CHARLES BABBAGE AND THE OPHTHALMOSCOPE

IN the early part of 1940, at one of the dinners of the Royal Society Dining Club, Sir John Parsons drew the attention of those present to a fact of some interest in the history of the Society, namely, that the Ophthalmoscope had been invented by Charles Babbage, F.R.S., in 1847, four years before H. von Helmholtz published his *Beschreibung Eines Augen-Spiegels* in 1851. Von Helmholtz however foresaw the great utility of his invention and devised a much more efficient instrument without knowing what Babbage had done and it is to him therefore that the credit belongs.

Babbage is well known as a mathematician who interested himself in the design and construction of scientific instruments. He was at Peterhouse, Cambridge, and was elected to the Fellowship of the Society in 1816. From 1828 to 1839 he held the Lucasian Chair of Mathematics at Cambridge, but is said to have delivered no lectures during his tenure of it. He took an active part in the foundation of the Royal Astronomical Society in 1820, and was secretary of it until 1824.

In 1823 Babbage wrote to Sir Humphry Davy, the President of the Society, giving an account of a machine which he had designed for calculating and printing mathematical tables. Considerable sums both in Government grants and from Babbage's own resources were devoted to the production of the machine, but in 1842 the Government declined to make any more grants. So much of the machine as was completed together with the plans and drawings relating to it and to his Analytical Engine are now at the Science Museum.

He was a Member of Council in 1822–1823, and again in 1826–1827 when he had an opportunity of learning something of the way in which the Society's administration was conducted. He was not favourably impressed and published his opinions and criticisms in a small volume, entitled *Reflections on the Decline of Science in England, and on some of its causes*, which appeared in 1830. While his complaints of the lack of control over expenditure by the Officers and Council were well founded, as was shown by the Treasurer W. J. Lubbock two years later, and also those of
somewhat arbitrary action by the Officers on some occasions, the remedies which he proposed were not very suitable. He did however draw the attention of Fellows to the need for a reform of the administration which was undertaken about twenty years later, but in which he does not seem to have taken any conspicuous part.

The idea of an instrument with which the interior of the eye could be seen was first suggested by William Cumming, a young surgeon who was working at the Royal London Ophthalmic Hospital. He published an article 'On a Luminous Appearance of the Human Eye' in the Medico-Chirurgical Transactions for 1846, in which he demonstrated that the colour of the living retina could readily be seen when the observer so placed himself that his eye was in the line of the rays of light falling on the retina of the eye examined. He proved that the interior of the eye is not a dull black but rather a light-coloured reflecting surface. He never saw the optic nerve nor the retinal vessels, but he had prepared the way for a more advanced study by others. He died in 1855 at the age of thirty-three, having lived to see the realization of what he had foretold.

His article came to the notice of Charles Babbage. Wharton Jones in his Manual of Surgery writes: 'Here I ought not to omit stating that in the spring of 1847 Mr Babbage showed me the model of an instrument which he had contrived for looking into the interior of the eye. The reflector was a small plane glass mirror, with a part of the silvering rubbed off to look through.'

Babbage placed his model in the hands of an English ophthalmic surgeon who unfortunately did not realize its value as a means of research in this field, and Babbage himself was, of course, not a competent judge in such a matter.

In a Report on the Ophthalmoscope which was published in the Medico-Chirurgical Review in 1854, Wharton Jones described Babbage's instrument as consisting of a tube blackened within and carrying at the proximate end a mirror of silvered glass set at such an angle that the light, as it was directed into the object eye, fell on it through an opening in the side of the tube. The silvering was removed from the centre of the mirror to afford a sight hole.

The two pioneers, Cummings and Babbage, were unfortunate since their instruments were regarded as 'mere toys' by those to whom they were exhibited, and their devices were laid aside without any notification of what they had accomplished.

The principles for the illumination of the depths of the eye had to
be rediscovered by H. von Helmholtz, and it is to him that the credit belongs.¹

Sir John Parsons has been so good as to contribute the following paragraph on the theory of the ophthalmoscope which will be of interest as supplementing the account of its early and, at the time, ineffective discovery.

‘The retina and choroid at the back of the eye act as a reflecting membrane. The reflected light, red from the blood supply, consists of parallel rays in the emmetropic, divergent rays in the hypermetropic, and convergent rays in the myopic eye. Hence in highly hypermetropic or “far-sighted” eyes a bright reflex may be seen in the pupil even if the observing eye is not very close to the source of light. Most animals’ eyes are hypermetropic, and the reflex is much stronger in many, especially carnivora, because they possess another strongly reflecting membrane, the tapetum, of which there are only microscopic vestiges in the human eye. The tapetum is fibrous or cellular, so that it causes iridescence; hence the colours from a cat’s eye. A growth of the retina, pushing forwards into the vitreous, has the same effect as hypermetropia; hence glioma of the retina in babies is often first noticed by the mother, owing to the bright reflex from the pupil—so-called “amaurotic cat’s eye.” No reflex is seen from the pupil of the normal or emmetropic eye unless the observer’s eye is very close to the source of illumination. Hence the ophthalmoscope. If the eye is very myopic or “short-sighted” the convergent rays emitted from it cross close in front of the eye, and the crossed divergent rays may enter an observing eye in the same way as for the hypermetropic eye. Ruete, in 1852, made use of this fact when he introduced the “indirect method” of ophthalmoscopy. By placing a strong convex lens in front of the eye the combination of eye and lens focussed the emergent rays between the lens and the observing eye, thus forming an inverted image of the fundus.’

Babbage is said to have left a diary at his death, and this does not seem to have been published. He was a critical observer and was well acquainted with the Society’s administration both before and after its reorganization in the first half of the nineteenth century took place, so that his experiences may well be of interest if they can be recovered.

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