# AHS London Lecture Thursday 13 March 2025

## Andrew Nahum, **Time and timing: the tuning fork and its role in modern science**

The tuning fork has an under-appreciated role in the history of time. For about a hundred years, tuning forks embodied a parallel, alternative story of time, doing a different, finer scale task than conventional clocks. We find them first, in science, in nineteenth-century laboratories. In the twentieth century they became important industrial tools.

Timekeeping and timing are different. When scientists began to probe rapid, transient events, regulator clocks, generally with pendulums beating seconds, were not suitable. Tuning forks offered the route to a finer subdivision of time.

The actions of muscles, and even the heart itself, had become an intense interest. Physiologists relied on a rotating drum, a kymograph, to record their motions, tracing them with a stylus onto a soft coating of carbon lamp black. A tuning fork with a hog bristle glued on also traced the sinusoidal time base on the drum. Electrically-maintained forks were also devised.

There were many scientific applications. In the 1860s, Henri Victor Regnault measured the speed of sound in the sewer tunnels being built under Haussmann's new Paris and Rudolph Koenig, pre-eminent acoustics expert and maker of calibrated forks contributed a tuning fork chronograph he had devised. Albert A. Michelson initially used Koenig's forks for his experiments to determine the speed of light.

With the advent of radio, and the pressure of the First World War, tuning forks were


Electrically-maintained tuning fork for timing physiological experiments by G. Boulitte, Paris, *c.* 1890. From the laboratory of Jacques Arsène d'Arsonval, Paris.

employed to standardize radio frequencies. In 1918 the electrical pioneer W. H. Eccles devised the first electronically driven fork, maintained by a thermionic valve. This system was adopted by David Dye at the National Physical Laboratory to produce a national radio frequency standard – studied in parallel with his work on the quartz ring as a time base. In the USA, similar experiments on both tuning fork and on quartz systems were conducted at the AT&T laboratories.

The electrically-maintained tuning fork also had industrial uses. Standardized forks set the 50-cycle frequency of alternating current electrical generators for the National Grid. Another intriguing use was transmission of photographs over phone lines, synchronizing the scanning of transmitter and receiver – a vital tool for newspapers in the analogue age.

Is the tuning fork the Cinderella of the timekeeping world? This talk sets out to uncover something of its history and role.

Dr Andrew Nahum is Keeper Emeritus at the Science Museum, London. In November 2015, he gave an AHS London lecture with a major emphasis on the Bulova Accutron tuning fork watch.

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