

Cambridge University Press

978-1-107-65267-5 - Goethe on Nature and on Science: The Philip Maurice Deneke Lecture Delivered at Lady Margaret Hall, Oxford on the 4th March 1942
Sir Charles Sherrington

Excerpt

[More information](#)

GOETHE ON NATURE & ON SCIENCE



TWO facts we may, at outset, recall about Goethe. Poet though he was, he was yet life-long an ardent student of the sciences of Nature. And this other, that with him—not merely as usage of the German language—Nature was usually Nature with a capital N. The thoughts of few men can be more liberally on record than are Goethe's, biographically and autobiographically, in his formal works and in his correspondence. We may look therefore to exceptional opportunity for knowing what this Nature with a capital N stood for in his mind.

He would have wished us to know. He was disappointed that his contemporaries did not pay more attention to his thoughts on Science and on Nature. He remarked more than once: 'I do not attach importance to my work as a poet, but I do claim to be alone in my time in apprehending the truth about colour.'¹ Again, in the pillage of Weimar, his main anxiety was for his scientific work in manuscript.²

We know something of his reaction to Nature in his childhood. A boy, during the family's theological dis-

¹ *Gespräche m. Eckermann* (Oxenford trans.; Dent and Co.), p. 302.

² Duntzer, *Life*, p. 745.

Cambridge University Press

978-1-107-65267-5 - Goethe on Nature and on Science: The Philip Maurice Deneke Lecture Delivered at Lady Margaret Hall, Oxford on the 4th March 1942
Sir Charles Sherrington

Excerpt

[More information](#)

cussions, he would sit silent, but on occasion in his bedroom afterwards would contrive an altar from a music-stand, decked with minerals and flowers, and crowned by a flame lit by a burning glass from the rays of the freshly risen sun. Clearly, a child's act of worship. Paganism we may think, but the boy came of a zealous Lutheran family.

In manhood, scientific studies always interested him. Let me use the term science here in brief to mean the sciences of Nature. Goethe's science, though not profound, was broad and reached physics, geology and biology.

Goethe was an assiduous investigator. In Rudolph Magnus's attractive volume *Goethe als Naturforscher* * all that side of him is charmingly set forth. He gave hours to observation and to experiments of a simple kind, covering all types of life as well as those of the 'higher' plants and animals. In physics, his best-known work—he called it 'optical'—was on colour. A feature of it was disagreement with that fundamental observation, already established a hundred years, known as the decomposition of white light into coloured lights on passing through a glass prism. He rejected this. He took exception even to the expression coloured 'lights' because he said, there is only one light.¹ He demurred against the new 'abstract' word 'refractivity'.² He asked, what does it mean?

In this same matter of coloured and white light, he found himself likewise unable to confirm that white could

¹ *Gesammte Werke, Goethe*, vol. xxviii, p. 296. Cotta, Stuttgart, 1858.

² Vol. xxviii, p. 297.

* Here and elsewhere an asterisk indicates that there is a note on pp. 51 ff.

Cambridge University Press

978-1-107-65267-5 - Goethe on Nature and on Science: The Philip Maurice Deneke Lecture Delivered at Lady Margaret Hall, Oxford on the 4th March 1942
Sir Charles Sherrington

Excerpt

[More information](#)

be arrived at by combining colours. ‘Dass alle Farben, zusammengemischt, Weiss machen, ist eine Absurdität (1808).¹’ [That all colours mixt together make white is an absurdity.]

In his *Annalen* for 1790 Goethe noted that, while thinking over the principles of Painting, he found ‘to his astonishment’ that Newton’s work on colour was demonstrably wrong. On turning to the *Life*² we find a more circumstantial account. Büttner the botanist had on Goethe’s request lent him some prisms in order to perform the experiments of Newton. But time slipped and Goethe never unpacked them—the prisms lay still in their box when the anatomist Loder wrote that the owner of the prisms was getting unhappy at receiving neither response nor prisms from Goethe. The prisms were at last unpacked, and before sending them off to their owner it occurred to Goethe to take one look through a prism. To his amazement the white wall at which he gazed through the prism remained white. Colour showed only where something dark edged the white. Colour showed brightest of all on the window frames. Goethe immediately concluded that he had thus discovered the Newtonian account of light to be an error.

In the following year³ he published what has been styled satirically ‘*Goethe v. the prism*’. For himself he spoke of it as the ‘Newton controversy’. In view of the known character of Newton it seems unlikely that had Newton been alive—he had been dead 70 years—he

¹ *Entw. ed. Farbenlehre*, par. 558, 28, p. 146.

² Duntzer, *Life*, bk. VI, cap. 2, p. 441.

³ *Beit. z. Optik.* (Weimar, 1791 and 1792).

Cambridge University Press

978-1-107-65267-5 - Goethe on Nature and on Science: The Philip Maurice Deneke Lecture Delivered at Lady Margaret Hall, Oxford on the 4th March 1942
Sir Charles Sherrington

Excerpt

[More information](#)

would have returned to a discussion he looked upon as settled. But despite having no living Newton to tilt against Goethe entered upon the wordy campaign which lasted the rest of his life. In it Goethe would, we must remember, appear to many not as the aggressor. To many he would stand as the protagonist of ancient orthodoxy, following as he did in the broad wake of Aristotle and Theophrastus. He translated Theophrastus (Aristotle) on Colour (1801). In 1824 he was imparting to Eckermann the Aristotelian teaching as still current! It was Newton with his prisms (1704,¹ in fact even earlier, 1671) whom Goethe could treat as the rebel. Moreover, Goethe held certain views as to what a scientific experiment should be, and the prism experiment did not conform with them. The prism introduced ‘hundertlei’² complications, and dragged in mathematics unwantedly. They had been introduced by a mathematician (Newton—Goethe seems habitually to have thought of Newton less as a natural philosopher than as a mathematician), though they were not part of the subject. The prism was an extraneous accessory. With Goethe the prism stood for ‘mathematics’. Goethe argued too that the prism implied a naïve attempt to analyse not colour but light itself. ‘Light’, he said, ‘is an elemental entity, and inscrutable attribute of creation, an “Einziges”,³ which has to be taken for granted.’ To try to analyse light was a shallow blunder. And the manner of the attempt! Through a tiny hole to admit a poverty-

¹ *Opticks or a Treatise of the Reflexions, Refractions, Inflexions and Colour of Light* (London, 1704).

² *Ges. Werke*, vol. xxviii, p. 296, par. 25.

³ *Ibid.*

Cambridge University Press

978-1-107-65267-5 - Goethe on Nature and on Science: The Philip Maurice Deneke Lecture Delivered at Lady Margaret Hall, Oxford on the 4th March 1942
Sir Charles Sherrington

Excerpt

[More information](#)

stricken thread of light into a darkened room, when by going into the open day any amount of it could be had—no wonder the students laughed¹ and ran off! And the supposition to which it led! A physicist's mathematics! There Goethe may have thought he could hear the chuckle of Mephistopheles himself. Streams of travelling particles or wavelets pouring from the sun! Why, we had but to step into the free daylight to see that it was not so. We encounter here in Goethe what seems an almost wilful inability to enter into the physicist's point of view. As was his wont, when thoroughly enjoying himself he broke into verse about this:

Möget ihr das Licht zerstückeln,
 Farb' um Farbe draus entwickeln,
 Oder andre Schwänke führen,
 Kügelchen polarisiren.
 Dass der Hörer ganz erschrocken
 Fühlet Sinn und Sinne stocken.
 Nein! es soll euch nicht gelingen.²

These lyrical outbursts illustrate an artistic principle which Goethe pressed. He said 'The world is so great and rich, and life so full of variety, that you can never want occasions for poems. But they must all be *occasioned*; that is to say, reality must give both impulse and material! All of my poems are occasioned poems, suggested by real life, and having therein a firm foundation. I attach no value to poems snatched out of the air.'³

¹ *Ges. Werke*, vol. xxx, p. 12: *Nachtr. zur Farbenl.*

² *Gesammte Gedichte*, vol. II, p. 147: *Gott u. Welt.*

³ *Gespräche m. Eckermann* (1823), p. 8.

Cambridge University Press

978-1-107-65267-5 - Goethe on Nature and on Science: The Philip Maurice Deneke Lecture Delivered at Lady Margaret Hall, Oxford on the 4th March 1942
Sir Charles Sherrington

Excerpt

[More information](#)

The *Annalen* relate how in 1817 he was present at a demonstration of the corpuscular theory of light given at Court. He writes of it that ‘a university professor’ ‘with incredible composure and assurance flourished the most impudent trickery before high (i.e. in the Court of Weimar) and intelligent people. After gazing and gazing, after blinking and blinking (with aching eyes), you were quite at a loss to know either what you had seen or what you were intended to see. At the first preparations I got up and went off, and on my return heard without surprise the course of his demonstration, as I had foreseen it. I was also taught on this occasion, by the illustration of billiard balls, how the round molecules of light, if they strike the glass with the poles, penetrate quite through, whereas if they meet it with the equator they are sent back with protest.’¹ Protest! How characteristically Goethean and medieval!

Goethe complained, when trying to repeat some of the Newtonian experiments with a view to publication of his own *Farbenlehre*, ‘that by joining together several instruments’ (optical) Newton has ‘perpetrated an experimental incoherence’.² But, enjoying recently the Tercentenary Lecture (1942) on Newton by our distinguished physicist and authority on Newton, Professor Andrade, I note that, after critically evaluating Newton’s optical researches, he adds: ‘Newton’s work on light establishes him as a supreme experimenter’.³

¹ Translated by Charles Nisbet; George Black and Sons, London 1892, p. 437.

² *Annalen*, p. 363 (for year 1807).

³ *Proceedings Physical Society* (1943), vol. LV, p. 129, London.

Cambridge University Press

978-1-107-65267-5 - Goethe on Nature and on Science: The Philip Maurice Deneke Lecture Delivered at Lady Margaret Hall, Oxford on the 4th March 1942

Sir Charles Sherrington

Excerpt

[More information](#)

Condemning though he did Newton's experiment 'in unmeasured terms'¹ Goethe yet, through all the years, was never at the pains to repeat it.² He said that prisms are 'always somewhat clouded', thus suggesting that the colour effect of a prism is due, as he contended all physical colour is, to cloudiness of a semi-opaque medium. He declared that to suppose all light is not one and the same and to suppose white light contains coloured light is to suppose absurdities. But criticising the point Helmholtz expressly states he does not understand in what way they appear absurd, and that Goethe does not declare in what way they do so.

And what did Goethe, rejecting Newton's fact of refraction and colour, put in its place? The following is his substitute. The phenomena of Nature, he tells us, are of two grades. The majority do not lend themselves well to analysis because in them the fundamental is obscured by the accessory. There are, however, certain natural phenomena which do lie open to human inquiry in their naked simplicity. This latter class are *Urphänomenen* or ground-phenomena.³ The *Urphänomen* is fundamental in significance.

Magnetism and the magnet exemplify it. It is something '*das man nur aussprechen darf um es erklärt zu haben*', i.e. is self-explanatory. We comprehend it instinctively. Science cannot, and never will, resolve further an *Urphänomen*. But by it a foundation is given on which to build. It allows insight into Nature. Thus, magnetic attraction and

¹ Helmholtz's *Physiologische Optik* (1856-66), p. 267.

² *Ibid.* p. 268.

³ *Zur Farbenlehre*, vol. II, pars. 174-7.

Cambridge University Press

978-1-107-65267-5 - Goethe on Nature and on Science: The Philip Maurice Deneke Lecture Delivered at Lady Margaret Hall, Oxford on the 4th March 1942
Sir Charles Sherrington

Excerpt

[More information](#)

repulsion ‘*zusammen deuten auf eine Scheidung, auf eine Entzweien das beim Magnet sein Entgegengesetzten, seine Totalität, sein Ganzes er wiedersucht*’. Goethe declares that there ‘is in Nature, both animate and inanimate, a something which manifests itself as contradiction’.¹

This smacks of Hegel,² but Goethe would hardly have admitted that. He was friendly with Hegel the man, but avoided Hegel the sophist.

In Mineralogy and Geology the Urphänomen is granite, because granite lies at the base of the Earth’s crust; the very heart of the mountains consists of it, ‘my spirit’s wings can go no further’.³

Goethe continues:

Treue Beobachter der Natur, wenn sie auch sonst noch so verschieden denken, werden doch darin mit einander übereinkommen, das alles, was erscheinen, was uns als ein Phänomen begegnen sollte, müsse entweder eine ursprünglicher Entzweigung, die einer Vereinigung fähig ist, oder ursprünglich Einheit, die zur Entzweigung gelangen könne, andeuten, und sich auf eine solche Weise darstellen. Das Geeinte zu entzweien, das Entzweite zu einigen, ist das Leben der Natur: dies ist die ewige Systole und Diastole, die ewige Synkrisis und Diakrisis, das Ein- und-Ausathmung der Welt, in der wir leben, weben und sind.⁴★

¹ *Ges. Werke*, vol. xx, p. 156: *Wahrh. u. Dicht.*

² *Gespräche m. Eckermann*, p. 244.

³ *Ueber den Granit* (1782). Cf. *Gespräche m. Eckermann* (18 May 1824), p. 65. Everyman’s Library.

⁴ *Ges. Werke*, vol. xxviii, Abth. 4, par. 739, p. 187: *Zur Farbenlehre*.

Cambridge University Press

978-1-107-65267-5 - Goethe on Nature and on Science: The Philip Maurice Deneke Lecture Delivered at Lady Margaret Hall, Oxford on the 4th March 1942
Sir Charles Sherrington

Excerpt

[More information](#)

A rhapsody!

The conception 'Urphänomen' as applicable truly to Nature, animate or inanimate, has failed, in spite of Goethe's advocacy, to establish itself in Science. More true to scientific thought has been the little quatrain from Tennyson:

Flower in the crannied wall
I pluck you out of the crannies,
And if I could understand you all in all
I should know what God and Man is.

That at least puts to us tellingly how Nature, despite all its complexity and its more than million-fold detail, is one unified system; though perhaps we may owe this impression of the unity of Nature to the circumstance that as observers we each, taken singly, observe as an integrated unit.

Goethe was one of those who, relying on introspection, believe that green as perceived contains 'perceived yellow and blue', an assertion difficult to challenge though difficult to accept. Arthur Schopenhauer supported warmly part of Goethe's views on colour; Goethe's *Annalen* mentions that, meeting in 1816, they agreed partly to disagree; but Schopenhauer, on publishing his book, speaks of Goethe taking him through the experiments in 1813. Goethe asserts that Hegel became an adherent to his view—but his adherence was temporary.¹ In later years, Tyndall, Arthur Schuster and W. Ostwald* took up the cudgels, and as physicists. Goethe's own description of the 'turbidity tints' suggests that either they were for him stronger than

¹ *Annalen*, p. 438.

Cambridge University Press

978-1-107-65267-5 - Goethe on Nature and on Science: The Philip Maurice Deneke Lecture Delivered at Lady Margaret Hall, Oxford on the 4th March 1942

Sir Charles Sherrington

Excerpt

[More information](#)

for most observers or that he overstated them. Dealing with Goethe's description as given in the *Farbenlehre* Helmholtz in the *Handbuch*¹ (1860), after furnishing a précis of Goethe's account, writes 'This description of the matter, if intended for physical, has no sense, . . .'. 'These Goethean descriptions are not to be understood as physical, but only as figurative dramatizations [or "interpretations"] of the process (*als bildliche Versinnlichungen des Vorgangs*).'² In other words, Helmholtz declined to accept the Goethe lucubrations as lying within the province of science at all. I can only say, in my later generation, I agree entirely with Helmholtz on the point.

Goethe never reconciled himself* to the Newtonian notion of light, though it became the stand-by on the subject for the scientific world. Perhaps as a corollary to that dislike, never does he, although writing and thinking about colour practically up to his death (1833), mention Thomas Young's theory (1801) which simplified the mathematical treatment of colour sensations by postulating three primary sensations due to sufficiently separated wave-lengths, a supposition later adopted by Helmholtz, and used as a working hypothesis for a century and a half. Newton had separated and dealt with a sample of the electro-magnetic radiation later assumed by physicists to stream from universe to universe; Young had taken advantage of that to examine physically Nature's great gift to man of colour. Goethe would listen to none of these 'physical' fancies. Refraction and polarisation? he said, 'beide sind hohle Worte die Denkenden gar

¹ *Physiologische Optik*, 1856-66, and again 2nd ed.

² *Physiologische Optik*, 1856-66, and in successive editions.