Young, Thomas-

Enlightenment Man

MD SCIENCE

In an era of great intellects there were none of more spectacular accomplishment than the 18th-century physician-physicist Thomas Young, known to his disciples as the English Leonardo, a man of universal erudition and almost universal accomplishments. ▪ Before the age of 14 he had mastered Hebrew, Persian and Arabic, but the most impressive of his linguistic feats was the deciphering of the hieroglyphic texts engraved on the Rosetta Stone in the British Museum. This feat was matched only by his seminal investigations into the wave theory of light, the theory of color vision and ocular accommodation. ▪ **BEGINNINGS.** Born on June 13, 1773 in Milverton, Somerset, Thomas Young was the eldest of ten children in a family of Quaker landowners. Thomas learned to read at two and before the age of four he had read the Bible and a collection of Watts' hymns twice through. He committed long fragments of poetry to memory and began the systematic study of Latin grammar at the age of six. ▪ At seven he was sent to a boarding school near Bristol which he later described as a "miserable place where he was taught nothing." After a year he returned home, largely self-taught and with a complete list of everything he had read. At the home of a neighbor, a land surveyor, he discovered the three-volume *Dictionary of the Arts and Sciences* and other books of science and mathematics that occupied him for the rest of that year. ▪ He was sent to an excellent school in Compton, Dorset, where he studied Greek, mathematics, natural philosophy, a term which then

included the sciences. Fascinated by the mechanical arts, he learned to use a lathe and tried to construct a microscope; it was here that he performed his first chemical experiments after reading a work by Joseph Priestley on the composition of air.

When he returned home he continued his study of Oriental languages. At Compton he had begun the study of Hebrew and by the age of 14 he was well versed not only in the classic and biblical languages but also in French, Italian, Persian, Arabic.

At 14 he wrote a comprehensive analysis of the Greek schools of philosophy and became a classics tutor to a boy two years younger than he. As an illustration of his talents he liked to show off his calligraphy in nine languages. During this time he suffered from an illness that was thought to be consumption (pulmonary tuberculosis) and his maternal great-uncle, Dr. Richard Brocklesby, assumed responsibility for his medical care and for supervising his future education.

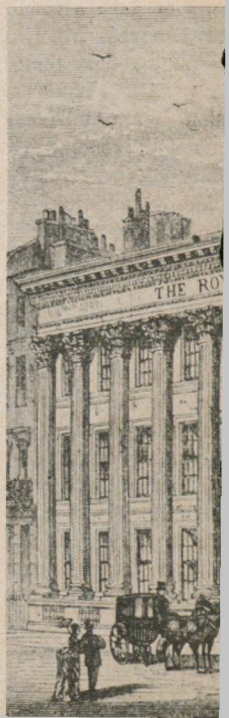
Young spent his winters in London with his uncle, who introduced him to some of the most distinguished literary and political figures of the day, among them Edmund Burke, James Boswell and Sir Joshua Reynolds. Here Young extended the scope of his studies to include higher mathematics, botany, geology, entomology.

Like many Quakers of the time he abstained from the use of sugar as a protest against the slave trade, but his uncle did not approve from either a medical or philosophical point of view. To his favorite nephew Brocklesby wrote: "Your prudery in abstaining from the use of sugar on account of the Negro Trade, in any one else would be altogether ridiculous, but as long as the whole of your mind keeps free from spiritual pride or too much presumption in your facility of acquiring language, which is no more than the dross of knowledge, you may be indulged in such whims, till your mind become enlightened with more reason. So great a system as the sugar cultivation in the West Indies can never be affected by one or hundred. Reformation must take its rise elsewhere."

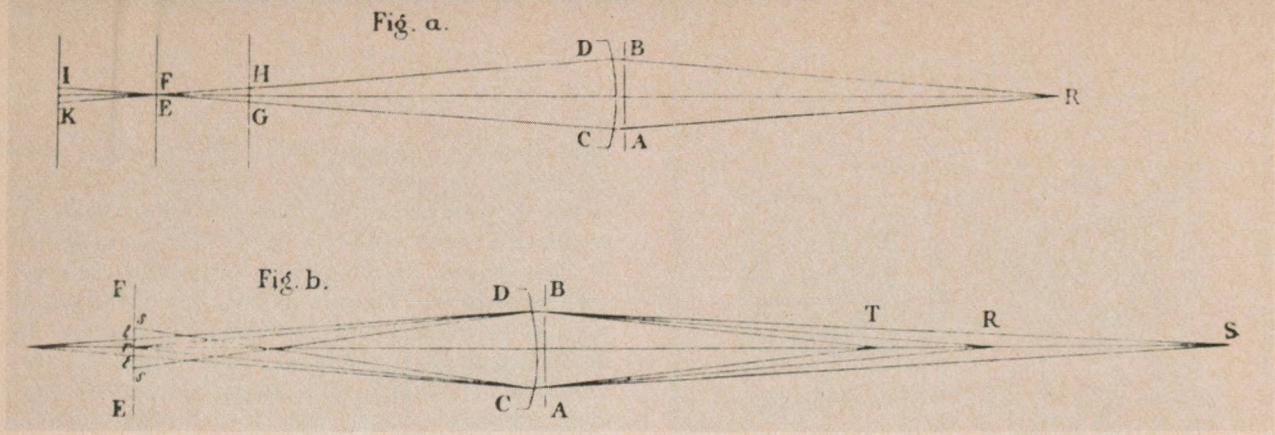
MAN. On the advice of his uncle, Young decided to enter the medical profession; his inclination was toward scholarship but he needed some means of earning his livelihood. In 1792 he took lodgings in London where he attended the lectures of William C. Cruikshank, known for his investigations of the lymphatic system, and those of John Hunter, the founder of pathologic anatomy in England.

The following year Young enrolled at St. Bartholomew's Hospital and within a short time he was nicknamed "Phenomenon Young." While dissecting the eye of an ox he discovered that the ciliary muscles, when stimulated mechanically, caused the shape of the lens to change. He was thus the first to prove that accommodation of the eye for vision at different distances was due to a change in the curvature of the crystalline lens.

Frontispiece portrait of Thomas Young shows him at a mirror taking measurements of his eye. Ludwig von Helmholtz, above, extended Young's work on the theory of color vision. In 1801 Young was appointed professor of physics at the Royal Institution.



Young's diagrams of the image of a point source due to refraction at a spherical surface, opposite top, is from his "Observations on vision" in A Course of Lectures on Natural Philosophy and the Mechanical Arts *published in 1807.*



He was also the first to describe and measure astigmatism, which he discovered in himself, and he propounded the theory of color perception which assumes the existence in the retina of three kinds of nerve fibers, that produce the sensation of red, green, violet. In 1801 Young's treatise *On the Mechanism of the Eye* was published, extended a theory of color vision that is still known today as the Young-Helmholtz theory after Ludwig von Helmholtz, the inventor of the ophthalmoscope who extended Young's work.

In 1794 Young was elected a member of the prestigious Royal Society and in his speech to them he thanked his parents for their Quaker heritage. He was not, he told the society, dazzled by empty titles which are "often conferred on weak heads and on corrupted hearts." I do not agree he said with those "moralists who allow ambition to be laudable as an ultimate object of human conduct. Each of us must determine our own line of conduct, and, if my opinion, in some respects, should differ from thine, and lead me into some slight variations, I hope our mutual charity will induce us not to doubt the purity of each others motives."

In the autumn of that year he moved to Edinburgh to continue his studies. He was particularly interested in the lectures of Joseph Black, pioneer in the chemistry of gases, and stayed two years. Young also continued his study of European languages.

He abandoned the austere Quaker dress, became interested in the social world and learned to play the flute, sing and dance. What he did not change were his habits of work: he rose earlier and retired later than his fellow scholars. Rigorous in his intellectual discipline, he never allowed himself more than two hours a week of unoccupied time on the theory that "application with very little leisure will produce very material benefits."

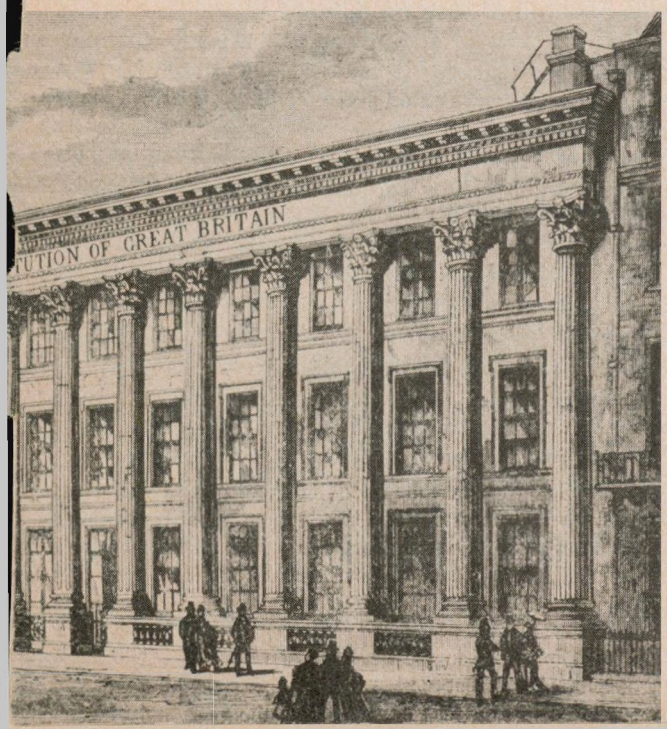
From Edinburgh Young traveled to Göttingen, where he earned the degree of doctor of physic. Here he learned horsemanship and devoted a considerable amount of time to the study of music and art. In the summer of 1796 he walked to Dresden* to study its art collection and was so fascinated by what he saw that he stayed four weeks.

The following year he entered Emmanuel College at Cambridge, but he had little faith in the worth of professors. He firmly believed that what one man had done another could do by books as well as by any "living instructor." To his brother he wrote: "The strength of the traveler and not of the guide must conquer the difficulties of the journey. Masters and mistresses are very necessary to compensate for want of inclination and exertion, but whoever would arrive at excellence must be self-taught."

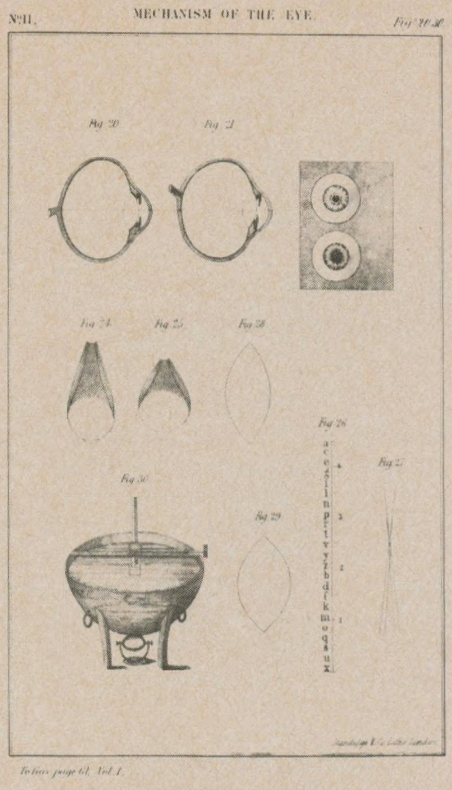
NATURAL PHILOSOPHY. Young inherited his uncle's house in 1797 including the library, paintings and £10,000 (a large sum then). The following summer he performed his first experiments in sound and light, the starting point of his contributions to theoretic physics, and the genesis of a very interesting controversy in the history of science.

In 1666 Isaac Newton sent a beam of white light through a glass prism that broke the beam up into a band of colored lights resembling a rainbow. He extended his experiments and concluded that light was made up of tiny particles or corpuscles that traveled in straight lines. The Dutch physicist Christiaan Huygens disputed his conclusion and argued that light, like sound, was composed of waves and did not travel in straight lines.

Newton's authority was undisputed in this matter until the publication of Young's paper, "Outlines of Experiments and Inquiries Respecting Sound and Light" in 1800. In this Young described his own ex-



*180 miles as the crow flies.



Drawings of his eyes and an apparatus for ascertaining lens' focal length in water is from his On the Mechanism of the Eye.

periment in interference which allowed a narrow beam of light to pass through two closely spaced holes. The two beams broadened and overlapped on a screen, but instead of reinforcing the light and brightening it at the region of overlap, bands of light were separated by mysterious bands of darkness.

If light consisted of particles there was no way of explaining this phenomenon, but if it consisted of waves there would be regions where the waves of the light beams would be in and out of phase, thus cancelling each other out and producing darkness. Young concluded that light consisted of undulations and that his phenomenon of "interference" could be duplicated in water waves, thus settling the debate between Newton and Huygens.

But Young himself was not without his critics: one called the paper "destitute of every species of merit" and admonished the Royal Society for printing such "paltry and unsubstantial papers." Young replied in kind but the validity of this wave theory of light was not clearly established until 16 years later with the publication of Jean Augustin Fresnel's* paper on the diffraction of light. This theory, in turn, was modified by Max Planck in 1900 who employed the quantum theory to show that while light travels in waves, it is corpuscular in nature, thus combining the discoveries of Newton and Young.

*French physicist and fellow of the Royal Society.

Young made other contributions to physics: he introduced the concept of "energy" and "work done" in their present meaning; and formulated the concept of modules (Young's modulus) which made it possible to establish the coefficient of elasticity. In his "Essay on the Cohesion of Fluids" (1804) he presented in nonmathematic language a theory of capillary action. He was the first to account on physical grounds for the constancy of the angle of contact of a solid and a liquid, a relationship later expressed mathematically by the French mathematician, Marquis de Laplace.

In 1801 Young was appointed professor of physics at the Royal Institution and editor of its *Journal*. In two years he delivered 91 lectures: his material was highly condensed and made no concessions to those of his students who were unwilling to follow his mental processes.

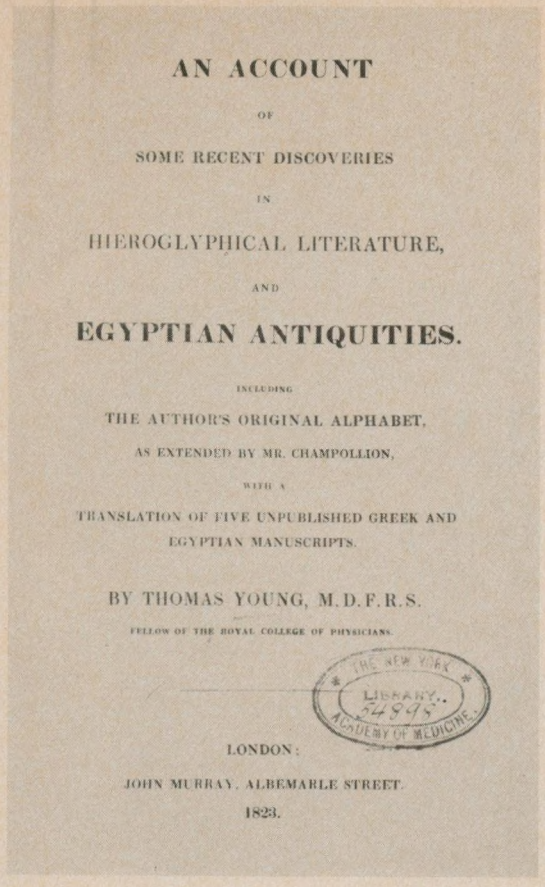
He lectured on the impossibility of any "material" theory of heat, insisting that heat consisted of vibrations of bodies larger and stronger than those of light. He also outlined a theory of tides, the nature of theoretic and practical mechanics, hydrostatics, hydrodynamics, acoustics, celestial mechanics, electricity, magnetism, climatology.

His talks, published under the title *A Course of Lectures on Natural Philosophy and the Mechanical Arts* (1807) were not appreciated by his contemporaries. Wrote Helmholtz: "They gazed at him with astonishment, but could not always follow the bold flights of his intellect, and thus a multitude of his most important ideas lay buried and forgotten in great tomes."

PHYSICIAN. Warned that his medical career was endangered because of his preoccupation with the physical sciences, Young resigned his professorship in physics in 1803. The following year he practiced as a physician at 48 Welbeck Street, London, and married Eliza Primrose Maxwell, a young woman who was said to have made him happy.

Young's waiting room was never crowded: his manners were gentle but he refused to prescribe the radical therapies, calomel and bleeding, then fashionable. He viewed medicine as an inductive philosophy dependent on observation and experiment to reach conclusions, and he was highly critical of physicians who preferred their own theories to a careful investigation of the nature of the disease. He believed that in the presence of uncertainty it was best to admit ignorance and follow nature's course than to arrogantly prescribe remedies that in all likelihood bore no relationship to the cause of the ailment.

Young's patients who were eager to find the "royal road" to health turned to other doctors and Young returned to his writing table. He wrote on the function of the heart and arteries, and in an essay on blood he suggested the use of an instrument capable of measuring globules of pus. Later he com-



AN ACCOUNT

OF

SOME RECENT DISCOVERIES

IN

HIEROGLYPHICAL LITERATURE,

AND

EGYPTIAN ANTIQUITIES.

INCLUDING

THE AUTHOR'S ORIGINAL ALPHABET,

AS EXTENDED BY MR. CHAMPOLLION,

WITH A

TRANSLATION OF FIVE UNPUBLISHED GREEK AND EGYPTIAN MANUSCRIPTS.

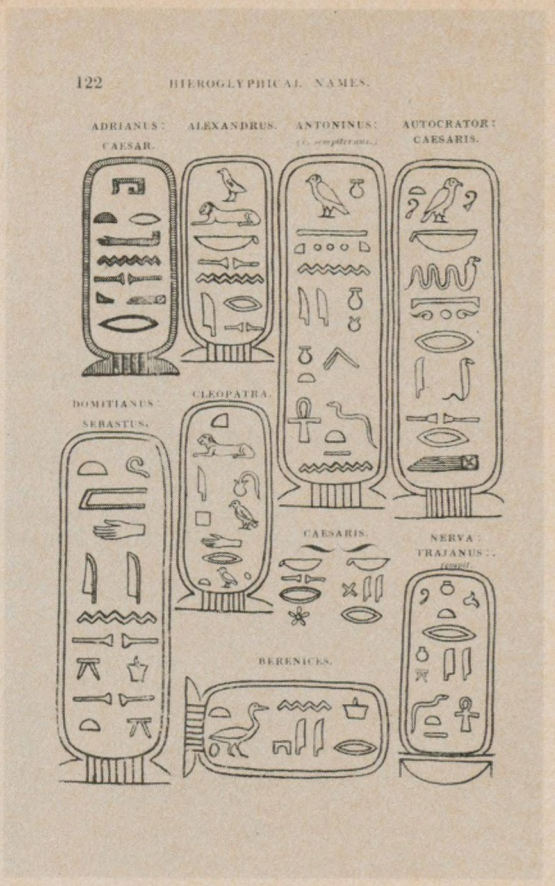
BY THOMAS YOUNG, M.D.F.R.S.

FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS.

LONDON:

JOHN MURRAY, ALBEMARLE STREET.

1823.



Title page of Young's account of his studies of hieroglyphics including the continuation of his work by the French Egyptologist Jean François Champollion, which resulted in the deciphering of the Rosetta Stone, and a table from the book showing hieroglyphs for certain Egyptian and Roman names.

piled a "Practical and Historical Essay on Consumptive Diseases" (1815) which was considered one of the best historical and contemporary accounts of the disease, and *An Introduction to Medical Literature, Including a System of Practical Nosology* (1813), which followed the botanic system of Linnaeus.

EGYPTOLOGIST. In 1814 he gave up his medical practice and made his first attempt to decipher the Egyptian hieroglyphics on the basalt Rosetta Stone discovered by the troops of Napoleon near the mouth of the Nile. The slab, bearing three columns of writing, in hieroglyphics, demotic and Greek, had long puzzled scholars until Young, by comparing the three scripts, established the hieroglyphics for "Ptolemy Epiphanes" to which he assigned the correct phonetic values. In 1818 he published in the *Encyclopedia Britannica* the now famous article on Egypt which has been called the foundation of Egyptology. His work was continued by the French scholar Jean François Champollion, who gave Young full credit for his work.

LAST YEARS. After spending most of his life studying theoretic questions Young turned to the solution of practical problems important to the comfort and safety of his countrymen and the economy of England. In 1814 he was appointed to a Royal Society Committee to investigate the possible risks in introducing illuminating gas in London, and in the same year, at the request of the admiralty, he reported improved methods of shipbuilding.

Young was appointed secretary of a commission to ascertain the length of the second's pendulum and to establish the imperial gallon. He later prepared the calculations of the Nautical Almanac, served on the Board of Longitude, which supplied information to navigators, and was an "inspector of calculations," hired by the Palladium Insurance Company, to prepare tables of probabilities in life insurance.

In 1827 he was elected one of the eight foreign members of the French Academy of Sciences. The following year, on a visit to Paris, he experienced fatigue and weakness at the slightest exertion. In the spring of 1829 he took to his bed but refused to abandon work on his Egyptian dictionary.

When Young was scolded for his inability to put down his pen, he replied that work did not bring him fatigue but amusement and that it would be "a great satisfaction never to have spent an idle day in his life." He died on May 10, 1829; the cause of death was given as "ossification of the aorta."*

SUMMING UP. By Helmholtz: "He was one of the most clearsighted men who ever lived."

*Most probably calcification.