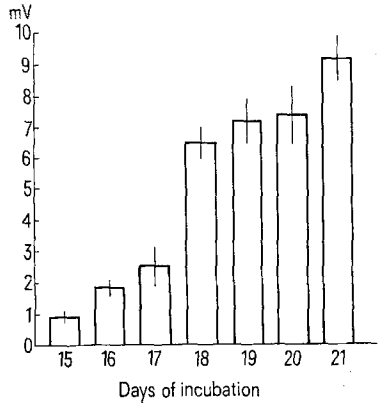
Development of the Steady Potential Differences of the Eyeball in Chick Embryos

The electrical activity of the optic afferent system in chick embryos is established at the break between day 17 and 18 of incubation[1-3]. The onset of functional activity of this system is based on synchronized maturation of pheripheral receptor and of projection centers in optic tectum. We performed this study of the development of DC potential of eyeball in chick embryos with the aim of further description of developmental stages of peripheral optic receptor.

Material and methods. 70 chick embryos (10 per day of incubation) of white Leghorns at the age from day 15 to 21 incubation were used. No anesthesia was applied. The head of embryo was fixed in a special stand. Both eyelids and nictitating membrane were removed without bleeding. The fine wick calomel electrodes were used: one electrode was placed in the center of corneal surface, the other one on the external surface of eyeball at the equatorial level some mm behind the corneal limbus. Steady potential differences were read out from the scale of compensation millivoltmeter with cathode follower input (grid current $< 5\times10^{-11}$A, input impedance $> 2\times10^{10}$ohm). The values of steady potential were measured in 30-sec intervals during 5 min after arrangement of electrodes. The experiments were carried out in darkness in an incubator at 37 °C.

Results. The DC potential of eyeball increased in 3 stages. The first significant increase occured between day 15 and 16 of incubation: from 0.92 $\pm$ 0.21 mV to 1.87 $\pm$ 0.23 mV ($p < 0.01$). The second stage was between day 17 and 18 of incubation: the DC potential increased from 2.57 $\pm$ 0.63 mV to 6.51 $\pm$ 0.46 mV ($p < 0.001$). Then the steady potential developed gradually to the value of 9.26 $\pm$ 0.76 mV in 21-day-old embryos, but the significant difference was between day 18 and 21 only ($p < 0.002$) (Figure).



Developmental values of steady potential differences of the eyeball in chick embryos. Columns: mean $\pm$ s.d. ($n = 10$ per day of incubation).

The developmental differences were manifested also in the stability of DC potential of eyeball within 5 min of measurement. It was shown that the stability developed in the same stages as the value of DC potential. The steady potential differences decreased in 15-day-old embryos within 5 min of measurement by 85 % of initial value, in 16- and 17-day-old embryos by 60.4 %, whilst in 18 to 21-day old embryos on anaverage by 22.5 % of initial value only.

Discussion. The steady potential differences of the eyeball may be derived mainly from 3 sources: from the activity of ciliary body[5,6], from the activity of retinal pigment cells[7] and from retinal neuronal elements[8], which are the developmental derivates of the optic tectum.

The main critical point of the DC potential of eyeball development was around day 17 of incubation similarly to the development of steady electrical properties of brain parts in chick embryos[4,9]. This critical moment is in full accordance with the functional onset of optic afferent system at the break between day 17 and 18 of incubation[3].

The development of DC potential of the eyeball in chick embryos is a further proof for the consideration that the peripheral part of optic afferent system undergoes around day 17 of incubation essential changes of maturation which ensure the onset its functional activity[10].

Résumé. Le potentiel D.C. mesuré sur la surface du globe oculaire de l'embryon de poulet croît à partir du 15ème jour de 0.92 $\pm$ 0.21 mV jusqu' à 9.26 $\pm$ 0.76 mV au 21ème jour l'incubation. L'augmentation maximum se situe entre le 17ème et 18ème jour (2.57 et 6.61 mV). Elle correspond à la mise en jeu de l'appareil visuel afférent. La stabilité du potentiel D.C. du globe oculaire est directement proportionnelle à sa valeut.

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Chronotropic Changes due to Pericardial Distension in Isolated Frog Hearts Perfused in situ

The influence of mechanical strech induced by changing the intraluminal pressure in the chamber containing the cardiac pacemaker, on the chronotropic response of amphibian and mammalian hearts, has been extensively investigated (PATHAK[1-5]) and it has been demonstrated that mechanical stretch acts as a fundamental stimulus for intrinsic autoregulation of pacemaker (PATHAK[6,7]). This work was prompted by the consideration that pacemaker cell configuration and fibre-lenght is also likely to be altered by extramural pressure changes. Since this aspect of pericardial tamponade has not been investigated so far, a preliminary report would be stimulating.

Material and methods. Hearts of decapitated frogs were perfused in situ through the posterior vena cava at a constant optimal pressure of 3 cm H_2O (PATHAK[1-3]) regulated by an overflow device, the velocity of flow being