Motor Cyclists

Visors worn by motor cyclists also fall into this category and, if tinted, constitute an unnecessary hazard at night. The British Standards Institution[7] has considered the matter superficially in its Specification for Motor Cyclists' Eye Protectors. The lenses—that is, the parts of an eyeprotector through which the wearer sees an object—shall transmit not less than 80% of the light that is transmitted by a gas-filled tungsten filament lamp operating at a colour temperature of 2854° K. There is no technical reason why the transmittance should not be higher in protectors worn at night. It is noteworthy that the prescribed minimum transmittance for windscreens reaches the level of 80% only in Australia. It is lower than this in the United States and in Germany. When one considers that older eyes need more light than young ones to compensate for normal senile ocular light losses,[8] and that the average car driver is older than the average motor cyclist, then this discrepancy is odd. It is based probably in part on commercial considerations, but in so far as low-transmittance materials are safe during daylight hours there is no medical ground for objection. Every effort should be made, however, to educate the public to treat them as unacceptable in the dark. In practice they should also learn that irremovable tints ought to be considered as inadmissible.

It also follows as a corollary that all transparent screens—windscreens, visors, spectacle glasses, and contact lenses—used at night should be clear, and that any light filtering required during daylight should be provided by accessory but removable means. Published figures[9] lead one to conclude that the accident rate varies inversely with illumination when this is low. This means, in figures, that, if the countries of the E.E.C. agree to the 70-75% accepted in the U.S. and Germany, the accident rate during the hours of darkness can be expected to be some 15% higher than it would be if the minimum transmittance for a suitable standard light were at least 85%. If the annual traffic fatalities in this country exceed 6,000 and two thirds occur in the dark then a maximal increase in the transmissivity of protective screen surfaces may save many lives.

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Outside Medicine

Thomas Young

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British Medical Journal, 1974, 4, 150-152

Thomas Young was one of the foremost natural philosophers of the first three decades of the last century, and in his achievements ranks with Sir Isaac Newton as one of England's most brilliant sons. By the range of his investigations Dr. Young belongs to the eighteenth century; by his discoveries he is a link between the scientists of his time and those of today.

He was born at Milverton near Taunton on 13 June 1773, the firstborn of 10 children of Thomas and Sarah Young—prominent Quakers. Under his parent's training and example he developed character qualities of dignity, reserve, and industry, for he says "the principles which I imbibed and the habits I formed under the guidance of these dear and excellent relatives have more or less determined my character in future life, whatever it may be." Beginning as a child prodigy he continued his early promise, becoming eminent alike in the sciences, medicine, and classics besides being a unique civil servant. He read fluently at the age of 2 and at 4 had read the Bible twice. His grandfather records that before his fifth birthday he repeated from memory Goldsmith's *Deserted Village*.

After about six years' schooling his education was continued under a private tutor appointed by the wealthy Norfolk Quaker merchant David Barclay, whose grandson, Hudson Gurney, was to join him in his studies and they became lifelong friends. Young soon outstripped John Hodgkin, the brilliant classical tutor, and so really trained himself and his friend. By 19 he had a profound knowledge of the classics, Hebrew, French, German, and Italian, the grammar of oriental languages, and he had also mastered Newton's works and those of current French philosophers. He was practical too, could turn a lathe, grind lenses, produce drawings, bind books, and he made a number of scientific instruments.

Medical Training

It was through Young's uncle, Dr. Brocklesbury—a prominent London physician—that he decided to train as a doctor, entering the "Hunterian School of Anatomy" in 1792 and a year later becoming a medical student at St. Bartholomew's Hospital. He was fortunate in moving in the circle of his uncle's friends Edmund Burke and Sir Joshua Reynolds. In May 1793 he read to the Royal Society his first major contribution entitled *Observation on Vision*, dealing with his theory that the crystalline lens could change its power

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Thomas Young. (Engraving by G. Adcock from a painting by Sir Thomas Lawrence. Reproduced by the Trustees of the British Museum.)

in the property of accommodation. This paper led to his election as a Fellow of the Royal Society in March 1794 at the age of 21. The same year he moved to Edinburgh Medical School and he enjoyed the social activities and dropped some of the more severe restrictions of Quaker practice. A year later he moved to Göttingen University and gives graphic descriptions of the country and the medical course. At his final examination "the four examiners were seated round a table well furnished with cakes, sweetmeats and wines, which helped to pass the time agreeably."

On his uncle's advice he proceeded to Emmanuel College, Cambridge, where he widened his knowledge of mathematics and carried out experiments in sound and light, and in the spring of 1799, having kept the six terms for his degree of M.B., he returned to live in London at 48 Welbeck Street. Two years previously Dr. Brocklesbury died leaving Young his fortune so that he was virtually financially independent. Owing to Cambridge medical regulations he could not submit his dissertation for his M.B. till 1803 and his M.D. till 1808 but this period was one of the most fruitful in his original discoveries.

Interest in Optics

He returned to the subject of the mechanism of the eye in two papers to the Royal Society in 1800 and 1801. He redesigned Porterfield's optometer and measured the focal length of his own eye in different planes and for the first time discovered astigmatism and its correction. With a key ring and dividers he measured the curvature of his cornea and also the length of the optic axis. He also measured small chromatic errors and spherical aberration. Immersing his eye in water or pressing a ring on the eyeball did not affect his accommodation; hence the faculty was dependent on the lens itself. The paper shows Young at his best: "First theoretical relations are worked out followed by accurate measurements with specially designed instruments. Next possible hypotheses are set out, erroneous ones eliminated by further experiments and the correct hypothesis is established by confirmatory observations." (Alex Wood). This is the pattern of the best scientific work of the present day. In the second paper Young advances his theory of colour vision stating that the retina is sensitive to red, green, and blue, the colour depending on the proportion of the hues. He modified Newton's colour top and produced the colour triangle which was later developed by Helmholtz and Maxwell. His theory was an inspired guess but it led him to explain colour blindness and is now the basis of modern colour photography and colour television.

According to Newton, light was emitted from sources in the form of weightless particles which had certain properties by which he was able to explain reflection, refraction, shadows, and other effects. His contemporary, the Dutch scientist Christian Huygens, favoured propagation in the form of waves and also explained many of these effects. Both theories had profound discrepancies until Young, in a masterly series of experiments, established the wave theory for good. He read four papers to the Royal Society between 1800 and 1804 in which he applied the principle of interference of light waves not only to demonstrate the effects but also to show the first measurements of the wave lengths of the colours of the spectrum. Criticism of Young's methods came from Henry Brougham, afterwards Lord Chancellor, delaying the acceptance of Young's wave theory till Fresnel—a decade later—vindicated Young's work in this field.

The Royal Institution

In the year 1799 Benjamin Thompson, later to become Count Rumford, founded the Royal Institution. His object was to bring artisans and scientists under the same roof to solve human needs by working together. He secured royal patronage, a building in Albermarle Street, London, and two lecturers, Humphrey Davy and Thomas Young, each appointment having far-reaching consequences. Davy was a popular lecturer and he made many discoveries, including new elements and his famous miner's safety lamp. Young, never attractive as a teacher, terminated his appointment after two years, but published in 1807 his lecture notes in two magnificent quarto volumes. These proved to be one of the greatest textbooks of physics of all time and a source of information and inspiration to many of the greatest names in science since that date.

Medical Career

His progress as a physician was slow; in his own words "my profession goes on quietly with tolerable success." He was appointed to the staff of St. George's Hospital in 1811, this being preceded by a period as lecturer to Middlesex Hospital 1809-10. The 36 lectures were very detailed and made too great demands on the students. Nevertheless, they were published in his *Introduction to Medical Literature, including a System of Practical Nosology* to which was added, 10 years later in 1823, an essay on *Palpitations*. He also wrote a *Practical and Historical Treatise on Consumptive Diseases*. He parted with the copyright of the *Medical Literature* for £100 in 1823 when the second edition appeared and remarked that "it was too good a book to be worth more." He was against rigorous treatment and in favour of milder remedies. Criticism came from his colleagues that he was more interested in diseases than the patients. Two subjects he dealt with are original. Firstly his application of the phenomenon of haloes to the "measurement of minute particles especially those of blood and pus." The modern eriometer is a development of Young's principle by Emmons in clinical studies. The second investigation, known as Young's Rule, is a formula for calculating the dosage of drugs suitable for children. He ceased to practise in 1817.

Civil Servant

Young's versatility is shown in his appointment in 1818 as secretary of the Board of Longitude and Superintendent of the Nautical Almanac and from then on he worked closely with the Admiralty. His diligence and efficiency soon made their mark in the revision of astronomical tables, though he received criticism from the astronomers—who wanted two editions, one for sailors and one for themselves. His contemporary, Babbage, considered the inventor of the modern calculating machine or computer, advised its use in Young's department. Young did not support the recommendation, so delaying progress for many years. At the Admiralty's request Young prepared a report on a new design in the construction of ships but he went beyond his brief by applying his scientific analysis showing that the shipbuilding methods were out of date. This annoyed the builders and he was not popular with the Sea Lords as his recommendations reduced the comfortable and relatively ample quarters of the captains. The Admiralty did not adopt his ideas, informing him "though science is much respected by their Lordships and your paper esteemed by them, it is too learned."

Other Activities

From 1817 to 1825 Young was a major contributor to the supplement of the fourth edition of the *Encyclopaedia Britannica.* His articles ranged over the subjects of cohesion, chromatics, Egypt, hydraulics, annuities, bridges, languages, roadmaking, weights and measures, tides, and double refraction—in all 380 pages including 45 biographies. He was an authority on all this wide knowledge; two of the subjects suffice as illustration. He was actuary and medical referee for the newly formed Palladium Insurance Company, later to be merged with the Eagle Star Company and wrote important papers on the expectancy of life.

The articles on Egypt reflected his lifelong interest in languages. In 1814 he was invited to decipher the two Egyptian scripts engraved above the Greek inscription on the famous Rosetta Stone which came into British hands from the French when Napoleon's army surrendered in Egypt in 1801. The stone was defaced but there were sufficient details for him to reach the following conclusions. In the upper true hieroglyphic text proper names such as Ptolemy, Berenice, Cleopatra were in a frame or cartouche; he identified a number of phonetic signs and by comparing the Greek text with the demotic or running hand of the second Egyptian text, he translated 80 demotic words and their hieroglyphics as well as some numbers. These findings were published in the *Encyclopaedia Britannica* and were also communicated to Champollion the Younger, the foremost French oriental scholar who had made no progress in deciphering the stone. From then on Champollion proceeded to the complete interpretation of hieroglyphics for which he is famous. Rival claims have persisted as to the priority of the discovery by Young or Champollion. Young's own words established himself as the originator: "if he [Champollion] did borrow an English key, the lock was so dreadfully rusty, that no common arm would have the strength to turn it. . . . "

Conclusion

In appearance Young had a fine open countenance displaying a kindly disposition. His portrait painted by Sir Thomas Lawrence is considered very accurate and there are also two engravings by G. R. Ward and G. Adcock, the latter being reproduced here. His marriage to Eliza Maxwell in 1804 proved a happy union in every way, though they were disappointed in having no children. Young enjoyed to the full the good things of life particularly those pleasures of cultured society. He showed no eccentricities usually associated with genius. He had a great belief in what could be achieved by singleness of purpose and hard work and prided himself on never having wasted a single day of his life. Young was not genial and never expressed more than he felt, only ventured an opinion when asked. He was an individualist par excellence and was content for his findings to speak for themselves. It is not surprising that his genius was not appreciated or understood in his lifetime. What was particularly frustrating for him was to see his original ideas and lines of research taken up by others without acknowledgement or credit.

Any one of Young's major discoveries could have made him famous yet posterity has eventually gained by the very diversity of his discoveries. As Foreign Secretary of the Royal Society he attended meetings regularly up to his last illness in the spring of 1829. Up to this time he had enjoyed good health but the postmortem examination after his death on 10 May 1829 showed an ossification of the aorta extending to the heart. At the time of his death he was engaged in the publication of the *Egyptian Dictionary* and Hudson Gurney saw this through the press. It was preceded by a short autobiography. Young was buried in Farnborough Church in Kent and a profile medallion with an inscription was placed as a monument in Westminster Abbey.

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