Method, and they throw light on his scientific qualities and defects. If we have hitherto followed him with sympathy and admiration, we must now be prepared to follow him with that feeling of pain which rises at the sight of a great intellect struggling in a false direction. His botanical and anatomical studies were of that high character which makes one angry at their cold reception; his optical studies were of a kind to puzzle and to irritate the professional public.

He has written the history of these studies also. From youth upwards he had been prone to theorise on painting, led thereto, as he profoundly remarks, by the very absence of a talent for painting. It was not necessary for him to theorise on poetry; he had within him the creative power. It *was* necessary for him to theorise on painting, because he wanted

"by reason and insight to fill up the deficiences of nature." In Italy these theories found abundant stimulus. With his painter friends he discussed colour and colouring, trying by various paradoxes to strike out a truth. The friends were all deplorably vague in their notions of colour. The critical treatises were equally vague. Nowhere could he find firm ground. He began to think of the matter from the opposite side—instead of trying to solve the artists' problem, he strove to solve the scientific problem. He asked himself, What is colour? Men of science referred him to Newton; but Newton gave him little help. Professor Büttner lent him some prisms and optical instruments, to try the prescribed experiments. He kept the prisms a long while, but made no use of them. Büttner wrote to him for his instruments; Goethe neither sent them back, nor set to work with them. He delayed from day to day, occupied with other things. At last Büttner became uneasy, and sent for the prisms, saying they should be lent again at a future period, but that at any rate he must have them returned. Forced thus to part with them, yet unwilling to send them back without making one effort, he told the messenger to wait, and taking up a prism, looked through it at the white wall of his room, expecting to see the whole wall coloured in various tints, according to the Newtonian statement. To his astonishment, he saw nothing of the kind. He saw that the wall remained as white as before, and that only there, where an opaque interfered, could a more or less decisive colour be observed; that the window frames were most coloured, while the light grey heaven without showed no trace of colour. "It needed very little meditation to discover that to produce colour a *limit* was necessary, and instinctively I exclaimed, 'Newton's theory is false!'" There could be no thought of sending back the prisms at such a juncture; so he wrote to Büttner begging for a longer loan, and set to work in real earnest.

This was an unhappy commencement. He began with a false conception of Newton's theory, and thought he was overthrowing Newton when, in fact, he was combating his own error. The Newtonian theory does *not* say that a white surface seen through a prism appears coloured, but that it appears white, its edges only coloured. The fancied discovery of Newton's error stung him like a gadfly. He multiplied experiments, turned the subject incessantly over in his mind, and instead of going the simple way to work, and learning the

a, b, c, of the science, tried the very longest of all short cuts, namely, experiment on insufficient knowledge. He made a white disc on a black ground, and this, seen through the prism, gave him the spectrum, as in the Newtonian theory; but he found that a black disc on a white ground also produced the same effect. "'If Light,' said I to myself, 'resolves itself into various colours in the first case; then must Darkness also resolve itself into various colours in this second case.'" And thus he came to the conclusion that Colour is not contained in Light, but is the product of an intermingling of Light and Darkness.

"Having no experience in such matters, and not knowing the direction I ought to take, I addressed myself to a Physicist of repute, begging him to verify the results I had arrived at. I had already told him my doubts of the Newtonian hypothesis, and hoped to see him at once share my conviction. But how great was my surprise when he assured me that the phenomenon I spoke of was already known, and perfectly explained by the Newtonian theory. In vain I protested and combated his arguments, he held stolidly to the *credo*, and told me to repeat my experiments in a *camera obscura*."

Instead of quieting him, this rebuff only turned him away from all Physicists, that is, from all men who had special knowledge on the subject, and made him pursue in silence his own path. Friends were amused and interested by his experiments; their ignorance made them ready adepts. The Duchess Luise showed especial interest; and to her he afterwards dedicated his *Farbenlehre*. The duke also shared the enthusiasm. The Duke of Gotha placed at his disposal a magnificent laboratory. Prince August sent him splendid prisms from England. Princes and poetasters believed he was going to dethrone Newton; men of science only laughed at his pretension, and would not pay his theory the honour of a refutation. One fact he records as very noticeable, namely, that he could count Anatomists, Chemists, Littérateurs, and Philosophers, such as Loder, Sömmering, Göttling, Wolff, Forster, Schelling (and, subsequently, Hegel), among his adherents; but not one Physicist—*hingegen keinen Physiker!* Nor does he, in recording this fact, see that it is destructive of his pretensions.

What claim had Anatomists, Littérateurs, and Philosophers to be heard in such a controversy? Who would listen to a mathematician appealing to the testimony of zoologists against

the whole body of mathematicians past and present? There is this much, however, to be said for Goethe: he had already experienced neglect from professional authorities when he discovered the intermaxillary bone, and when, in the *Metamorphoses of Plants*, he laid before them a real discovery, the truth of which he profoundly felt. He was prepared therefore for a similar disregard of his claims when he not only produced a new theory, but attacked the highest scientific authority. He considered that Newtonians looked on him as a natural enemy. He thought them steadfastly bent on maintaining established prejudice. He thought they were a guild united against all innovation by common interest and common ignorance. Their opposition never made him pause; their arguments never made him swerve. He thought them profoundly in error when they imagined optics to be a part of mathematics; and as he did not understand mathematics, he could not appreciate their arguments.

His *Beiträge zur Optik*, which appeared in 1791, was a sort of feeler thrown out to the great public. The public was utterly unsympathising. The ignorant had no interest in such matters, and certainly would not address themselves to a poet for instruction; the physicists saw that he was wrong. "Everywhere," he says, "I found incredulity as to my competence in such a matter; everywhere a sort of repulsion at my efforts; and the more learned and well-informed the men were, the more decided was their opposition."

For years and years he continued his researches with a patience worthy of admiration. Opposition moved him not: it rather helped to increase his obstinacy. It extorted from him expressions of irritability and polemical bad taste, which astound us in one elsewhere so calm and tolerant. Perhaps, as Kingsley once suggested to me, he had a vague feeling that his conclusions were not sound, and felt the jealousy incident to imperfect conviction. Where his conviction was perfect, he was calm. The neglect of his Metamorphoses—the denial of his discovery of the intermaxillary bone—the indifference with which his essays on Comparative Anatomy were treated—all this he bore with philosophic serenity. But on the *Farbenlehre* he was always sensitive, and in old age ludicrously so. Eckermann records a curious conversation, wherein he brings forward a fact he has observed, which contradicts the theory of colours; and Goethe not only grows angry, but refuses to admit the fact. In this matter of Colour he showed himself morally

weak, as well as intellectually weak. "As for what I have done as a poet," said the old man once, "I take no pride in it whatever. Excellent poets have lived at the same time with myself; more excellent poets have lived before me, and will come after me. But that in my century I am the only person who knows the truth in the difficult science of colours —of that, I say, I am not a little proud."

The reader will doubtless be curious to know something of this Theory of Colours; and although it must necessarily appear greatly to its disadvantage in the brief abstract for which alone I can find space, an abstract without the numerous illustrations and experiments which give the theory a plausible aspect, yet the kernel of the matter will appear.

The Newtonian theory is that white light is composed of the seven prismatic colours, *i.e.* rays having different degrees of refrangibility. Goethe says it is not composed at all, but is the simplest and most homogeneous thing we know.[1] It is absurd to call it composed of *colours*, for every light which has taken a colour is darker than colourless light. Brightness cannot therefore be a compound of darkness. There are but two pure colours, *blue* and *yellow*, both of which have a tendency to become *red*, through *violet* and *orange;* there are also two mixtures, *green* and *purple*. Every other colour is a degree of one of these, or is impure. Colours originate in the modification of Light by outward circumstances. They are not developed *out* of Light, but *by* it. For the phenomenon of Colour, there is demanded Light and Darkness. Nearest the Light appears a colour we name *yellow;* nearest the Darkness, a colour we name *blue*. Mix these two and you have *green*.

Starting from the fundamental error of the simplicity of Light, Goethe undertakes to explain all the phenomena of Colour, by means of what he calls the *Opaques*—the media. He maintains that on the one hand there is Light, and on the other Darkness; if a semi-transparent medium be brought between the two, from these contrasts and this medium, Colours are developed, contrasted in like manner, but soon through a reciprocal relation tending to a point of reunion.

1 "Let us thank the gods," exclaims Schelling, "that they have emancipated us from the Newtonian spectrum (*spectrum* truly!) of composed light. We owe this to the genius to whom our debt is already so large."—*Zeitschrift, für specul. Philos.* ii. p. 60. To the same effect Hegel in his *Encyclopädie der philos. Wissenschaften.*

The highest degree of Light seen through a medium very slightly thickened appears *yellow*. If the density of the medium be increased, or if its volume become greater, the light will gradually assume a *yellow-red*, which deepens at last to a *ruby*.

The highest degree of Darkness seen through a semi-transparent medium, which is itself illuminated by a light striking on it, gives a *blue* colour; which becomes paler as the density of the medium is increased; but on the contrary becomes darker and deeper as the medium becomes more transparent. In the least degree of dimness short of absolute transparency, the deep *blue* becomes the most beautiful *violet*.

There are many interesting facts adduced in illustration. Thus, smoke appears yellow or red before a light ground, blue before a dark ground; the blue colour, at the under part of a candle-flame, is also a case of blue seen opposite a dark ground. Light transmitted through the air is yellow, orange or red, according to the density of the air; Darkness transmitted through the air is blue, as is the case of the sky, or distant mountains.

He tells a curious anecdote in illustration of this blueness of darkness. A painter had an old portrait of a theologian to clean; the wet sponge passing over the black velvet dress, suddenly changed it to a *light blue plush*. Puzzled at this truly remarkable phenomenon, and not understanding how light blue could be the ground of deep black, he was in great grief at the thought of having thus ruined the picture. The next morning, to his joy, he found the black velvet had resumed its pristine splendour. To satisfy his curiosity, he could not refrain from wetting a corner once more, and again he saw the *blue* appear. Goethe was informed of the phenomenon, which was once more produced, in his presence. "I explained it," he says, "by my doctrine of the semi-opaque medium. The original painter, in order to give additional depth to his black, may have passed some particular varnish over it; on being washed, this varnish imbibed some moisture, and hence became semi-opaque, in consequence of which the *black* beneath immediately appeared *blue*." The explanation is very ingenious; nor does the Edinburgh reviewer's answer seem to meet the question, when he says:[1] "As there is no gum or resin, or varnish of any kind that possesses the property of yielding blue or any other colour by being wetted, we have

[1] *Edin. Rev.* Oct. 1840, p. 117.

no doubt the varnish had been worn off, or else the picture never had been varnished." It is not a question of wetted varnish yielding blue, but of wetted varnish furnishing the medium through which black appears blue. His own explanation, however, is probably correct. He assumes that there was no varnish, and that the particles of bodies which produce blackness, on the usual theory, are smaller than those which produce blue or any other colour; and if we increase the size of the particles which produce blackness by the smallest quantity, they yield the *blue* colour described by Goethe. The action of the water swelled them a little, and thus gave them the size which fitted them to reflect *blue* rays.

The theory loses much of its seductive plausibility when thus reduced to its simplest expression. Let us, however, do the same for the Newtonian theory, and then estimate their comparative value. Newton assumes that white Light is a compound; and he proves this assumption by decomposing a beam of light into its elements. These elements are rays, having different degrees of refrangibility, separable from each other by different media. Each ray produces its individual colour. Not only will the beam of white Light in passing through a prism be separated into its constituent rays, or colours, but these rays may be again collected by a large lens, and, in being thus brought together, again reappear as white Light. There are few theories in science which present a more satisfactory union of logic and experiment.

It cannot be denied that Goethe's theory is also extremely plausible; and he has supported it with so many accurate experiments and admirable observations, that to this day it has not only found ardent advocates, even among men of science, though these are few, but has very sorely perplexed many Newtonians, who, relying on the mathematical accuracy of their own theory, have contemptuously dismissed Goethe's speculation instead of victoriously refuting it. His obstinacy was excusable, since believing himself to be in the right he challenged refutation, and no one picked up his gauntlet. They declined in contempt; he interpreted it as bigotry. He tried to get the French Academy to make a report on his work. This honour was withheld: Cuvier disdainfully declaring that such a work was not one to occupy an Academy; Delambre answering all solicitations with this phrase: "Des observations, des expériences, et surtout ne commençons pas par attaquer Newton." As if the *Farbenlehre* were not founded

on observations and experiments! as if the glory of Newton were to stand inviolate before all things! Goethe might well resent such treatment. If he was wrong in his theory, if his experiments were incomplete, why were these errors not pointed out? To contradict Newton might offer a presumption against the theory; but Newtonians were called upon not to explain the contradiction between Goethe and Newton, which was vociferously announced, but the contradiction between Goethe and Truth, which they contemptuously asserted.

As this is a branch of science in which I can pretend to no competence, and as I have met with no decisive refutation of Goethe which can be quoted here, I should consider it sufficient to say that the fact of the vast majority of physicists in Europe refusing to pay any attention to the *Farbenlehre*, although not in itself more than a presumption against that theory, is nevertheless a presumption so very strong as only to be set aside by stringently coercive evidence. Looking at the *Farbenlehre* from the impartial, if imperfect, point of view of an outsider, I should say that not only has Goethe manifestly misunderstood Newton, but has presented a theory which is based on a radical mistake. The mistake is that of treating Darkness as a positive quality, rather than as a simple negation of Light. By means of this Darkness, as a *co-operating agent* with Light, colours are said to arise. Stripped of all the ambiguities of language, the theory affirms that Light is itself perfectly colourless until mingled with various degrees of Nothing—or, in other words, until it suffers various diminutions; and with each diminution the colours become of a deeper hue. This may seem too preposterous for belief; yet what is Darkness but the negation of Light? It is true that Goethe has in one place named Darkness, in the abstract, a pure negation; but it is not less true that in the construction of his theory, Darkness plays the part of a positive; and necessarily so; for if we once conceive it as a simple negative, the theory falls to the ground. Light being assumed as colourless, no diminution of the colourless can give colours. Unless Darkness be positive,—co-operative,—we are left to seek the elements of colour *in* Light; and this is precisely where the Newtonian theory finds it.

It was an old idea that the different confines of shadow variously modify light, producing various colours. This Newton has elaborately refuted (*Optics*, part II. book i.), proving by simple experiments that all colours show themselves indiffer-

ently in the confines of shadow; and that when rays which differ in refrangibility are separated from one another, and any one is considered apart, "the colour of the light which it composes cannot be changed by any refraction or reflection whatever, as it ought to be were colours nothing else than modifications of light caused by refractions, reflections, and shadows."

It should be emphatically stated that the highest physical authorities have borne testimony to the accuracy of Goethe's facts; and as these facts are exceedingly numerous, and often highly important, the value of his optical studies must be estimated as considerable. He was a man of genius, and he laboured with the passionate patience of genius. But in awarding our admiration to the man, we may withhold assent from his theory. That which has exasperated men of science, and caused them to speak slightingly of his labours, is the bitterly polemical tone of contempt with which he announced a discovery which they could not recognise as true. He was aggressive and weak. He vociferated that Newton was in error; and a casual glance at his supposed detection of the error discovered a fundamental misconception. If we stand aloof from these heats of personal conflict, and regard the subject with a calmer eye, we shall see that the question simply reduces itself to this: which of the two theories offers the fullest and clearest explanation of the facts?

Light and Colours are, like Sound and Tones, to be viewed as objective phenomena, related to certain external conditions; or as subjective phenomena, related to certain sensations. Before asking What is Light or Sound? we must consider whether we seek the objective fact, or the subjective sensation. Every one admits that, apart from a sensitive organism, the objective phenomena of Light and Sound exist, although *not* as the Light and Sound known in our sensations. But as we can only know them through our sensations, it seems eminently philosophical to begin our study with these. And this Goethe has done. He first unfolds the laws of physiological colours, *i.e.*, the modifications of the retina; and his immense services in this direction have been cordially recognised by Physiologists. Since, however, we can never learn thus what are the external *conditions* of the phenomena, we have to seek in objective facts such an explanation as will best guide us. The assumption of rays having different degrees of refrangibility may one day turn out to be erroneous; but it

is an assumption which colligates the facts better than any other hitherto propounded, and therefore it is accepted. By regarding both Sound and Light as produced from waves of an elastic medium, acoustic and optic phenomena are reducible to *calculation*. It is true they thus incur Goethe's reproach of ceasing to be concrete objects to the mind, and becoming mathematical symbols; but this is the very ambition of scientific research: a point to which I shall presently return. Let us compare the objective and subjective facts.

If an elastic rod be made to vibrate, the ear perceives nothing until the vibrations reach eight in a second, at which point the lowest tone becomes audible; if the rapidity of the vibrations be now constantly accelerated, tones higher and higher in the scale become audible, till the vibrations reach 24,000 in a second, at which point the ear again fails to detect any sound. In like manner, it is calculated that when vibrations reach 483 billions in a second, Light, or rather the red ray, begins to manifest itself to the retina; with increasing rapidity of vibration, the colours pass into orange, yellow, green, blue, and violet, till 727 billions are reached, at which point no *light* is perceptible. Here chemical action begins; and the rays are called chemical rays; as at the other end of the spectrum they are called heat rays. These are objective *conditions* which have been rigorously ascertained: and most important results have been arrived at through them.

The subjective facts according to Goethe lead to the belief that Tones are the product of Sound and Silence, as Colours are of Light and Darkness. Sound is made various (in tones) by various intermixtures with Silence. Descending from the highest audible note there is a gradual retardation of the vibrations, caused by the gradual encroachments of Silence, until at length Silence predominates and no Sound is heard. Suppose this hypothesis granted, we shall still have to ask what are the *conditions* of this Silence? If these are retardations of vibration, we may dispense with the hypothetical Silence. By similar reasoning we dispense with the hypothetical Darkness.

The assumption of different rays of unequal refrangibility is not only supported by the prismatic decomposition and recomposition of Light, but also finds confirmation in the law of Refraction discovered by Snellius. And the consequence drawn from it, namely, that the relation of the sine of incidence, though constant for each colour, *varies* in the different colours of the spectrum, brings the whole question within the

domain of mathematical calculation. The phenomena cease to be *qualitative* only, and become *quantitative:* they are measurable, and are measured. On Goethe's theory, granting its truth, the phenomena are not measurable; and whoever glances into a modern work on Optics will see that the precision and extent to which calculation has been carried, are in themselves sufficient grounds for assigning the preference to the theory which admits such calculation. For as Copernicus profoundly says, "It is by no means necessary that hypotheses should be true, nor even seem true; it is enough if they *reconcile calculation with observations.*"[1]

Goethe's want of acquaintance with Mathematics and with the Methods of Physical Science prevented his understanding the defect in his own theory, and the manifest superiority of the theory which he attacked. He opposed every mathematical treatment of the subject as mischievous; and Hegel, who has shown himself still more opposed to the Methods of Science, applauds him on this very point.

"I raised the whole school of Mathematicians against me," says Goethe, "and people were greatly amazed that one who had no insight into Mathematics could venture to contradict Newton. *For that Physics could exist independently of Mathematics no one seemed to have the slightest suspicion.*" Nor has that suspicion gained yet any ground with men in the least conversant with Physics, however necessary it may sometimes have been to protest against too exclusive an employment of Mathematics. But the misconception which lies at the bottom of Goethe's polemics was a very natural one to a poet never trained in Mathematical or Experimental science, and unaware of the peculiar position occupied by Mathematics as the great Instrument of research. In his essay, *Ueber Mathematik und deren Misbrauch*,[2] he compares the philosopher employing such an instrument to a man who should invent a machine for drawing a cork, an operation which two arms and hands very easily effect.

To make his error intelligible, let us suppose a man of great intellectual acuteness and energy suddenly to light upon the idea that our chemical theories were vitiated by a false basis—that the atomic theory was not only an hypothesis, but an hypothesis which misrepresented the order of Nature; there being, in truth, none of the quantitative relations as are

[1] COPERNICUS: *De Revolutionibus Orbium Cœlestium*, 1566.
[2] *Werke*, xl. p. 468.

presupposed in that theory. Imagine the reformer setting to work, multiplying experiments, inventing explanations, disregarding all that the accumulated experience of ages had stored up on this very matter, and above all despising, as useless or worse, the very Instrument which rescues Chemistry from rough guess-work, and elevates it into the possibility of a science—the Instrument known as the Balance. It is probable that our reformer would make many curious observations, some of them quite new. It is probable that he would in many directions stimulate research. But it is certain that he would be hopelessly wrong in his theories, for he would necessarily be imperfect in his data. Without the delicate control of the Balance, chemical experiment can never become *quantitative;* and without quantitative knowledge there can be no chemical science strictly so called, but only *qualitative*, *i.e.* approximative knowledge. No amount of observation will render observation precise unless it can be measured. No force of intellect will supply the place of an Instrument. You may watch falling bodies for an eternity, but without Mathematics mere watching will yield no law of gravitation. You may mix acids and alkalis together with prodigality, but no amount of experiment will yield the secret of their composition, if you have flung away the Balance.

Goethe flung away the Balance. Hegel boldly says this is Goethe's merit—*das Prisma heruntergebracht zu haben.* He praises the "pure sense of Nature," which in the poet rebelled against Newton's "barbarism of Reflection." To the same effect Schelling, who does not hesitate to choose it as the very ground for proclaiming Goethe's superiority over the Newtonians, that "instead of the artificially confused and disfiguring experiments of the Newtonians, he places the purest, simplest verdicts of Nature herself before us;" he adds, "it is not surprising that the blind and slavish followers of Newton should oppose researches which prove that precisely the very section of Physics, in which up to this time they have imagined the most positive, nay, almost geometric evidence, to be on their side, is based on a fundamental error."[1]

This point of Method, if properly examined, will help to elucidate the whole question of Goethe's aptitude for dealing with physical science. The native direction of his mind is visible in his optical studies as decisively as in his poetry;

[1] SCHELLING: *Zeitschrift für spekulative Philos.* ii. p. 60.

that direction was towards the *concrete* phenomenon, not towards abstractions. He desired to explain the phenomena of colour, and in Mathematics these phenomena disappear; that is to say, the very *thing* to be studied is hurried out of sight and masked by abstractions. This was utterly repugnant to his mode of conceiving Nature. The marvellous phenomena of polarised light in the hands of Mathematicians excited his boundless scorn. "One knows not," he says, "whether a body or a mere ruin lies buried under those formulas."[1] The name of Biot threw him into a rage; and he was continually laughing at the Newtonians about their Prisms and Spectra, as if Newtonians were pedants who preferred their dusky rooms to the free breath of heaven. He always spoke of observations made in his garden, or with a simple prism in the sunlight, as if the natural and simple Method were much more certain than the artificial Method of Science. In this he betrayed his misapprehension of Method. He thought that Nature revealed herself to the patient observer—

> Und was sie deinem Geist nicht offenbaren mag,
> Das zwingst du ihr nicht ab mit Hebeln und mit Schrauben.

"And what she does not reveal to the Mind will not be extorted from her by Levers and Screws." Hence his failure; hence also his success; for we must not forget that if as a contribution to Optics his *Farbenlehre* be questionable, as a contribution to the knowledge of colour demanded by Artists it is very valuable. Painters have repeatedly acknowledged the advantage they have derived from it; and I remember hearing Riedel, at Rome, express the most unbounded enthusiasm for it; averring that, as a colourist, he had learned more from the *Farbenlehre*, than from all the other teachers and books he had ever known. To artists and physiologists —*i.e.* to those who are mainly concerned with the phenomena of colour as perceptions, and who demand qualitative rather than quantitative knowledge—his labours have a high value; and even physicists must admit that, however erroneous the theory and imperfect the method he has adopted, still the immense accumulation and systematisation of facts, and the ingenuity with which he explains them, deserve serious respect. As Bacon felicitously says, a tortoise on the right path will beat a racer on the wrong path; and if it be true that Goethe

[1] *Werke*, xl. 473.

was on the wrong path, it is not less true that he shows the thews and sinews of a racer.

It is with other feelings that we contemplate him labouring in the organic sciences. There the native tendencies of his mind and the acquired tendencies of education better fitted him for success. Biology has peculiar fascinations for the poetical mind, and has seduced several poets to become physiologists. Mathematics are not required. Concrete observations furnish the materials for a keen and comprehensive comparison.

Let it be distinctly understood, and that not on the testimony of the admiring biographer, but on some of the highest scientific testimonies in Europe,[1] that in the organic sciences Goethe holds an eminent place—eminent not because of his rank as a poet, but in spite of it. Let it be understood that in these sciences he is not to be treated as a poet, a facile amateur, but as a *thinker* who, having mastered sufficient knowledge to render his path secure, gave an impulse to the minds of contemporaries and successors, which is not even yet arrested.

Goethe was a thinker in science, a manipulator of scientific ideas. He was not one of those laborious and meritorious workers who with microscope and scalpel painfully collect the materials from which Science emerges. He worked, too, in his way, and everywhere sought in the order of Nature for verification of the ideas which he had conceived *a priori*. Do not however mistake him for a metaphysician. He was a positive thinker on the *a priori* Method; a Method vicious only when the seeker rests contented with his own assumptions, or seeks only a *partial* hasty confrontation with facts—what Bacon calls *notiones temere a rebus abstractas;* a Method eminently philosophic when it merely *goes before* the facts, anticipating what will be the tardy conclusions of experience. The *a priori* Method is a bright and brilliant instrument. It will cut the fingers when clumsily handled. It will cut deep into the truth if rightly used; as it was by Kepler and Goethe,

[1] In the first edition of this work several passages were quoted in support of the assertion in the text; but one effect of this chapter has been to render such evidence superfluous, Goethe's position in science becoming daily more widely recognised. The following references are therefore all that need now be given:—AUGUSTE ST. HILAIRE: *Morphologie Végétale*, i. p. 15. OSCAR SCHMIDT: *Goethe's Verhältniss zu den organischen Wissenschaften*, p. 10. JOHANNES MUELLER: *Ueber phantastische Gesichtserscheinungen*, p. 104. CUVIER: *Histoire des Sciences Naturelles*, iv. p. 316. ISIDORE, GEOFFROY ST. HILAIRE: *Essais de Zoologie générale*, p. 139. OWEN: *Archetype and Homologies of the Skeleton*, p. 3. HELMHOLTZ: *Allgemeine Monatsschrift*, May 1853. VIRCHOW: *Goethe als Naturforscher.*

who looked upon nature from the heights, but having seen or fancied they saw something in the plains, at once descended to verify the truth of their observation.

We will glance at his achievements in this field, The intermaxillary bone[1] was long a bone of contention among anatomists. Vesalius—one of the grandest and boldest of the early pioneers who wrote against Galen, as the philosophers wrote against Aristotle—declared, and with justice, that Galen's anatomy was not founded on the dissection of the *human* body, but on that of animals. A proof, said he, is that "Galen indicates a separate bone connected with the maxillary by sutures; a bone which, as every anatomist can satisfy himself, exists only in animals." The Galenists were in arms. They could bring no fact in evidence, but *that* was of very little consequence; if facts were deficient, was not hypothesis always ready? Sylvius, for example, boldly said that man *had formerly* an intermaxillary bone. If he has it no longer, he *ought* to have it. It is luxury, it is sensuality which has gradually deprived man of this bone.[2] What has not luxury been made to answer for! The dispute was carried down through centuries, no one attempting to demonstrate anatomically the existence of the bone. Camper actually raised this presumed absence of the bone into the one distinguishing mark separating man from the ape; which is doubly unfortunate, for in the first place the bone is not absent in man, and secondly, in as far as it can be considered absent in man it is equally absent in the chimpanzee, the highest of the apes.[3] Thus was anatomy a treacherous ally in this question, although Camper knew not how treacherous.

This slight historical sketch will serve to show that the discovery, if unimportant, was at least far from easy; indeed so little did it lie in the track of general knowledge, that it was at first received with contemptuous disbelief, even by men so eminent as Blumenbach,[4] and it was forty years gaining general

[1] It is the centre bone of the upper jaw—that which contains the incisor teeth.

[2] This same Sylvius it was who replied to Vesalius that Galen was not wrong when he described man as having seven bones in his sternum (there are only three): "for," said he, "in ancient times the robust chests of heroes might very well have had more bones than our degenerate day can boast." It is impossible to decide upon what might have been; but the mummies are ancient enough, and they have no more bones than we.

[3] Blumenbach had already noted that in some young apes and baboons no trace was discoverable of the bone.

[4] See his *Comparative Anatomy*, translated by Lawrence; and the translator's note, p. 60.

acceptance, although Loder, Spix, and Sömmering at once recognised it. Camper, to whom Goethe sent the manuscript, found that it was *très élégant, admirablement bien écrit, c'est à dire d'une main admirable*, but thought a better Latin style desirable. Goethe began to despise the pedantry of professional men who would deny the testimony of their five senses in favour of an old doctrine; and he admirably says, "the phrases men are accustomed to repeat incessantly end by becoming convictions, *and ossify the organs of intelligence.*"[1]

The most remarkable point in this discovery is less the discovery than the Method which led to it. The intermaxillary bone in animals contains the incisor teeth. Man has incisor teeth; and Goethe, fully impressed with the conviction that there was Unity in Nature, boldly said, if man has the teeth in common with animals, he must have the bone in common with animals. Anatomists, lost in details, and wanting that fundamental conception which now underlies all philosophical anatomy, saw no abstract necessity for such identity of composition; the more so, because *evidence* seemed wholly against it. But Goethe was not only guided by the true philosophic conception, he was also instinctively led to the true Method of demonstration, namely, Comparison of the various modifications which this bone underwent in the animal series. This Method has now become *the* Method; and we require to throw ourselves into the historical position to appreciate its novelty, at the time he employed it. He found on comparison that the bone varied with the nutrition of the animal, and the size of the teeth. He found, moreover, that in some animals the bone was not separated from the jaw; and that in children the sutures were traceable. He admitted that seen from the front no trace of the sutures was visible, but on the interior there were unmistakable traces. Examination of the fœtal skull has since set the point beyond dispute. I have

[1] Since the first edition of this work was published, I have come upon a piquant illustration of the not very honourable tendency in men to plume themselves on the knowledge of a discovery which they had formerly rejected. VICQ D'AZYR: *Discours sur l'Anatomie* (*Œuvres*, iv. 159), mentioning his discovery of the intermaxillary, adds, "J'ai appris de M. Camper, dans son dernier voyage à Paris, *que cet os lui est connu depuis très long temps.*" Now this same Camper, on receiving the anonymous dissertation in which Goethe propounded the discovery, said, "Je dois ré-examiner tout cela"; but on learning that Goethe was the author, he wrote to Merck that he had "convinced himself that the bone did not exist" (see VIRCHOW: *Goethe als Naturforscher*, p. 79); yet no sooner does a great anatomist tell him that the bone exists, than he complacently declares "I have known it a long while."

seen one where the bone was distinctly separated; and I possess a skull, the ossification of which is far advanced at the parietal sutures, yet internally faint traces of the intermaxillary are visible.[1]

Goethe made his discovery in 1784, and communicated it to several anatomists. Loder mentions it in his *Compendium* in 1787.

Respecting Goethe's claim to the honour of this discovery, I have recently discovered a fact which is of great or small significance according to the views we hold respecting such claims; namely, whether the clear enunciation of an idea, though never carried out in detail, suffices to give priority; or whether, in the words of Owen,[2] "He becomes the true discoverer who establishes the truth: and the sign of the proof is the general acceptance. Whoever, therefore, resumes the investigation of a neglected or repudiated doctrine, elicits its true demonstration, and discovers and explains the nature of the errors which have led to its tacit or declared rejection, may calmly and confidently await the acknowledgments of his rights in its discovery." If we hold the former view, we must assign the discovery of the intermaxillary in man to Vicq d'Azyr; if we hold the latter, to Goethe. In the *Traité d'Anatomie et de Physiologie*, which the brilliant anatomist published in 1786, we not only find him insisting on the then novel idea of an uniform plan in the structure of organic beings, according to which Nature "semble opérer toujours d'après un modèle primitif et général dont elle ne s'écarte qu'à regret et dont on rencontre partout des traces;"[3] but we find this explicit illustration given among others: "Peut on s'y refuser enfin (*i.e*, to admit the traces of a general plan) en comparant les os maxillaires antérieurs que j'appelle *incisifs* dans les quadrupèdes, avec cette pièce osseuse qui soutient les dents incisives supérieurs dans l'homme, où elle est séparée de l'os maxillaire par une petite fêlure très remarquable dans les fœtus, à peine visible dans les adultes, et dont personne n'avoit connu l'usage." In a subsequent passage of the second *Discours*

[1] These might be considered abnormal cases. But M. J. Weber has devised a method of treating the skull with dilute nitric acid, which makes the separation of the bones perfect. *Froriep's Notizen*, 1828, bd. 19, 282. VIRCHOW: *l.c.* p. 80.

[2] OWEN: *Homologies of the Skeleton*, p. 76. Comp. also MALPIGHI: *Opera Posthuma*, 1697, p. 5.

[3] VICQ D'AZYR: *Œuvres*, iv. p. 26. The work is there called *Discours sur l'Anatomie.*

he say: "Toutes ces dents sont soutenues dans la mâchoire antérieure par un os que j'ai décrit sous le nom d'incisif ou labial, que quelques-uns appellent intermaxillaire, que l'on à découvert depuis peu dans les morses, et *dont j'ai reconnu les traces dans les os maxillaires supérieurs du fœtus humain.*"[1]

The reader will remark that this is not simply the announcement of the fact, but is adduced in illustration of the very same doctrine which Goethe invoked. The *Traité d'Anatomie*, as we have seen, was published in 1786; that is to say, two years after Goethe had made his discovery; and Sömmering, in writing to Merck,[2] says: "I have expressed my opinion on Vicq d'Azyr's work in the *Götting. Gelehrt. Anzeig.* It is the best we have. But as far as the work has yet gone Goethe is not mentioned in it." From which it may be inferred that Sömmering supposed Vicq d'Azyr to have been acquainted with Goethe's contemporary labours; but against such a supposition we must remember that, if Germany took note of what was passing in France, discoveries made in Germany travelled with great slowness across the Rhine; and in illustration of this slowness we may note that Geoffroy St. Hilaire, who was several years afterwards nobly working out conceptions of Philosophical Anatomy in a spirit so identical with that of Goethe, was utterly unconscious of the existence of a predecessor, and noticing the monograph of G. Fischer, said, "*Gœthes* aurait le premier découvert l'interpariétal dans quelques rongeurs, et se serait contenté d'en faire mention par une note manuscrite sur un exemplaire d'un traité d'anatomie comparée."[3]

But the conclusive point is this: although the *Traité d'Anatomie* did not appear till 1786, the discovery of the intermaxillary was published by Vicq d'Azyr in the Académie des Sciences for 1779,[4] five years before Goethe announced his discovery to Herder. The question of priority is therefore settled. The Frenchman had no need of any acquaintance with what the German poet had worked out; and Merck's astonishment at finding Goethe's "so-called discovery accepted

[1] VICQ D'AZYR: *Œuvres*, iv. p. 159. [2] *Briefe an Merck*, p. 493.

[3] *Philosophie Anatomique*, ii. p. 55. Geoffroy was afterwards very proud to have the suffrage of *Gœthes;* and Geoffroy's son has spoken most honourably of the coincidence between the speculations of his father and the poet.

[4] In the first edition I stated that "from a note to BLUMENBACH'S *Comparative Anatomy* (p. 19), it seems as if Vicq d'Azyr had made this observation as early as 1780." The date in the text is given by Vicq d'Azyr himself, *Œuvres*, iv. 159.

by Vicq d'Azyr" was wholly misplaced; but can we be equally sure that Goethe was altogether ignorant of his predecessor? I think he was. The sudden enthusiasm, the laborious investigation, the jubilate of triumph, are evidences that if ever his predecessor's discovery had come under his notice (which is highly improbable) it was completely forgotten; and we may judge how completely Vicq d'Azyr's announcement had been without echo in the scientific world, from the fact that the three most illustrious men of the day, Camper, Blumenbach, and Sömmering, knew nothing of it, and denied the existence of the bone Goethe claimed to have discovered. Thus, in assigning priority to Vicq d'Azyr, we by no means diminish Goethe's merit. He it was who thoroughly worked out the discovery; he it was who gave it a fixed and definite place in science; he it is who is always named as the discoverer.

The only importance of this discovery is the philosophic Method which it illustrates; the firm belief it implies that all organisms are constructed on an uniform plan, and that Comparative Anatomy is only valid because such a plan is traceable. In our day it seems an easy conception. We are so accustomed to consider all the variations in organic structures as modifications of a type, that we can hardly realise to ourselves any other conception. That it was by no means an obvious idea, nor one easy to apply, may be seen in two brilliant applications—the metamorphosis of plants, and the vertebral theory of the skull.

Place a flower in the hands of the cleverest man of your acquaintance, providing always he has not read modern works of science, and assure him that leaf, calyx, corolla, bud, pistil, and stamen, differing as they do in colour and in form, are nevertheless all modified leaves; assure him that flower and fruit are but modifications of one typical form, which is the leaf; and if he has any confidence in your knowledge he may accept the statement, but assuredly it will seem to him a most incomprehensible paradox. Place him before a human skeleton, and, calling his attention to its manifold forms, assure him that every bone is either a vertebra, or the appendage to a vertebra, and that the skull is a congeries of vertebræ under various modifications; he will, as before, accept your statement, perhaps; but he will, as before, think it one of the refinements of transcendental speculation to be arrived at only by philosophers. Yet both of these astounding propositions are first

principles in Morphology; and in the History of Science both of these propositions are to be traced to Goethe. Botanists and anatomists have, of course, greatly modified the views he promulgated, and have substituted views nearer and nearer the truth, without yet being quite at one. But he gave the impulse to their efforts.

While botanists and anatomists were occupied in analysis, striving to distinguish separate parts, and give them distinct names, his poetical and philosophic mind urged him to seek the supreme synthesis, and reduce all diversities to a higher unity. In his poem addressed to Christiane he says:

> Thou, my love, art perplexed with the endless seeming confusion
> Of the luxuriant wealth which in the garden is spread;
> Name upon name thou hearest, and in thy dissatisfied hearing,
> With a barbarian noise one drives another along.
> All the forms resemble, yet none is the same as another;
> Thus the whole of the throng points at a deep-hidden law.[1]

To prove this identity was no easy task. He imagined an ideal typical plant (*Urpflanze*), of which all actual plants were the manifold realisations; and this I cannot but agree with Schleiden in considering a conception at once misleading and infelicitous. He was happier in the conception of all the various organs of the plant as modifications of one fundamental type; this type he names the *Leaf*. Not that we are to understand the metamorphosis of plants to be analogous to the metamorphosis of animals (an error into which I fell in my first edition, as Ferdinand Cohn properly points out), nor indeed is it such a metamorphosis at all. The pistil and petal are not first developed into leaves, and from these leaves changed into petal and pistil; as a caterpillar develops into a grub, and the grub into a butterfly. This would be metamorphosis. Instead of this we must conceive the whole plant as a succession of repetitions of the original type variously modified; in some of these repetitions the modification has been slight, in others considerable. The two typical forms are stem and leaf. From the seed there is an ascending and a descending axis, formed of a succession of stems: the ascending axis is called the aerial stem; the descending axis is the root. From both of these stems lateral stems or branches are given off; and from these again others. The Leaf is the second type: it forms all the other organs by various modifications. Widely as a pistil differs from a petal,

[1] Whewell's translation: *Hist. Inductive Sciences*, iii. 360.

and both from an ordinary leaf, they are disclosed as identical by the history of their development.

It is impossible to be even superficially acquainted with biological speculations, and not to recognise the immense importance of the recognition of a Type. As Helmholtz truly observes: "The labours of botanists and zoologists did little more than collect materials, until they learned to dispose them in such a series that the laws of dependence and a generalised type could be elicited. Here the great mind of our poet found a field suited to it; and the time was favourable. Enough material had been collected in botany and comparative anatomy for a clear survey to be taken; and although his contemporaries all wandered without a compass, or contented themselves with a dry registration of facts, he was able to introduce into science two leading ideas of infinite fruitfulness."

And here the question presents itself: Is Goethe rightfully entitled to the honour universally awarded to him of having founded the Morphology of Plants? We must again evoke the distinction previously stated (p. 356). No one denies that the doctrine was so entirely novel that botanists at first rejected it with contempt, and only consented to accept it when some eminent botanists had shown it to be true. No one denies that Goethe worked it out; if any predecessor had conceived the idea, no one had carried the idea into its manifold applications. But he has himself named Linnæus and Wolff as his precursors; and it is of some interest to ascertain in what degree these precursors have claim to the honour of the discovery.

It has been remarked by the eminent botanist Ferdinand Cohn,[1] that the great Linnæus mingled with his observation much fantastic error, which the poet Goethe was the first to eliminate. But Dr. Hooker, while admitting the metaphysical and speculative matter which Linnæus has mixed up with his statements, is disposed to value them highly. "The fundamental passage is in the *Systema Naturæ*, in the introduction to which work the following passage occurs: 'Prolepsis (Anticipation) exhibits the mystery of the metamorphosis of plants, by which the herb, which is the *larva* or imperfect condition, is changed into the declared fructification: for the plant is capable of producing either a leafy herb or a fructification.

[1] *Goethe und die Metamorphosen der Pflanzen*, in the *Deutsches Museum of* PRUTZ, iv. Jan. 1862.

. . . When a tree produces a flower, nature anticipates the produce of five years where these come out all at once; forming of the bud leaves of the next year, *bracts;* of those of the following year, the *calyx;* of the following, the *corolla;* of the next, the *stamina;* of the subsequent, the *pistils*, filled with the granulated marrow of the seed, the terminus of the life of a vegetable.' . . . In the *Prolepsis* the speculative matter, which Linnæus himself carefully distinguishes as such, must be separated from the rest, and this may, I think, be done in most of the sections. He starts with explaining clearly and well the origin and position of buds, and their constant presence, whether developed or not, in the axils of the leaf: adding abundance of acute observations and experiments to prove his statements. The leaf he declares to be the first effort of the plant in spring: he proceeds to show, successively, that bracts, calyx, corolla, stamen, and pistils are each of them metamorphosed leaves."[1] Dr. Hooker adds, "There is nothing in all this that detracts from the merits of Goethe's re-discovery;" and there can be little doubt that, had not Goethe, or another, proved the doctrine, botanists would to this day have continued to pass over the passage in Linnæus as one of his "fanciful flights."

The *aperçu* was in Linnæus; a spark awaiting the presence of some inflammable imagination; and when we remember how fond Goethe was of Linnæus, we can hardly suppose that this *aperçu* had not more than once flashed across his mind as a gleam of the truth. With regard to Caspar Friedrich Wolff the evidence is far from satisfactory. It is certain that Wolff in his immortal work on "Generation" had clearly grasped the morphological principles, and had left Goethe very little to add to them. But it is very uncertain whether Goethe had ever read Wolff. Some years after the publication of his work he mentions with pride the fact of Wolff having been his "admirable precursor," and says that his attention to the work had been drawn by a namesake of the great embryologist. It was with no little surprise therefore that I read in Düntzer,[2] the unhesitating assertion that in 1785 Herder had made Goethe a present of Wolff's *Theoria Generationis*, which contained a rough outline of several of Goethe's favourite ideas. If this statement were correct, Goethe would be under serious suspicion; but it is not correct. On referring to the passage

[1] WHEWELL: *Hist. of Ind. Sciences*, 3rd ed., iii. 553.
[2] *Goethe und Karl August*, 1861, p. 212.

in Herder's letter to Knebel, which Düntzer pretends is the authority for this statement, I find, in the first place, that Herder does not specify the *Theoria Generationis*, nor indeed can we be sure he refers to C. F. Wolff at all; he merely says, "Wolf," which is a common name among German authors; in the second place he does not say that he has *given* the book to Goethe, but that he *intends* doing so when he can get a copy; meanwhile Knebel is not to mention the book to Goethe. And out of such a sentence as this, Düntzer has constructed a "fact," which while it gives his pedantry the small delight of correcting in a foot note Goethe's assertion that F. A. Wolff directed his attention to the *Theoria Generationis*, lays Goethe open to the charges of having borrowed his morphology from Wolff, of having concealed the fact, and of having pretended never to have seen his predecessor's work until his attention was directed to it some years afterwards. Against such charges the following arguments may be urged. First, there is Goethe's own explicit statement—and his veracity is not lightly to be questioned. Secondly, if the work referred to by Herder was the *Theoria Generationis* (which is probable, but not certain), and if it was given as intended (also probable but not certain), we have no evidence that Goethe read it. Thirdly, and conclusively, the date of the very letter in which Herder mentions his intention is ten years *later* (1795) than Düntzer would have us suppose; and is thus five years *after* the publication of Goethe's views (1790).[1]

The *Metamorphosen* was published in 1790. In 1817 Goethe says that he had requested his scientific friends to make notes of any passages they might meet in earlier writers relative to the topic he had treated, because he was convinced that there was nothing absolutely new. His friend F. A. Wolff directed him to Caspar Friedrich. In expressing his admiration for his great predecessor he is proud to acknowledge how much he had learned from him during five-and-twenty years. Now five-and-twenty years from 1817 brings us back to 1792—that is to say, two years after the publication of the *Metamorphosen*, and three years before the letter written by Herder.[2] So that

[1] See KNEBEL: *Nachlass*, ii. 268, which is the authority cited by Düntzer, whose inaccuracy is unpardonable in one so uniformly dull, and so merciless in ferreting out the small inaccuracies of others.

[2] It should be added that Knebel's editors place a (?.) after the date 1795. But we have no reason to suppose they could err by *ten* years in assigning this letter its place; Düntzer professes no doubt as to the accuracy of the date; and internal evidence, taken with what is said above, renders it highly probable that 1795 is very little removed from the correct date.

if we assume the work in question to have been the *Theoria Generationis*, Goethe was perfectly correct in mentioning A. F. Wolff, and not Herder, as the friend to whom he was first indebted for a knowledge of its existence.

The tone in which Goethe speaks of Caspar Friedrich Wolff is assuredly not that of a man who had any obligations to conceal; but of a man who recognising a precursor with pleasure, speaks of the two theories as two independent modes of conceiving the phenomena, the theory of his precursor being pre-eminently physiological, while his own was pre-eminently morphological.

With regard both to Linnæus and Wolff it may be said that they anticipated the morphology of plants, but that to Goethe belongs the credit of establishing it. We do not take from the credit of Columbus by showing that five centuries before he discovered the New World, Scandinavian voyagers had repeatedly touched on those shores; nor do we diminish the value of Goethe's contribution to Science, by showing that before him Wolff had perceived the identity of the various organs of the plant. It was not the purpose of the Scandinavians to discover the New World. They did not make their discovery a possession for mankind. Neither was it Wolff's purpose to create a new theory in Botany. He discovered a process of Nature while he was seeking the laws of Epigenesis, and he only used his discovery as one of several illustrations. Columbus set out with the distinct purpose of discovery, and made his discovery a possession for all time. So also Goethe set out with the distinct purpose, and Botanists justly declare that to his work they owe the idea of plant metamorphosis.

Goethe's work is very beautiful, and may be read without any previous botanical knowledge. It traces the metamorphoses of the grain into the leaf, and thence into the flower. The morphological part is perfect, except that, as Cohn remarks, he has given an exclusive predominance to the leaf, and overlooked the not less important stem. It is to be regretted that he hampers himself with the following physiological hypothesis: every segment proceeding immediately from that which goes before it, receiving its nourishment through all the segments which have gone before, must, he says, be more perfect, and must send to its leaves and buds a more elaborated sap. The result is that the coarser fluids are rejected, the finer attracted, and the plant grows more and more perfect till it reaches its point of culmination.

This hypothesis of a more elaborated sap, reaching the ultimate segments, is in direct contradiction to the hypothesis of Wolff, which also declares the flower to be modified leaves; but how modified?[1] they are modified because they are imperfect. Their development has been arrested. They are smaller, have less sap, the sap has lost its chlorophyl, and the colour of the flower is an evidence of *imperfection*. I cannot stop to consider Wolff's ingenious arguments by which he endeavours to show that flowering and fructification are arrests of development. It is enough to indicate the contrast between his and Goethe's views. Both are agreed that inasmuch as a differentiation does take place, it must have some cause; but the cause is by Wolff said to be deficiency of sap, by Goethe elaborated sap.

Goethe agrees with Wolff as regards the passage of the leaf into the flower being dependent on the acceleration or retardation of the sap. It had been noticed by Linnæus that a too abundant supply of food retards the flowering, and accelerates the growth of leaves; whereas a moderate supply, nay, even an approach to starvation, accelerates the flowering and diminishes the number of leaves. Wolff attributes this simply to the fact that so long as there is abundant nutriment there will be abundant growth, and no arrest in the shape of imperfect leaves (*i.e.* flowers); and when nutriment is scanty, the arrest soon takes place. But unfortunately for this opinion, and indeed for the opinion that flowers are imperfect leaves resulting from a want of nutriment, there is a class of plants which blossom *before* they put forth leaves. Goethe's explanation, hypothetical though it be, is better. He says that as long as there are any of the grosser fluids to be rejected, the organs of the plant are forced to employ themselves in this labour, which labour renders flowering impossible; but no sooner do we limit the nourishment than, by diminishing this process of elaboration, we accelerate the flowering.

We are here touching on the great law of antagonism between Growth and Development which is intimately connected with the law of Reproduction—a subject too vast to be even indicated in this rapid survey. The student will note, however, that although Goethe perils his position by the introduction of an hypothetical elaboration of fluids, without assigning a cause for that elaboration, he nevertheless sees, what many

[1] *Theorie von der Generation*, § 80, *sq.*

fail to see, that Reproduction is only another form of Growth —a process of differentiation. "The vital forces of the plant," he says, "manifest themselves in two ways: on the one hand *vegetation*, issuing in the stem and leaves; and on the other *reproduction*, issuing in flowers and fruits. If we examine vegetation closely, we shall see that the plant continuing itself from articulation to articulation, from leaf to leaf, and putting forth buds, accomplishes a *reproduction* which differs from that ordinarily so-named in being *successive*—it manifests itself in a series of isolated developments instead of manifesting itself *simultaneously*. That force which produces buds has the greatest analogy with that which determines simultaneously the higher act of propagation. We can force the plant to produce buds incessantly, or we can accelerate the epoch of flowering; the first by abundant nourishment, the second by nourishment less abundant. In defining *budding* as 'successive propagation,' and *flowering* and *fructification* as 'simultaneous propagation,' we designate the mode in which each manifests itself. Thus, then, whether the plant buds, flowers, or fructifies, it is always by means of *the same organs*, the form and destination of which are changed. The same organ which expands into a leaf upon the stem and presents such varied forms, contracts to make the calyx, expands again to make the petal, to contract once more into the sexual organs, and expand for the last time into fruit."

Whatever may be the final decision upon the Metamorphoses of Plants, there must ever remain the great and unique glory of a poet having created a new branch of science, and by means as legitimately scientific as those of any other creation. Morphology now counts among its students illustrious names, and crowds of workers. And this science we owe to the author of *Faust*. Nor is this all. He has priority in some of the most luminous and comprehensive ideas which are now guiding philosophic speculation on the science of life. In the historical sketch which Carus prefixes to his *Transcendental Anatomy*, after setting forth the various tentatives men had made to discover by means of *descriptive* anatomy, and occasional comparisons, the true relations of the various parts of the body, he says:[1] "If we go back as far as possible into the history of the labours undertaken with a view to arrive at the philosophic conception of the skeleton, we find that the first

[1] *Anatomie Comparée*, vol. iii. p. 3. French trans.

idea of a metamorphosis of the osseous forms,—*i.e.* that all forms are but modifications more or less traceable of one and the same Type—belongs to Goethe." After a quotation of Goethe's words, Carus adds: "It is difficult to express in clearer terms the idea of the Unity which rules over the plurality of the skeleton-forms. Its first great application was the vertebral theory of the skull."

Let me repeat, as a matter of justice, and not to allow the high praise bestowed on Goethe's efforts to mislead the reader's expectation, that the merit is that of a *thinker in science*, not the merit of an industrious discoverer and collector of details. His great effort was to create a Method, to establish principles upon which the science could be founded. In an admirable little essay on "Experiment as the mediator between the Object and the Subject," written in 1793, we see how clear were his ideas on Method. "Man," he says, "regards at first all external objects with reference to himself; and rightly so, for his whole fate depends on them, on the pleasure or pain which they cause him, on their utility or danger to him." This is the initial stage of all speculation. Its Method is the determination of the external order according to *analogies drawn from within*. The culmination of this Method is seen in the fundamental axiom of Des Cartes and Spinoza: *all clear ideas are true*. So long as this Method is followed, Metaphysics reigns triumphant, and Science is impossible. It is displaced by the Objective Method. Goethe remarks how much more difficult is the task of discerning objects according to this Method, *i.e.* not as related to *us*, but as related to one another. Our touchstone of pleasure or pain is given up. With godlike indifference we become *spectators*, and seek that which *is*, not that which touches *us*. Thus the real botanist considers less the beauty, or the use of flowers, than their laws of growth, and their relation to each other. And as the sun shines on them, developing them all impartially, so must the philosopher look on them with calm contemplative eye, taking the terms of his comparison from the circle he contemplates, not from any figments of his own mind. Goethe sets aside all inquiry into final causes,—by Bacon justly styled "barren virgins,"—and seeks to know what *is*.

It is worthy of remark that the study of Development is quite a modern study. Formerly men were content with the full-statured animal,—the perfected art,—the completed society. The phases of development and the laws of growth

were disregarded, or touched on in a vague uncertain manner. A change has come over the spirit of inquiry. "The history of Development," says Von Baer, "is the true torchbearer in every inquiry into organic bodies." In Geology, in Physiology, in History, and in Art, we are now all bent on tracing the phases of development. To understand the *grown* we try to follow the *growth*.

As a thinker in science Goethe was truly remarkable, and as a worker not contemptible. To prove how far he was in advance of his age we have only to cite a single passage which, in its aphoristic pregnant style, contains the clear announcement of biological laws, which have since been named among the glories of Geoffroy St. Hilaire, Von Baer, Milne-Edwards, Cuvier, and Lamarck.

"Every living being is not a unity but a plurality. Even when it appears as an individual, it is the reunion of beings living and existing in themselves, identical in origin, but which may appear identical or similar, different or dissimilar.

"The *more imperfect* a being is the more do its individual parts *resemble each other*, and the more do these parts *resemble the whole*. The *more perfect* the being is the more *dissimilar are its parts*. In the former case the parts are more or less a repetition of the whole; in the latter case they are totally unlike the whole.

"The more the parts resemble each other, the less subordination is there of one to the other. *Subordination of parts indicates high grade of organisation.*"[1]

To illustrate by familiar examples. Take a polyp and cut it into several pieces; each piece will live and manifest all those phenomena of nutrition and sensibility which the whole polyp manifested. Turn it inside out like a glove, the internal part becomes its skin, the external part becomes its stomach. The reason is, that in the simple structure of the polyp, the parts resemble each other and resemble the whole. There is no individual organ, or apparatus of organs, performing one function, such as nutrition, and nothing else. Every function is performed by every part; just as in savage societies, every man is his own tailor, his own armourer, his own cook, and his own policeman. But take an animal higher in the scale, and there you find the structure composed of dissimilar parts, and each part having a different office. That animal cannot

[1] *Zur Morphologie*, 1807 (written in 1795), *Werke*, xxxvi. p. 7.

be hewn in pieces and each piece continue to live as before. That animal cannot have its skin suddenly turned into a stomach. That animal, in the social body, cannot make his own clothes or his own musket; the division of labour which has accompanied his higher condition has robbed him of his universal dexterity.

The law invoked by Goethe, is now to be met with in every philosophic work on zoology. One form of it is known in England as Von Baer's law, viz. that Development proceeds from the Like to the Unlike, from the General to the Particular, from the Homogeneous to the Heterogeneous. I have too profound an admiration for Von Baer to wish in any way to diminish his splendid claims, but I cannot help remarking that when writers attribute to him the merit of having discovered this law, they are in direct contradiction with Von Baer himself, who not only makes no such claim, but in giving the formula adds, "this law of development has indeed never been overlooked."[1] His merit is the splendid application and demonstration of the law, not the first perception of it.

It is generally known that the law of "division of labour in the animal organism" is claimed by Milne-Edwards, the great French zoologist, as a discovery of his own. Yet we see how clearly it is expressed in Goethe's formula. And with even more clearness do we see expressed Cuvier's principle of classification, viz. the *subordination of parts*. I do not wish to press this point further, nor do I wish that these great men should be robbed of any merit in order to glorify Goethe with their trophies. The student of history knows how discoveries are, properly speaking, made by the Age, and not by men. He knows that all discoveries have had their anticipations; and that the world justly credits the man who makes the discovery *available*, not the man who simply perceived that it was possible. I am not here writing the history of science, but the biography of Goethe; and the purpose of these citations is to show that he placed himself at the highest point of view possible to his age, and that as a thinker he thought

[1] "Dieses Gesetz der Ausbildung ist wohl nie verkannt worden." *Zur Entwickelungsgeschichte.* Erster Theil, p. 153. Among others, WOLFF has clearly stated it. *Theorie von der Generation*, § 28, p. 163. See also MECKEL, *Traité d'Anatomie Comparée.* French trans., i. 297. BUFFON also says: "Un corps organisé dont toutes les parties seraient semblables à lui-même est la plus simple car ce n'est que la répétition de la même forme." *Hist. Nat.*, 1749, ii. 47.

the thoughts which the greatest men have subsequently made popular.

Observe, moreover, that Goethe's anticipation is not of that slight and fallacious order which, like so many other anticipations, rests upon a vague or incidental phrase. He did not simply attain an *aperçu* of the truth. He mastered the law, and his mastery of that law sprang from his mastery of the whole series of conceptions in which it finds its place. Thus in his "Introduction to Comparative Anatomy," written in 1795, he pointed out the essentially sterile nature of the comparisons then made, not only in respect of comparing animals with men and with each other, not only in the abuse of final causes, but also in taking man as the standard, instead of commencing with the simplest organisms and rising gradually upwards. One year after this, Geoffroy St. Hilaire, ignorant of what was passing in the study at Weimar, and in the Museum at Jena, published his *Dissertation sur les Makis*, wherein he began his renovation of the science. He, too, like Goethe, was bent on the creation of a Type according to which all organised structures could be explained. This conception of a Type (*allgemeines Bild*), according to which the whole animal kingdom may be said to be constructed, was a truly scientific conception, and has borne noble fruit. It must not, however, be confounded with a Platonic Idea. It was no metaphysical entity, it was simply a scientific artifice. Goethe expressly says that we are not for an instant to believe in the *existence* of this Type as an objective reality, although it is the generalised expression of that which really exists. This caution has not been sufficiently present to the minds of several speculators; and the idea of a Type has engendered not a few extravagances. Nevertheless, the net result of these speculations has been good.

One of the most interesting applications of the idea of a Type is the theory of the vertebral structure of the skull. Every cultivated reader knows that transcendental anatomists now conceive the skull as composed of three, or more, vertebræ variously modified; but very few readers have a distinct conception of what parts of the skull are separable into vertebræ, or what is the amount of resemblance now traceable underneath the modifications; and this is the less to be wondered at, seeing that even now there is no great unanimity among independent investigators. The principles of Morphology are not always sufficiently attended to. Just as in con-

sidering the Metamorphoses of Plants we had to dismiss the idea of the pistil or stamen having been modified from a leaf, so must we dismiss the idea of a skull having been modified from a vertebral column. In both cases we may express the morphological identity—the unity of composition—by considering every organ in the plant as a modification of the typical leaf, and every bone in the skeleton as a modification of the typical vertebra (or part of a vertebra); but it is as inaccurate and misleading to call the skull a vertebral column, as it would be to call the brain a spinal cord. Between the brain and cord there is a fundamental identity: both are masses of ganglionic substance, having (as I have elsewhere shown)[1] identical properties and similar, though not the same, functions. But over and above these fundamental resemblances there are manifest and important differences. To disregard these differences, and fix attention solely on the resemblances, is eminently unphilosophical; and we can only be justified in saying that the structure of the skull is on the same *general plan* as the structure of the rest of the spinal axis, precisely as we say that the structure of the fish exhibits the same general plan as the structure of the quadruped. In other words, every special vertebra is the *individual* form of a *general* type. The skull is not, as Oken maintains, a modified spinal column.[2] To maintain this is to say that the spinal vertebra is the typical form from which the cranial vertebræ are developed; whereas, in truth, both are but variations of one typical form; and the idea of Kielmeyer that the spinal column is a skull, is quite as accurate as the idea of Oken that the skull is a spinal column. Indeed, Kielmeyer's idea is the more admissible of the two; for if we seek our evidence in embryology, or in that "permanent embryology" the Animal Series, we find the cranial vertebræ are *first* in order of time: in fishes the skull alone presents true osseous development of all the segments of the typical bone; and if we go still lower in the series, we find—in the Cephalopoda—a rudimentary brain, not unlike the lower forms of the brain in fishes, enclosed in a rudimentary skull, but without a spinal cord or spinal column. We are justified, therefore, in saying that the skull cannot be a modification of the spinal column.

[1] *Reports of British Association for the Advancement of Science*, 1859, and *Physiology of Common Life*, vol. ii.

[2] "As the brain is a more voluminously developed spinal cord, so is the brain-case a more voluminous spinal column." OKEN; cited by OWEN, *Homologies*, p. 74.

Oken and Spix regard the head as a "repetition" of the trunk; the brain is a repetition of the spinal cord; the mouth repeats the intestine and abdomen; the nose repeats the lungs and thorax; the jaws the limbs. Unfortunately for this ingenious scheme, there are vertebrate animals with heads but without limbs; and it would therefore be nearer the mark to call the limbs modified jaws, than to call jaws modified limbs. In presence of such perplexities, we cannot wonder if some men have objected to the vertebral theory, that it amounts to nothing more than saying a vertebra is a bone.

The typical vertebra is thus defined by Owen: "One of those segments of the endoskeleton which constitutes the axis of the body and the protecting canals of the nervous and vascular trunks."[1] A perfect vertebra should therefore contain at least two arches, one to form the protecting walls of a nervous centre, the other to form the protecting walls of the great blood-vessels. Now if we make a section of the skull, we find that this bony box "consists of a strong central mass whence spring an upper arch and a lower arch. The upper arch is formed by the walls of the cavity containing the brain, and stands in the same relation to it as does the neural arch of a vertebra to the spinal cord with which that brain is continuous. The lower arch encloses the other viscera of the head, in the same way as the ribs embrace those of the thorax. And not only is the general analogy between the two manifest, but a young skull may readily be separated into a number of segments, in each of which it requires but little imagination to trace a sort of family likeness to such an expanded vertebra as the atlas."[2]

The luminous guide of anatomical research, by Geoffroy St. Hilaire named "le principe des connexions," will thus easily lead us to recognise the neural arches of the brain-case as homologues of the neural arches of the spinal axis, and we may ask with Huxley, "What can be more natural than to take another step to conceive the skull as a portion of the vertebral column still more altered than the sacrum or coccyx, whose vertebræ are modified in correspondence with the expansion of the anterior end of the nervous centre and the needs of the cephalic end of the body?" This was the question which flashed upon the poet's mind, and which indeed is so intimately allied to the morphological doctrines

[1] OWEN: *Homologies*, p. 81.
[2] HUXLEY: *Croonian Lecture*, 1858.

he had already found realised in plants, that far from estimating it as a discovery which reflects singular honour on his sagacity, I am disposed to think more lightly of it than of many a neglected sentence in his little studied essays. I say this, not because the idea seems obvious now it has been stated, and every one can make the egg stand on end after Columbus, but because in Goethe's attempt to carry his idea into anatomical detail, it is universally confessed that he was not successful. This is a point to which we shall presently return. Meanwhile I may add that, on re-examination of this complex subject, I am of opinion that neither Goethe nor Oken has been free from a certain indistinctness of conception, or has sufficiently kept before him all the elements of the problem. A fundamental mistake, already touched upon, is in the supposed relation of the skull to the spinal axis. Anatomists would scarcely venture to affirm that the brain bears the same relation to the cervical enlargement of the spinal cord, as that enlargement bears to the lumbar enlargement of the cord; yet they affirm, explicitly and implicitly, that the brain-case bears the same relation to the cervical vertebræ as those vertebræ bear to the lumbar. Whereas anatomy very plainly teaches that over and above certain fundamental resemblances between the brain and spinal cord, resemblances not much greater than between the sympathetic ganglia and the brain, there are also manifest and important differences, very early exhibited in the course of embryological development, and bringing with them corresponding differences in the protecting bones. And in this point of view the researches of embryologists, as expounded in Huxley's remarkable Croonian Lecture, seem decisive. I will cite here the conclusion to which Huxley is led: "The fallacy involved in the vertebral theory of the skull," he says, "is like that which before Von Baer infested our notions of the relations between fishes and mammals. The mammal was imagined to be a modified fish, whereas, in truth, both fish and mammal start from a common point, and each follows its own road thence. So I conceive what the facts teach us is this:—the spinal column and the skull start from the same primitive condition—a common central plate with its laminæ dorsales and ventrales—whence they immediately begin to diverge. The spinal column, in all cases, becomes segmented into its somatomes; and in the great majority of cases distinct centra and intercentra are developed, enclosing

the notocord more or less completely. The cranium never becomes segmented into somatomes; distinct centra and intercentra, like those of the spinal column, and never developed in it. Much of the basis cranii lies beyond the notocord. In the process of ossification there is a certain analogy between the spinal column and the cranium, but the analogy becomes weaker as we proceed towards the anterior end of the skull."

Although Huxley insists, perhaps, too much upon the *differences*, in his impatience at the too great emphasis which has been laid on the *resemblances*, his criticism seems to me conclusive against the vertebral theory as generally understood. It is certainly extending the principles of transcendental anatomy to a hazardous limit when the brain is regarded as a "repetition" of any segments of the spinal cord. The differences between the two are more than differences of volume and shape. In the one the grey matter is inside; in the other it is outside. From the one sensory and motor nerves, symmetrically in pairs, are given off to supply the skin and muscles; in the other the sensory and motor nerves are not only distributed in a very different manner—the optic, olfactory, and acoustic having no corresponding motor nerves—but they are limited to ganglia at the base and in the medulla oblongata: the two most voluminous and important parts of the brain (the cerebrum and cerebellum) having *no* nerves whatever. In the presence of such wide diversities as these, not to mention others, it is surely an abuse of language when Oken calls the brain a more voluminously developed spinal cord, and deduces thence that the brain-case is only a repetition of the spinal column.

Having thus endeavoured to convey some idea of the famous vertebral theory of the skull, I have now to consider a somewhat angrily debated question, affecting Goethe's character more than his intellectual pretensions, namely, the charge of mendacious vanity brought against him by Oken, and, I am sorry to say, very inconsiderately countenanced by Professor Owen,[1] in respect to priority in the discovery.

Fifteen years after Goethe had passed away from this world, and when therefore there was no power of reply, Oken in the *Isis* (1847, *Heft* vii.) made his charge. His statement completely staggered me, suggesting very painful feelings as to Goethe's conduct. Indeed, the similarity in the stories of

[1] Art. OKEN in *Encyclopædia Britannica*, 8th edition.

both suggests suspicion. Goethe, during one of his rambles in the Jewish cemetery near Venice, noticed the skull of a ram, which had been cut longitudinally, and on examining it, the idea occurred to him that the face was composed of three vertebræ: "the transition from the anterior sphenoid to the ethmoid was evident at once." Now, compare Oken's story. He narrates how in 1802 in a work on the Senses, he had represented these organs as repetitions of lower organs, although he had not then grasped the idea, which lay so close at hand, respecting the skull as a repetition of the spinal column. In 1803 he identified the jaws of insects as limbs of the head; and in 1806, while rambling in the Harz mountains, he picked up the skull of a deer: on examining it, he exclaimed, "That is a vertebral column!" Virchow admits that the coincidence in the stories is singular, but adds that the discovery is just as probable in the one case as in the other; all that is proved by the coincidence being that both minds were on the verge of the discovery. Goethe by long physiognomical and osteological studies was prepared for the idea; and was naturally led from the Metamorphoses of Plants to those of Insects; and if Oken reversed this order, passing from insects to mammals, he was, nevertheless, many years later than Goethe, as dates unequivocally prove. It is important to bear in mind that the vertebral theory is only another application of those morphological doctrines which Goethe had developed and applied to plants; and although it is quite *possible* that he might have held these views without making the special application to the skull; yet we know as a fact that he at once saw how the morphological laws must necessarily apply to animals, since he expressly states this in announcing his discovery to Herder.[1] Nay, he shortly afterwards wrote, "In Natural History I shall bring you what you little expect. I believe myself to be very near the law of organisation." Still it may be objected, this is no proof; it only shows that Goethe applied his doctrines to the animal organisation, not that he made a special application to the skull. Even this doubt, however, has been finally settled by the recently published correspondence, which gives us a letter from Goethe to Herder's wife, dated 4th May 1790, from Venice. "Through a singular and lucky accident I have been enabled to take a step forwards in my explanation of the

[1] *Italiänische Reise*, ii. p. 5.

animal development (*Thierbildung*). My servant, in jest, took up the fragment of an animal's skull from the Jewish cemetery, pretending to offer it me as a Jew's skull." Now when we remember that Goethe in after years affirmed that it was in 1790, and in the Jewish cemetery of Venice, that the idea of the vertebral structure of the skull flashed upon him, the evidence of this letter is conclusive.

Oken declares he made his discovery in 1806, and that in 1807 he wrote his Academic Programme. He was then a *Privat-Docent* in Göttingen, "at a time, therefore, when Goethe certainly knew nothing of my existence." He sent his dissertation to Jena, where he had just been appointed professor. Of that university Goethe was curator. Oken considers this fact decisive: namely, that Goethe would assuredly have remonstrated against Oken's claim to the discovery had he not recognised its justice. The fact, however, is by no means decisive: we shall see presently that Goethe had his own reasons for silence. "I naturally sent Goethe a copy of my programme. This discovery pleased him so much that he invited me, at Easter, 1808, to spend a week with him at Weimar, which I did. As long as the discovery was ridiculed by men of science Goethe was silent, but no sooner did it attain renown through the works of Meckel, Spix, and others, than there grew up a murmur among Goethe's servile admirers that this idea originated with him. About this time Bojanus went to Weimar, and hearing of Goethe's discovery, half believed it, and sent the rumour to me, which I thoughtlessly printed in the *Isis* (1818, p. 509); whereupon I announced that I made my discovery in the autumn of 1806." This is equivocal. He did *not* throw any doubt on Goethe's claim to priority, he only asserted his own originality. "Now that Bojanus had brought the subject forward," he adds, "Goethe's vanity was piqued, and he came afterwards, thirteen years subsequent to my discovery, and said he had held the opinion for thirty years."

Why was Goethe silent when Oken first announced his discovery? and why did not Oken make the charge of plagiarism during Goethe's lifetime? The first question may be answered from Goethe's own works. In a note entitled *Das Schädelgerüst aus sechs Wirbelknochen auferbaut*, after alluding to his recognition first of three and subsequently of six vertebræ in the skull, which he spoke of among his friends, who set to work to demonstrate it if possible, he says: "In

the year 1807 this theory appeared tumultuously and imperfectly before the public, and naturally awakened great disputes and some applause. How seriously it was damaged by the incomplete and fantastic method of exposition History must relate." This criticism of the exposition will be understood by every one who has read Oken, and who knows Goethe's antipathy to metaphysics.[1] With all his prepossession in favour of a Type, he could not patiently have accepted an exposition which "tumultuously" announced that "The whole man is but a vertebra." Accordingly he took no notice of the tumultuous metaphysician; and in his *Tag und Jahres Hefte* he mentions that while he was working out his theory with two friends, Riemer and Voigt, they brought him, with some surprise, the news that this idea had just been laid before the public in an academic programme, "a fact," he adds, "*which they, being still alive, can testify.*" Why did he not claim priority? "I told my friends to keep quiet, for the idea was not properly worked out in the programme; and that it was not elaborated from original observations would be plain to all scientific men. I was frequently besought to speak plainly on the subject; but I was firm in my silence."

When I first discussed this question, and knew nothing of the decisive evidence which lay unpublished in the letter to Herder's wife, I said that this statement carried complete conviction to my mind. It was published many years before Oken made his charge, and it accused him in the most explicit terms of having prematurely disclosed an idea Goethe was then elaborating with the assistance of his friends. Nor was this all. It appealed to two honourable and respected men, then living, as witnesses of the truth. Oken said nothing when the question could have been peremptorily settled by calling upon Voigt and Riemer. He waited till death rendered an appeal impossible. He says, indeed, that he made no answer to the first passage I have cited, because he was not *named* in it, and he "did not wish to involve himself in a host of disagreeables." But this is no answer to the *second* passage. There he is named as plainly as if the name of Oken were printed in full; and not only is he named, but Goethe's friends speak of Oken's coming forward with Goethe's idea as a matter which "surprised" them. Those to whom this reason-

[1] So also Cuvier's antipathy to this exposition made him blind to the truth which it contained.

ing was not conclusive are now referred to the confirmation it receives from the letter to Herder's wife.

Having vindicated Goethe's character, and shown that *biographically* we are fully justified in assigning to him the honour of having first conceived this theory, it now remains to be added that *historically* the priority of Oken's claim must be admitted. In writing the poet's biography, it is of some importance to show that he was not indebted to Oken for the discovery. In writing the history of science, it would be to Oken that priority would be assigned, simply because, according to the judicious principles of historical appreciation, priority of publication carries off the prize. No man's claim to priority is acknowledged unless he can bring forward the evidence of publication; otherwise every discovery might be claimed by those who have no right to it. Moreover, Oken has another claim: to him undeniably belongs the merit of having introduced the idea into the scientific world, accompanied with sufficient amount of detail to make it acceptable to scientific minds, and to set them to work in verifying the idea. On these grounds I think it indisputable that the vertebral theory must be attributed to Oken, and not to Goethe; although it is not less indisputable that Goethe did anticipate the discovery by sixteen years, and would have earned the right to claim it of History, had he made his discovery public, instead of privately discussing it with his friends. Virchow thinks otherwise; he assigns priority to Goethe; but he would, I am sure, admit the generally received principle that priority of publication is the test upon which alone History can rely.

To conclude this somewhat lengthy chapter on the scientific studies, it must be stated that, for the sake of bringing together his various efforts into a manageable whole, I have not attended strictly to chronology. Nor have I specified the various separate essays he has written. They are all to be found collected in his works. My main object has been to show what were the directions of his mind; what were his achievements and failures in Science; what place Science filled in his life, and how false the supposition is that he was a mere dabbler. What Buffon says of Pliny may truly be said of Goethe, that he had *cette facilité de penser en grand qui multiplie la science;* and it is only as a thinker in this great department that I claim a high place for him.

## CHAPTER XI

### THE CAMPAIGN IN FRANCE

We now return to the narrative, some points of which have been anticipated in the preceding chapter. In 1790 Goethe undertook the government of all the Institutions for Science and Art, and busied himself with the arrangement of the Museums and Botanical Gardens at Jena. In March of the same year he went once more to Italy to meet the Duchess Amalia and Herder in Venice. There he tried in Science to find refuge from troubled thoughts. Italy on a second visit seemed, however, quite another place to him. He began to suspect there had been considerable illusion in the charm of his first visit. The *Venetian Epigrams*, if compared with the *Roman Elegies*, will indicate the difference of his mood. The yearning regret, the fulness of delight, the newness of wonder which give their accents to the Elegies, are replaced by sarcasms and the bitterness of disappointment. It is true that many of these epigrams were written subsequently, as their contents prove, but the mass of them are products of the Venetian visit. Something of this dissatisfaction must be attributed to his position. He was ill at ease with the world. The troubles of the time, and the troubles of his own domestic affairs, aggravated the dangers which then threatened his aims of self-culture, and increased his difficulty in finding that path in Science and Art whereon the culture of the world might be pursued.

In June he returned to Weimar. In July the duke sent for him at the Prussian Camp in Silesia, "where, instead of stones and flowers, he would see the field sown with troops." He went unwillingly, but compensated himself by active researches into "stones and flowers," leaving to the duke and others such interest as was to be found in soldiers. He lived like a hermit in the camp, and began to write an essay on the development of animals, and a comic opera.

In August they returned. The Duchess Amalia and Herder, impatient at "such waste of time over old bones," plagued him into relinquishing osteology, and urged him to complete *Wilhelm Meister*. He did not, however, proceed far with it. The creative impulse was past; and to disprove Newton was

a more imperious desire. In 1791, which was a year of quiet study and domestic happiness for him, the Court Theatre was established. He undertook the direction with delight. In a future chapter we shall follow his efforts to create a national stage, and by bringing them before the eye in one continuous series, save the tedious repetition of isolated details. In July the Duchess Amalia founded her Friday Evenings. Her palace, between the hours of five and eight, saw the duke, the Duchess Luise, Goethe and his circle, with a few favoured friends from the court, assembled to hear some one of the members read a composition of his own. No sort of etiquette was maintained. Each member, on entering, sat down where he pleased. Only for the Reader was a distinct place allotted. One night Goethe read them the genealogy of Cagliostro, which he had brought from Italy; another night he gave them a lecture on Colours; Herder lectured on Immortality; Bertuch on Chinese Colours and English Gardens; Böttiger on the Vases of the Ancients; Hufeland on his favourite theme of Longevity; and Bode read fragments of his translation of Montaigne. When the reading was over, they all approached a large table in the middle of the room, on which lay some engravings or some novelty of interest, and friendly discussion began. The absence of etiquette made these reunions delightful.

The mention of Cagliostro in the preceding paragraph recalls Goethe's comedy *Der Gross Kophta*, in which he dramatised the story of the Diamond Necklace. It had originally been arranged as an opera; Reichardt was to have composed the music; and if the reader happens to have waded through this dull comedy, he will regret that it was not made an opera, or anything else except what it is. One is really distressed to find such productions among the writings of so great a genius, and exasperated to find critics lavish in their praise of a work which their supersubtle ingenuity cannot rescue from universal neglect. I will not occupy space with an analysis of it.

And now he was to be torn from his quiet studies to follow the fortunes of an unquiet camp. The King of Prussia and the Duke of Brunswick at the head of a large army invaded France, to restore Louis XVI. to his throne, and save legitimacy from the sacrilegious hands of Sansculottism. France, it was said, groaned under the tyranny of factions, and yearned for deliverance. The emigrants made it clear as day that the

allies would be welcomed by the whole nation; and the German rulers willingly lent their arms to the support of legitimacy. Karl August, passionately fond of the army, received the command of a Prussian regiment. And Goethe, passionately fond of Karl August, followed him into the field. But he followed the duke—he had no sympathy with the cause. Indeed, he had no strong feeling either way. Legitimacy was no passion with him; still less was Republicanism. Without interest in passing politics, profoundly convinced that all salvation could only come through inward culture, and dreading disturbances mainly because they rendered culture impossible, he was emphatically the "Child of Peace," and could at no period of his life be brought to sympathise with great struggles. He disliked the Revolution as he disliked the Reformation, because they both thwarted the peaceful progress of development:

> Franzthum drängt in diesen verworrenen Tagen wie ehmals Lutherthum es gethan, ruhige Bildung zurück.

That philosophers and patriots should thunder against such a doctrine, refute its arguments, and proclaim its dangers, is reasonable enough; but how strangely unreasonable in philosophers and patriots to thunder against Goethe, because he, holding this doctrine, wrote and acted in its spirit! We do not need this example to teach us how men transfer their hatred of opinions to the holders of the hated opinions, otherwise we might wonder at the insensate howl which has been raised against the greatest glory of the German name, because he did not share the opinions of the howlers; opinions, too, which they for the most part would not have held, had they not been instructed by the events which have since given approbation to what *then* seemed madness.

It was not in Goethe's nature to be much moved by events, to be deeply interested in the passing troubles of external life. A meditative mind like his naturally sought in the eternal principles of Nature the stimulus and the food, which other minds sought in passing phenomena of the day. A poet and a philosopher is bound to be interested in the great questions of poetry and philosophy; but to rail at him for not also taking part in politics, is as irrational as to rail at the prime minister because he cares not two pins for Greek Art, and has no views on the transmutation of species. It is said, and very foolishly said, that Goethe turned from politics to art and

science, because politics disturbed him, and because he was too *selfish* to interest himself in the affairs of others. But this accusation is on a par with those ungenerous accusations which declare heterodoxy to be the shield of profligacy: as if doubts proceeded only from dissolute habits. How unselfish Goethe was, those best know who know him best; it would be well if we could say so much of many who devote themselves to patriotic schemes. Patriotism may be quite as selfish as Science or Art, even when it is a devout conviction; nor is it likely to be less selfish when, as so often happens, patriotism is only an uneasy pauperism.

That Goethe sincerely desired the good of mankind, and that he laboured for it in his way with a perseverance few have equalled, is surely enough to absolve him from the charge of selfishness, because his labours did not take the special direction of politics? What his opinions were is one thing, another thing his conduct. Jean Paul says, "he was more far-sighted than the rest of the world, for in the beginning of the French Revolution he despised the patriots as much as he did at the end." I do not detect any feeling so deep as contempt, either late or early; but it is certain that while Klopstock and others were madly enthusiastic at the opening of this terrible drama, they were as madly fanatical against it before its close; whereas Goethe seems to have held pretty much the same opinion throughout. It has been finely said: "Toute période historique a deux faces: l'une assez pauvre, assez ridicule, ou assez malheureuse, qui est tournée vers le calendrier du temps; l'autre grande, efficace, et sérieuse, qui regarde celui de l'éternité." Of no epoch is this more strikingly true than of the French Revolution. In it Goethe only saw the temporal aspect; his want of historical philosophy prevented him from seeing the eternal aspect.

There were three principles promulgated by the Republicans, which to him were profound absurdities. The first was the doctrine of equality; not simply of equality in the eye of the law (that he accepted), but of absolute equality. His study of Nature, no less than his study of men, led him, as it could not but lead him, to the conviction that each Individual is perfect in itself, and in so far equals the highest; but that no one Individual is exactly like another.

Gleich sei keiner dem Andern; doch gleich sei Jeder dem Höchsten.
Wie das zu machen? es sei Jeder vollendet in sich.

The second revolutionary principle was the doctrine of government by the people. He believed in no such governmental power. Even when you kill the king, he says, you do not know how to rule in his place.

Sie gönnten Cäsar'n das Reich nicht,
Und wussten's nicht zu regieren.

He pointed to the fate of France "as a lesson both to governors and the governed, but more even for the latter than the former. The rulers were destroyed, but who was there to protect the Many *against* the Many? The Mob became the Tyrant."

Frankreichs traurig Geschick, die Grossen mögen's bedenken;
Aber bedenken fürwahr sollen es Kleine noch mehr.
Grosse gingen zu Grunde: doch wer beschützte die Menge
Gegen die Menge? Da war Menge der Menge Tyrann.

What wonder then if he felt repulsion to all the "Apostles of Freedom," when on close scrutiny he found they all sought nothing but license?

Alle Freiheits-Apostel, sie waren mir immer zuwider
Willkür suchte doch nur Jeder am ende für sich.

The third revolutionary principle was, that political freedom is necessary to man. In the early days of authorship he had already spoken his conviction that such freedom was by no means necessary. In *Egmont* it reappears; and through life we find him insisting on the fact that no man *can* be free; the only freedom necessary is that which enables each to go about his business in security, to rear house and children, to move unconstrained in his small circle. It does not seem to occur to him that even this freedom is impossible without political freedom. It does not occur to him that police regulations affect the individual, and governmental regulations affect the nation.[1]

But while he was thus fundamentally opposed to the principles of the Revolution, and the government of the Many, it is equally clear that he had no sympathy with the

[1] This was Dr. Johnson's opinion: "Sir, I would not give a guinea to live under one form of government rather than another. It is of no moment to the happiness of an individual. Sir, the danger of the abuse of power is nothing to a private man. What Frenchman is prevented from passing his life as he pleases?"—BOSWELL, chap xxvi. No one thinks this opinion a proof of Johnson's heartless egoism.

Royalists; that he absolved neither their policy nor their acts. The madness of the Terrorists was to him no excuse for the duplicity of the Royalists. "No, you are not right. No, you must not deceive the Mob, because the Mob is wild and foolish. Wild and foolish are all Mobs which have been duped. Be only *upright* with them, and you will gradually train them to be men."

Sage, thun wir nicht recht? Wir müssen den Pöbel betrügen.
Sieh' nur, wie ungeschickt, sieh' nur, wie wild er sich zeigt!—
Ungeschickt und wild sind alle rohen Betrognen;
Seid nur *redlich*, und so führt ihn zum Menschlichen an.

Nor was all the wild oratory so irrational in his eyes as the Royalists proclaimed it. "These street orators seem to me also mad; but a madman will speak wisdom in freedom, when in slavery wisdom is dumb."

Mir auch scheinen sie toll; doch redet ein Toller
Weise Sprüche, wenn, ach! Weisheit im Sclaven verstummt.

To Eckermann he said: "A revolution is always the fault of the government, never of the people."

I might extend these remarks by showing how such political principles naturally grew up in the course of his education, and how he, in the forty-third year of his age, was not likely to become an apostle of Freedom, or to become deeply interested in political disturbances, especially at this period when he had completely emerged from the rebellious strivings of his youth, and had settled the aims of manhood. But enough has been said to show what his position truly was; and the reader who will not accept it with that impartiality which it claims, will certainly not accept it more readily, because he is told its origin and growth. The American who despises the Negro because he is black, will not despise him less on learning that the blackness is nothing but a peculiar modification of the pigment in the skin.

Goethe has himself written a diary of the "Campaign in France," [1] and if I had any belief in the reader's following the advice, I would advise him to read that work, and save some pages of this volume. In well-grounded suspicion that he will do nothing of the kind, I select a few details of interest, and string them on a thread of narrative.

[1] It has been translated by Mr. Robert Farie. The extracts which follow are from this translation.

The Allies entered France, believing the campaign would be a mere promenade. Longwy they were assured would soon surrender, and the people receive them with open arms. Longwy did surrender; but the people, so far from showing any disposition to welcome them, everywhere manifested the most determined resistance. The following passage will let us pretty clearly into the secret of Goethe's views. "Thus did the Prussians, Austrians, and a portion of the French, come to carry on their warlike operations on the French soil. By whose power and authority did they this? They might have done it in their own name. War had been partly declared against them—their league was no secret; but another pretext was invented. They took the field in the name of Louis XVI.: they exacted nothing, but they borrowed compulsorily. *Bons* had been printed, which the commander signed; but whoever had them in his possession filled them up at his pleasure, according to circumstances, and Louis XVI. was to pay. Perhaps, after the manifesto, nothing had so much exasperated the people against the monarchy as did this treatment. I was myself present at a scene which I remember as a most tragic one. Several shepherds, who had succeeded in uniting their flocks, in order to conceal them for safety in the forests or other retired places, being seized by some active patrols and brought to the army, were at first well received and kindly treated. They were asked who were the different proprietors: the flocks were separated and counted. Anxiety and fear, but still with some hope, fluctuated in the countenances of the worthy people. But when this mode of proceeding ended in the division of the flocks among the regiment and companies, whilst, on the other hand, the pieces of paper drawn on Louis XVI. were handed over quite civilly to their proprietors, and their woolly favourites were slaughtered at their feet by the impatient and hungry soldiers, I confess that my eyes and my soul have seldom witnessed a more cruel spectacle, and more profound manly suffering in all its gradations. The Greek tragedies alone have anything so purely, deeply pathetic."

Throughout these pages he is seen interesting himself in men, in science, in nature,—but not at all in the cause of the war. Soldiers fishing attract him to their side, and he is in ecstasies with the optical phenomena observed in the water. The bombardment of Verdun begins, and he enters a battery which is hard at work, but is driven out by the intolerable roar

of the cannon; on his way out he meets the Prince Reuss. "We walked up and down behind some vineyard walls, protected by them from the cannon-balls. After talking about sundry political matters by which we only got entangled in a labyrinth of hopes and cares, the prince asked me what I was occupied with at present, and was much surprised when, instead of speaking of tragedies and novels, excited by the phenomenon of to-day, I began to speak with great animation of the doctrine of colours." He has been reproached for this "indifference," and by men who extol Archimedes for having prosecuted his studies during the siege of Syracuse. It was as natural for Goethe to have his mind occupied with a curious phenomenon amid the roar of cannon, as it was for the soldiers to sing libertine songs when marching to death. The camp too afforded him, with its opportunities for patience, some good opportunities for observing mankind. He notices the injurious influence of war upon the mind: "You are daring and destructive one day, and humane and creative the next; you accustom yourself to phrases adapted to excite and keep alive hope in the midst of most desperate circumstances; by this means a kind of hypocrisy is produced of an unusual character, and is distinguished from the priestly and courtly kind."

After detailing some of the miseries of the campaigning life, he says: "Happy is he whose bosom is filled with a higher passion. The colour phenomenon observed at the spring never for a moment left me. I thought it over and over again, that I might be able to make experiments on it. I dictated to Vogel a loose sketch of my theory, and drew the figures afterwards. These papers I still possess with all the marks of the rainy weather, as witnesses of the faithful study in the dubious path I had entered." Very characteristic of his thirst for knowledge is this daring exposure of himself: "I had heard much of the cannon fever, and I wanted to know what kind of thing it was. Ennui and a spirit which every kind of danger excited to daring, nay, even to rashness, induced me to ride up quite coolly to the outwork of La Lune. This was again occupied by our people; but it presented the wildest aspect. The roofs were shot to pieces, the cornshocks scattered about, the bodies of men mortally wounded stretched upon them here and there, and occasionally a spent cannon-ball fell and rattled among the ruins of the tile-roofs. Quite alone, and left to myself, I rode away on the heights to the left, and could plainly survey the favourable position of the French: they

were standing in the form of a semicircle, in the greatest quiet and security; Kellermann, on the left wing, being the easiest to reach. . . . I had now arrived quite in the region where the balls were playing across me: the sound of them is curious enough, as if it were composed of the humming of tops, the gurgling of water, and the whistling of birds. They were less dangerous by reason of the wetness of the ground; wherever one fell it stuck fast. And thus my foolish experimental ride was secured against the danger at least of the balls rebounding. In these circumstances, I was soon able to remark that something unusual was taking place within me: I paid close attention to it, and still the sensation can be described only by similitude. It appeared as if you were in some extremely hot place, and at the same time quite penetrated by the heat of it, so that you feel yourself, as it were, quite one with the element in which you are. The eyes lose nothing of their strength or clearness; but it is as if the world had a kind of brown-red tint, which makes the situation, as well as the surrounding objects, more impressive. I was unable to perceive any agitation of the blood, but everything seemed rather to be swallowed up in the glow of which I speak. From this, then, it is clear in what sense this condition can be called a fever. It is remarkable, however, that the horrible uneasy feeling arising from it is produced in us solely through the ears. For the cannon thunder, the howling, whistling, crashing of the balls through the air, is the real cause of these sensations. After I had ridden back, and was in perfect security, I remarked with surprise that the glow was completely extinguished, and not the slightest feverish agitation was left behind. On the whole, this condition is one of the least desirable, as indeed among my dear and noble comrades, I found scarcely one who expressed a really passionate desire to try it. Thus the day had passed away; the French stood immovable, Kellermann having taken also a more advantageous position. Our people were withdrawn out of the fire, and it was exactly as if nothing had taken place. The greatest consternation was diffused among the army. That very morning they had thought of nothing short of spitting the whole of the French and devouring them; nay, I myself had been tempted to take part in this dangerous expedition from the unbounded confidence I felt in such an army and in the Duke of Brunswick; but now every one went about alone, nobody looked at his neighbour, or if it did happen, it was to

curse or to swear. Just as night was coming on, we had accidentally formed ourselves into a circle, in the middle of which the usual fire even could not be kindled: most of them were silent, some spoke, and in fact the power of reflection and judgment was awanting to all. At last I was called upon to say what I thought of it; for I had been in the habit of enlivening and amusing the troop with short sayings. This time I said: From this place and from this day forth commences a new era in the world's history, and you can all say that you were present at its birth."

The night brought rain and wind. They had lain on the ground behind a hill which protected them from the cutting wind, when it was proposed that they should bury themselves in the earth, covered by their cloaks. Holes were dug, and even Karl August himself did not refuse this "premature burial." Goethe wrapped himself in a blanket and slept better than Ulysses. In vain a colonel remonstrated, and pointed out to them that the French had a battery on the opposite hill with which they could bury the sleepers in real earnest. Sleep and warmth for the present were worth more than security against possible danger.

The defeat at Valmy, slight as it was, discouraged the Prussians, and exhilarated the French. The Prussians, startled at the cry of *vive la nation!* with which the republicans charged them, and finding themselves on a foreign territory without magazines, stores, or any preparations for a great conflict, perceived the mistake they had made, and began to retreat. It was doubtless a great relief to Goethe to hear that he had not much longer to endure the hardships of campaigning. He had no interest in the cause, and he had not gained, by closer contact with the leaders, a higher opinion of their characters. "Although I had already found among the diplomatic corps some genuine and valuable friends, I could not refrain, so often as I saw them in the midst of these great movements, from making some odd comparisons which forced themselves irresistibly upon my mind: they appeared to me as so many playhouse directors, who choose the pieces, distribute the parts, and move about unseen; whilst the actors, doing their best, and well prompted, have to commit the result of their exertions to fortune and the humour of the public."

He fell in with a collection of pamphlets, and among them were the instructions of the Notables. "The moderation of the people's demands at this time, the modesty with which

they were put forward, formed a striking contrast to the violence, insolence, and desperation of the present state of things. I read these papers with genuine emotion, and took copies of some of them."

His return was slow. Meanwhile, the arms of the French seemed everywhere victorious. Verdun and Longwy were once more occupied by the republicans. On the Rhine, Treves and Mainz had capitulated to Custine. Goethe says:

"In the midst of this misery and confusion, a missing letter of my mother's found me, and reminded me, in a strange manner, of many peaceful passages of my youth, and circumstances connected with my family and native town. My uncle, the Alderman Textor, had died, whose near relationship had excluded me, during his lifetime, from the honourable and useful post of a Frankfurt councillor; and now, in accordance with an established and laudable custom, they thought immediately of me, I being pretty far advanced among the Frankfurt graduates. My mother had been commissioned to ask me whether I would accept the office of councillor if I were chosen one of those to be balloted for, and the golden ball should fall to me? Such a question could not, perhaps, have arrived at a more singular time than the present; I was taken by surprise, and thrown back upon myself; a thousand images started up before me, and prevented me from forming any connected conclusion. But as a sick person or prisoner forgets for the moment his pains and troubles whilst listening to some tale which is related to him, so was I also carried back to other spheres and other times. I found myself in my grandfather's garden, where the espaliers, richly laden with nectarines, were wont to tempt the grandson's longing appetite; and only the threat of banishment from this paradise, only the hope of receiving from the good old grandfather's own hand the red-cheeked fruit when ripe, could restrain this longing within reasonable bounds till the proper time at length arrived. Then I saw the venerable old man busied with his roses, and carefully protecting his hands from the thorns with the antiquarian gloves, delivered up as tribute by tax-freed cities; like the noble Laertes,—all but in his longings and his sorrows. Afterwards I saw him in his mayor's robes, with gold chain, sitting on the throne-seat under the emperor's portrait; then, last of all, alas! in his dotage, for several years in his sick chair; and, finally, in his grave! On my last journey to Frankfurt, I had found my uncle in possession of the house, court, and garden;

as a worthy son of such a father, he attained, like him, the highest offices in the government of this free town. Here, in this intimate family circle, in this unchanged old well-known place, these boyhood recollections were vividly called forth, and brought with new emphasis before me. They were united also with other youthful feelings which I must not conceal. What citizen of a free city will deny that he has been ambitious of, sooner or later, rising to the dignity of councillor, alderman, or burgomaster; and has industriously and carefully striven, to the best of his ability, to attain to them, or perhaps other less important offices? For the pleasing thought of one day filling some post in the government is awakened early in the breast of every republican, and is liveliest and proudest in the soul of a boy. I could not, however, abandon myself long to these pleasing dreams of my childhood. But, too soon aroused, I surveyed the ominous locality which surrounded me, the melancholy circumstances which hemmed me in, and, at the same time, the cloudy obscured prospect in the direction of my native town. I saw Mentz in the hands of the French; Frankfurt threatened, if not already taken; the way to it obstructed; and within those walls, streets, squares, dwellings, the friends of my youth, and my relations, already overtaken perhaps by the same misfortunes from which I had seen Longwy and Verdun so cruelly suffer: who would have dared to rush headlong into the midst of such a state of things? But even in the happiest days of that venerable corporation, it would have been impossible for me to agree to this proposal; the reasons for which are easily explained. For twelve years I had enjoyed singular good fortune,—the confidence as well as the indulgence of the Duke of Weimar. This highly-gifted and cultivated prince was pleased to approve of my inadequate services, and gave me facilities for developing myself, which would have been possible under no other conditions in my native country. My gratitude was boundless, as well as my attachment to his august consort and mother, to his young family, and to a country to which I had not been altogether unserviceable. And had I not to think also of newly-acquired, highly-cultivated friends, and of so many other domestic enjoyments and advantages which had sprung from my favourable and settled position?"

A pleasant surprise was in store for him on his return to Weimar, in the shape of the house in the *Frauenplan*, which the duke had ordered to be rebuilt during his absence. This

house, considered a palace in those days, was a very munificent gift. It was not so far advanced in the reconstruction but that he could fashion it according to his taste; he arranged the splendid staircase, which was too large for the proportions of the house, but was a pleasant reminiscence of Italy.

The passer-by sees, through the windows, the busts of the Olympian gods, which stand there as symbols of calmness and completeness. On entering the hall, the eye rests upon two noble casts, in niches; or rests on the plan of Rome which decorates the wall, and on Meyer's *Aurora*, which colours the ceiling. The group of Ildefonso stands near the door; and on the threshold, welcome speaks in the word "SALVE." On the first floor we enter the Juno room, so called from the colossal bust of Juno which consecrates it; on the walls are the *Loggie* of Raphael. To the left of this stands the Reception room; in it is the harpsichord which furnished many a musical evening: Hummel and the young Mendelssohn played on it, Catalani and Sontag sang to it. Over the doors were Meyer's mythological cartoons; on the walls a copy of Aldobrandi's Wedding, with sketches of the great masters, and etchings. A large cabinet contained the engravings and gems; a side closet the bronze statuettes, lamps and vases. On the other side, connected with the Juno room and opposite the Reception room, were three small rooms. The first contained sketches of Italian masters, and a picture by Angelica Kaufmann. The second and third contained various specimens of earthenware, and an apparatus to illustrate the *Farbenlehre*. A prolongation of the Juno room backwards was the Bust room, with the busts of Schiller, Herder, Jacobi, Vos, Sterne, Byron, &c. To this succeeded, a few steps lower, and opening on the trellised staircase leading to the garden, a small room in which he was fond of dining with a small party. The garden was tastefully laid out. The summer-houses contained his natural history collections.

But the sanctuary of the house is the study, library, and bedroom. In the rooms just described the visitor sees the tokens of Goethe's position as minister and lover of Art. Compared with the Weimar standard of that day, these rooms were of palatial magnificence; but compared even with the Weimar standard, the rooms into which we now enter are of a more than bourgeois simplicity. Passing through an antechamber, where in cupboards stand his mineralogical collections, we enter the study, a low-roofed narrow room, somewhat

dark, for it is lighted only through two tiny windows, and furnished with a simplicity quite touching to behold.[1] In the centre stands a plain oval table of unpolished oak. No arm-chair is to be seen, no sofa, nothing which speaks of ease. A plain hard chair has beside it the basket in which he used to place his handkerchief. Against the wall, on the right, is a long pear-tree table, with book-shelves, on which stand lexicons and manuals. Here hangs a pincushion, venerable in dust, with the visiting cards, and other trifles, which death has made sacred. Here, also, a medallion of Napoleon, with this circumscription: "Scilicet immenso superest ex nomine multum." On the side wall, again, a bookcase with some works of poets. On the wall to the left is a long desk of soft wood, at which he was wont to write. On it lie the original manuscripts of *Götz* and the *Elegies*, and a bust of Napoleon, in milk-white glass, which in the light shimmers with blue and flame colour; hence prized as an illustration of the *Farbenlehre*. A sheet of paper with notes of contemporary history is fastened near the door, and behind this door schematic tables of music and geology. The same door leads into a bedroom, if bedroom it can be called, which no maid-of-all-work in England would accept without a murmur: it is a closet with a window. A simple bed, an arm-chair by its side, and a tiny washing-table with a small white basin on it, and a sponge, is all the furniture. To enter this room with any feeling for the greatness and goodness of him who slept here, and who here slept his last sleep, brings tears into our eyes, and makes the breathing deep.

From the other side of the study we enter the library; which should rather be called a lumber-room of books. Rough deal shelves hold the books, with paper labels on which are written "philosophy," "history," "poetry," &c., to indicate the classification. It was very interesting to look over this collection, and the English reader will imagine the feelings with which I took down a volume of *Taylor's Historic Survey of German Poetry*, sent by Carlyle, and found, in the piece of paper used as a book-mark, a bit of Carlyle's own handwriting.

Such was Goethe's House, during the many years of his occupation. At the time of which we now write it was of course somewhat different. The pleasure of reconstructing it,

[1] I describe it as it now stands, just as it was on the day of his death.

and the happiness of being once more at home with Christiane and his boy, able to pursue his studies in peace, were agreeable contrasts with his life in the camp. Meyer had returned from Italy, and came to live with him. Meyer's historical knowledge and true friendship made him very valuable. Optical studies alternated with discussions upon Art.

In this year, 1793, much was studied, but little produced. The comedy of the *Bürgergeneral* was written, that of the *Aufgeregten* was commenced, and the *Unterhaltungen der Ausgewanderten* planned. More important was the version of *Reinecke Fuchs*. All these are products of the French Revolution. The *Bürgergeneral* is really an amusing little piece, setting forth the absurdity of loud-mouthed patriotism; but it has greatly incensed all those who are angry with Goethe for not having espoused the cause of the Revolution. It is admitted that there was much in the Revolution which was hollow, foolish, and wicked; but the Revolution was too serious a thing to be treated only with ridicule. I quite agree with this opinion. But considering his sentiments and position, it seems to me quite natural that he who neither sympathised with the Revolution, nor absolved the Royalists; who could therefore neither write dithyrambs of freedom nor cries of indignation; who did not fully appreciate the historical importance of the event, and only saw its temporal and *personal* aspect, should have taken to Comedy, and to Comedy alone. He did not write invectives; he did not write satires. He saw the comic aspect, and he smiled. As events deepened the shadows of the picture, he, too, became more serious. The *Aufgeregten*, which was never completed, would have given a complete expression to his political views. *Reinecke Fuchs* was commenced as a relief; it was turned to as an "unholy World-bible," wherein the human race exhibited its unadorned and unfeigned animal nature with marvellous humour, in contrast to the bloody exhibition which the Reign of Terror then offered as a spectacle to the world.

He was now, May 1794, once more to join the army which was besieging Mainz. The narrative, which is also to be found in Mr. Farie's translation, presents him in no new aspect, and may therefore be passed over with this allusion. The city capitulated on the 24th of July, and on the 28th of August—his forty-fifth birthday—he re-entered Weimar; to finish *Reinecke Fuchs*, and to pursue his scientific researches. "I go home," he wrote to Jacobi, "where I can draw a circle