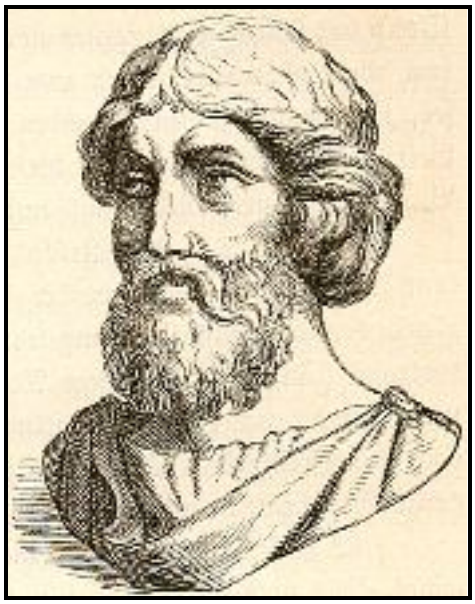
APPENDIX-1: PIONEERS in ACOUSTICS

[271] PYTHAGORAS c582/c497 BC



Greek philosopher and mathematician. Sought to explain the nature of all things in mathematical terms. His greatest scientific studies were of sound: "He found that the strings of musical instruments delivered sound of higher pitch as they were made shorter." He discovered the relationship of pitch with string length and recognised "if one string was twice the length of another, the sound it emitted was just an octave lower."
47. Asimov, entry 5.

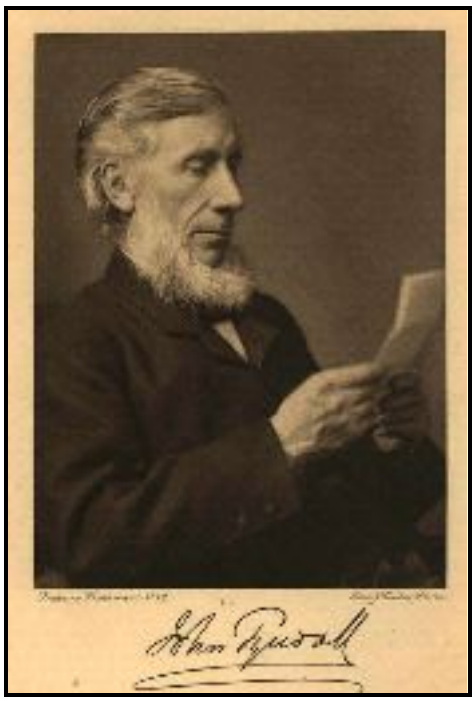
[272] POLYCLEITUS THE YOUNGER active 360 BC

Greek architect and sculptor. Designed the famous open-air theatre at Epidaurus which is the best preserved, and generally considered to be the most beautiful, of surviving Greek Theatres. It took thirty years to build: "Its vast symmetrical auditorium, rather more than semi-circular in plan, is divided by radiating stairways and, unusually, has two distinct slopes, the upper being steeper." The early Greek civilisation was probably the earliest to concern itself with acoustics and the control of sound. The Roman writer Vitruvius [181] studied these Greek designs and gave detailed descriptions of "several acoustic calculations and contrivances" and "prescriptions as to the size and proportions of the stage and the plan for the spectators" to ensure "the voice will meet with no obstruction." He wrote also of harmonics and on the design and use of bronze sounding vessels to reinforce speech at various frequencies as employed "in a good many Greek states." {Polycleitus is also probably responsible for inventing the form of Corinthian capital which became standard in later Hellenistic and Roman architecture.}
75. Morgan, (Vitruvius, Book V). 98. Billington & Roberts, pp47/49.

[273] Hermann Ludwig Ferdinand von HELMHOLTZ 1821/94

German physiologist and physicist*. Studied medicine. Graduated Berlin (1842). Served as a surgeon in Prussian Army. Later taught physiology at Könisberg, anatomy at Heidelberg (1858) and physics at Berlin (1871). Made a close study of the human eye. Also studied the ear and "advanced the theory that the ear detected differences in pitch through the action of the cochlea, a spiral organ in the inner ear." He noted the quality of a tone depends on the nature, number and relative intensities of the overtones (harmonics). He also analysed music and found that "combinations of notes sounded well or discordant on the basis of wavelengths and the production of beats at particular rates."
47. Asimov, entry 518. Portrait 122, p356.
* He is generally best known for his treatment of the conservation of energy.

[273a] John TYNDALL 1820/1893

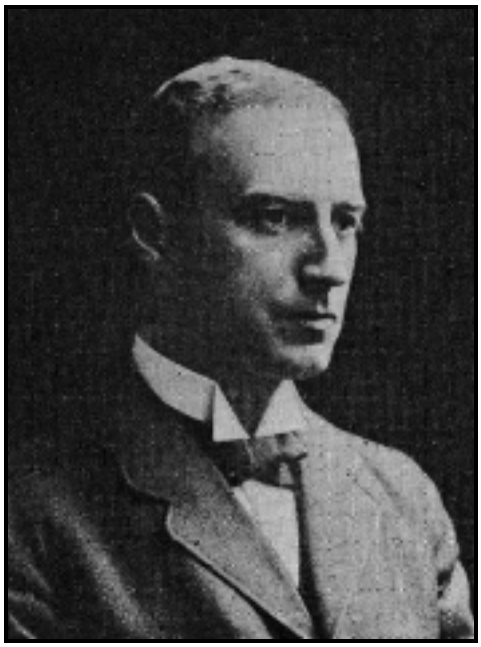


John Tyndall was born on Aug. 2, 1820, at Leighlin Bridge, near Carlow, Ireland, where his father was a constable. After a little formal schooling, he gained a practical education by working as a surveyor and engineer. He entered the University of Marburg, Germany, in 1848 and earned his doctorate 2 years later. His dissertation research interested Michael Faraday, who later brought him to the Royal Institution of London. In 1867 Tyndall succeeded Faraday as superintendent there. He was awarded the Rumford medal in 1864. He wrote the classic textbook "Heat: A Mode of Motion" and also "Sound" which dealt extensively with the theory of vibration.

[274] John William STRUTT, 3rd Baron RAYLEIGH 1842/1919

English physicist. Studied mathematics at Cambridge where he was head of his class (1865). Elected Royal Society (1873). Director of Cavendish Laboratory, Cambridge (1879/84). Specialised in the study of wave motion of all varieties, including electromagnetic, black-body radiation, water and earthquake waves and sound waves. Wrote (1877) in his famous Treatise of Sound, "It appears that the streams of energy required to influence the ear and eye are of the same magnitude..." Secretary Royal Society (1885/96). Awarded Order of Merit (1902). Became Chancellor of Cambridge University (1908).

[275] Wallace Clement Ware SABINE 1868/1919



American physicist and pioneer in acoustics. Graduated Ohio University (1886). Worked at Harvard where he was appointed a Professor of Physics (1905). Began his acoustical studies (1895) when asked to investigate the excessive reverberation in a new lecture room. He even photographed sound waves using light refraction techniques. Sabine founded the science of architectural acoustics and developed methods of calculation. Boston Symphony Hall (1900) designed according to his principles was a great success. He measured the acoustic absorptivity of many materials. "He found that the duration of the reverberation multiplied by the total absorptivity was a constant and that this constant varied in proportion to the volume of the room." Now known as Sabine's Law, this forms the basis for the architectural design of "acoustically useful rooms."
47. Asimov, entry 792. Portrait 119. p539.