

force of the wind. In none of the above records did the wind exert any influence. To what extent fright was a factor could not be determined. Both the Turkey Vulture and the Woodcock rose from roads boarded by dense woods and flew for a few hundred feet directly in front and close to my car. The varying speeds may suggest an accelerative action by the birds, some inaccuracy in reading the speedometer or slight wind influence.—HAROLD B. WOOD, M.D., *Harrisburg, Pa.*

A Suggestion for a Scientific Method of Studying Bird Sounds.—

The study of bird sounds seems to have lagged far behind other branches of ornithology. This may be due to the prevalent practice of following the line of least resistance and investigating fields that are not so difficult of approach. Bird sounds are not easy to study. No adequate system has been proposed that will enable one to convey to another person the salient features of a sound so it can be recognized. This suggestion has to do with the analysis of sounds from the standpoint of physics, and not with graphical or symbolical systems devised for ready field identification.

Saunders (Auk, XXXII, 1915, pp. 173-183) seems to have proposed the best method of field study, but it requires considerable training and above all a good musical sense. Furthermore it is subject to the limitations of the human ear. Brand (Auk, XLIX, 1932, pp. 436-439) has taken a step in the right direction in making a permanent record of the sound. Here again, since the ultimate analysis of the records depends on the ear, the accuracy will be limited.

Sound consists of vibrations in some medium, usually air. Its motion is simple harmonic and can be represented graphically as a sine curve. The intensity will be indicated by the amplitude of the curve, the pitch by the frequency or number of complete cycles per second, and the quality by the wave shape, the latter determined by the number and phase position of the overtones or harmonics. I have thought for some time that if an instrument could be constructed, sufficiently sensitive to record these vibrations, then we would be down to the very fundamentals of sound.

In going through the literature of communication engineering I find that the Bell Telephone Laboratories have been doing some very interesting and important work in relation to sounds. While primarily interested in communication their engineers have been led to make a thorough study of human speech, music, and noises. Their numerous publications on sound may well serve as a starting point for the study of bird sounds.

They are using the electric oscillograph in their researches. This instrument has been in use for a number of years to record the variations of alternating current, usually 25 and 60 cycles. In recent years its frequency range has been gradually increased and now we have the "Rapid Record Oscillograph" with a range up to 10,000 cycles (Curtis, Bell System Technical Journal, XII, January 1933, pp. 76-90). This will record most of the components of speech and music. Briefly the principle is as follows: Sound waves striking a diaphragm cause proportional variations in an

electric current. This in turn sets a vibrator into motion. Through a suitable optical system these vibrations are photographed on a rapidly moving roll of film. This strip of film, when developed, gives a permanent record of the sound. The duration, relative amplitude, frequency, and wave shape can be measured directly from the film.

This, I think, should be the next development in the study of bird sounds. We know very little of the frequencies at which birds sing. Only a trial of this instrument will show whether it is applicable to the entire range. However, at the present rate of technical progress, it can only be a question of time before the complete audible band of frequencies can be recorded. The disadvantages of the instrument are few and can be overcome. Skilled engineers will be necessary to operate it. Its great cost will prevent the ordinary ornithologist from using it, but there are a number of large, well-endowed biological laboratories which could take it up. I believe the results will put the study of birds' songs and calls on a scientific basis and will be well worth the time, trouble and cost.—ANDERS H. ANDERSON, *Route 2, Box 386, Tucson, Arizona.*

Correction. Through an unfortunate error Topsell's name for the Towhee on the plate accompanying Mr. Christy's article in the July 'Auk' was misspelled. The spelling is correct in the text and from it the reader will appreciate the effort to imitate the call of the bird; a similar attempt is responsible for the names 'Towhee' and "Chewink"—Ed.