

or vibrations (as they are called when of small extent and great rapidity as in the case of atoms) may follow the general law of the pendulum and be isochronous, or they may be very irregular. Some irregular vibrations, as is shown in general physics, are closely related to the phenomenon of heat; but only regular ones enter into our consideration.

Having shown that vibration of bodies is possible it remains to show that wherever there is sound there is also vibration, and that the two phenomena occur coincidently. Example is at once the easiest and most efficient method. Take the usual means of producing sound for experimental purposes — the vibration of rods, plates and membranes, strings and columns of air. When a tuning fork is producing sound, its vibrations are perhaps visible to the unaided eye or to the touch are also sensible: if not they may be rendered visible by reflected light from a mirror on one of the legs or by any of the numerous graphic methods that have been invented. When the fork is producing no sound the absence of vibrations may be discovered in the same way. When sound is produced by means of plates or membranes the vibrations may be made visible by covering the plates with sand or some such substance, when it will be seen that the sand is agitated. When there is no sound, no such agitation occurs. The vibration of strings when producing sound may be made apparent by the use of "riders," which may be merely bits of paper rolled and bent, then suspended on the string whence they are thrown off by the vibrations. The vibration of columns of air in tubes (such as organ pipes) is made visible by lowering into the tube a stretched membrane covered with a powdered substance, when the same phenomenon is observed as in the case of a vibrating plate; or it may be shown by the ingenious and interesting apparatus of Konig, known as the manometric flame.

In all these cases (and many more could easily be given) where sound is produced, and by widely different methods and substances, it is shown that vibration is also coincident, and that, when there is no sound, no vibration is discoverable. Hence it may be inferred that sound is the result of the vibration of bodies.

But vibration is an objective while sound is a subjective phenomenon. Where, then, is the link between vibration and sound? What is the bridge between the objective and subjective; the mediator between matter and mind? The answer to this question leads us to a discussion of two subjects — the propagation of sound in the different media and the construction of the human ear.

The ear is the organ by which the vibrations are communi-