Physiology. — "*Muscle Sound in Birds*". By Miss L. KAISER. (Communicated by Prof. G. VAN RIJNBERK).

(Communicated at the meeting of April 30, 1921).

Concerning muscle sound and action currents in birds I found no data except a provisional communication by WEISS [1]), which as far as I know has not been followed by a more ample one. WEISS recorded the sound of the m. pectoralis of a pigeon by means of a very thin membrane, the pigeon being poisoned with strychnine. He so obtained a curve in which the distance between two crests varied from $\frac{1}{80}$ to $\frac{1}{165}$ second. The action current of the same muscle in similar conditions showed waves of a duration of $\frac{1}{85}$ to $\frac{1}{170}$ second, which agrees perfectly with the values mentioned above. SCHWARZKOPF [2]) found, as other investigators (MAREY, RICHET, and EXNER) had found before him, that the number of stimuli necessary to produce complete tetanus for pigeon muscle is 70 to 125 per second. PÜTTER [3]) mentions 70 to 80 per second as the greatest number of separate contractions possible in bird's muscle.

EWALD [4]) has described a vibration, which he observed in pigeons and in a few other birds at the upper edge of the orbita and at the eyeball. He supposes a simultaneous contraction of both the m. obliqui to be the cause of this vibration and calls the phenomenon "Augenschwingen". By means of a lever, attached to the head of the pigeon and resting upon the upper edge of the orbita, as well as by means of a double needle with writing apparatus fixed into the eyeball, EWALD succeeded in recording this phenomenon. The curves obtained by these two methods practically confirm each other, the rate of the waves being 25 to 30 per second.

The same phenomenon was further examined by the author.

The vibration, which may be observed by touch, over the whole head of the bird, is also very evident to the ear. A phonendoscope placed upon the head of the pigeon conducts to the ear a low sound, in which a tone of a low pitch may be distinguished.

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[1]) Centralblatt f. Physiol. Bd. 26. 1912.

[2]) Pflüger's Archiv. Bd. 121. 1908.

[3]) A. PÜTTER, Vergleichende Physiologie, 1912.

[4]) Archiv. f. experiment. Pathol. u. Pharmakol. Suppl. 1908. Festschrift SCHMIEDEBERG.

Even without any apparatus, by holding the head of the bird to the ear, the sound may be perceived sufficiently.

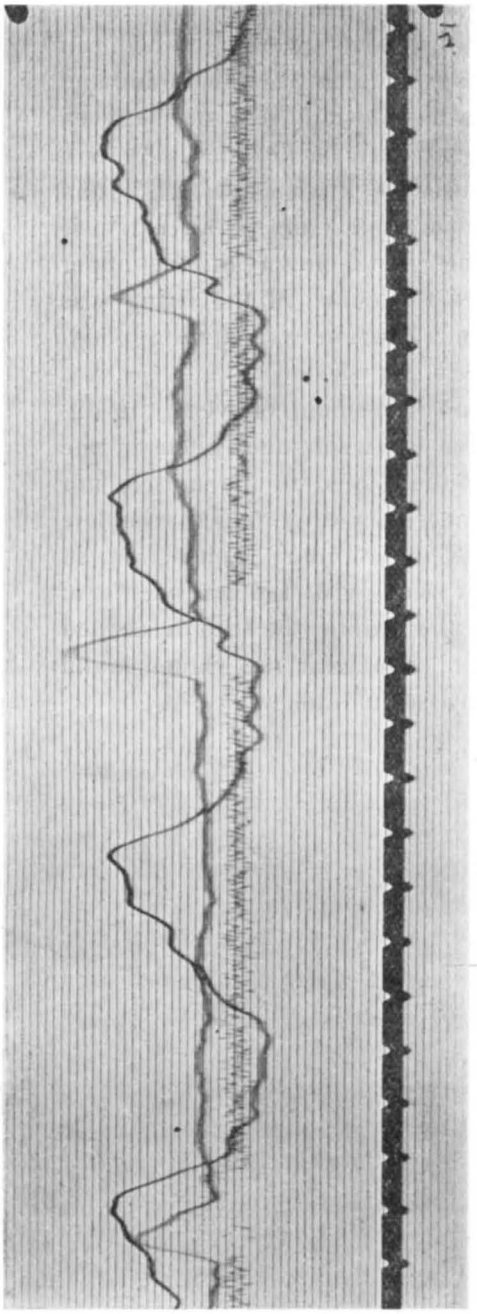

Figure 1.

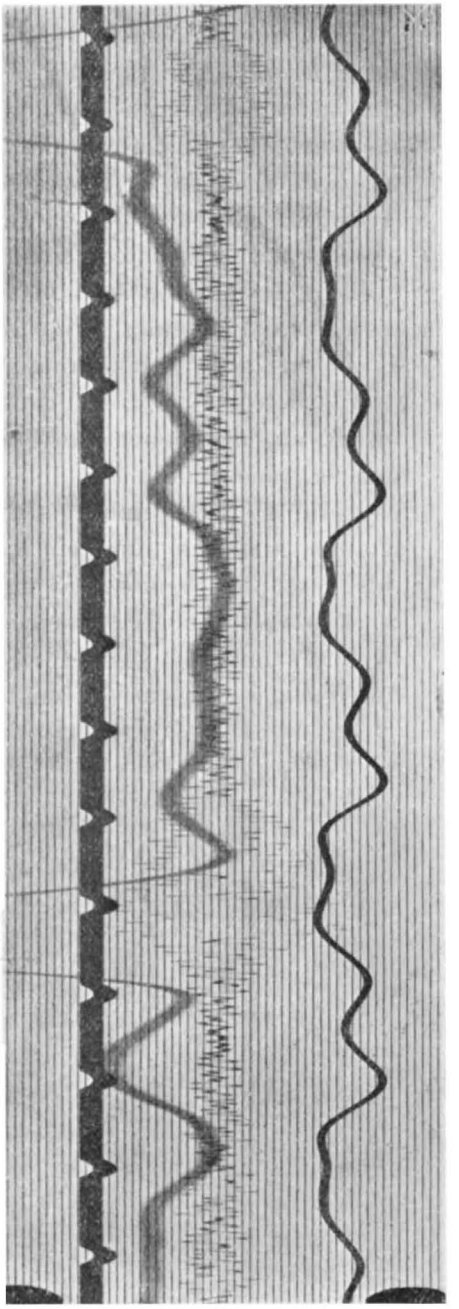

Figure 2.

These curves were obtained by conducting the sound by means of a microphone to the string of the string galvanometer (Fig. 1 and 2).

Besides the movement of the string, *S*, the respiratory movement, *A*, and the movement of the upper eyelid, *O*, were recorded. In these figures appears a distinct relation existing between the sound and the movement of the eyelid, whereas no constant relation between the sound and the respiratory movement may be detected. As will be exposed in the Archives Néerlandaises de Physiologie, the sound is caused probably by a simultaneous contraction of all extrinsic eyemuscles, which coincides with the going down of the upper eyelid. As may be seen in the figures the curve of the string was regular and distinct. The rate of the vibration was always about 17 in one fifth second, that is about 85 per second.

Apart from the fact that there is no agreement between the different authors concerning the relation between the pitch of the muscle tone and the number of stimuli applied to the muscle nor concerning the number of stimuli necessary to produce complete tetanus and the number of impulses in voluntary contraction, in this case the number 85 agrees very well with the statements of SCHWARZKOPF and PÜTTER concerning the number of stimuli needed by bird's muscle to go into tetanus and also with the values found by WEISS in the case of contraction by strychnine.