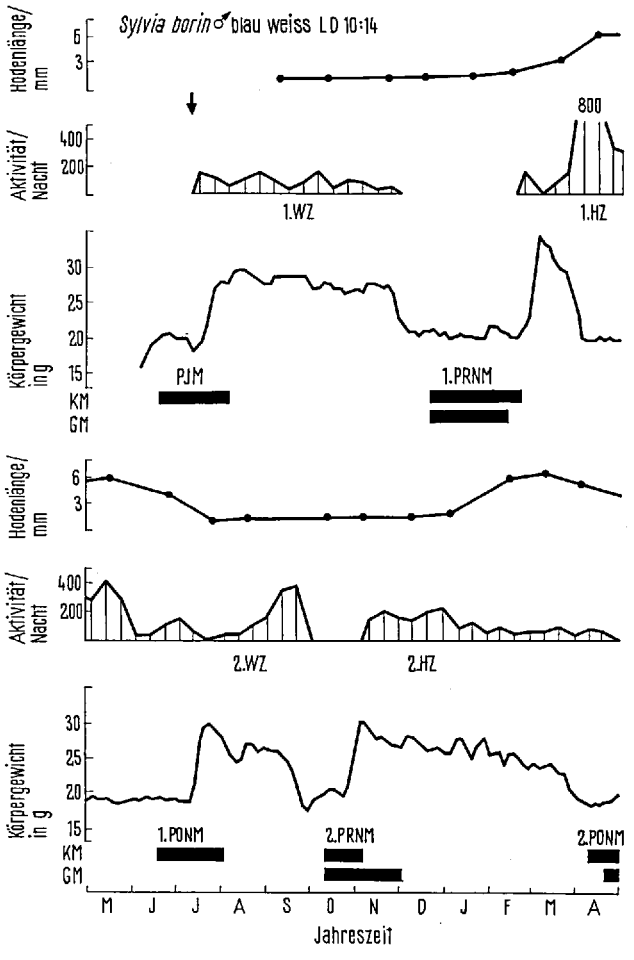
Circannuale Periodik bei Grasmücken (*Sylvia*)[1]

Bei Vögeln konnte eine endogene Jahresperiodik bisher nur für zwei Laubsängerarten der Gattung Phylloscopus und zwar für drei Vorgänge – Mauser, Zugaktivität und jahreszeitliche Körpergewichtsänderungen – nachgewiesen werden; für eine Reihe weiterer Arten und für weitere Prozesse bestehen lediglich Hinweise auf eine solche Periodik (Übersicht[2]). Im Rahmen des Grasmückenprogramms unseres Instituts[3,4] konnten wir 1. eine circannuale Periodik bei zwei weiteren Arten feststellen: bei *Sylvia borin*, einem ausgeprägten Zugvogel (Weitstreckenzieher, Figur), und bei *S. atricapilla*, einem weniger ausgeprägten Zugvogel (Mittelstreckenzieher). Die Mehrzahl von je 40 grösstenteils handaufgezogenen Garten- und Mönchsgrasmücken zeigte über (bisher) 2 Jahre eine endogene Jahresperiodik der Mauser, der Zugunruhe und der Körpergewichtsänderungen in 3 verschiedenen konstanten Bedingungen (tägliches Licht-Dunkel-Verhältnis = LD: 10:14, 12:12 und 16:8, jeweils 450:0,01 Lux; Temperatur 20 ± 1,5 °C; Näheres siehe [4]). 2. Wir fanden bei beiden Arten ausserdem eine circannuale Periodik der Gonadengrösse: Hodenzyklus (Figur) und Ovarzyklus waren bei mehr als 15 daraufhin untersuchten Vögeln auch unter konstanten Bedingungen zu beobachten. Bisher gab es unseres Wissens lediglich mehr oder weniger gute Hinweise auf eine circannuale Periodik des Gonadenzyklus[5–9]. 3. Da unsere handaufgezogenen Versuchsvögel spätestens vom 60. Lebenstag ab unter konstanten Bedingungen lebten, muss ihre circannuale Periodik angeboren sein. Unsere Ergebnisse sprechen dafür, dass bei Zugvögeln wie den beiden hier untersuchten Arten zumindest viele jahresperiodische Prozesse einschliesslich des Gonadenzyklus primär durch eine circannuale Periodik gesteuert werden.



Circannuale Periodik der Hodenlänge, der Nachtunruhe, der Körpergewichtsänderungen und der Klein- und Grossgefiedermauser (KM, GM) einer *Sylvia borin* im LD 10:14. ↓ Zeitpunkt, an dem der Vogel (geschlüpft am 29. Mai 1968) in konstante Bedingungen übergeführt wurde. WZ, Wegzug; HZ, Heimzug; PJM, postjuvenile Mauser; PRNM, praenuptiale Mauser; PONM, postnuptiale Mauser. Obere Bildhälfte: Prozesse im 1. Jahr, untere Bildhälfte: Prozesse im 2. Jahr. Die Hodenlänge wurde in 1 bis 2monatigen Abständen durch Laparotomie bestimmt. Die Periodenlänge der einzelnen Vorgänge betrug 8–12 Monate, die des Gonadenzyklus 10 Monate.

Summary. In *Sylvia borin* and *S. atricapilla*, circannual rhythmicity was found in moult, migratory restlessness and in changes of body weight and gonad size under constant photoperiodic conditions.

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Presynaptic Depolarization of Olfactory Afferent Fibers in Cat Prepyriform Cortex

Ascending specific sensory pathways are known to be under modulatory control from brain stem loci, cortical regions and peripheral nerves. Inhibitory influences, responsible for the negative sign of this feed-back loop, seem to belong mainly to the pre-synaptic type at the dorsal column nuclei[1], trigeminal complex[2] and lateral geniculate[3]. Although reciprocal, dendrodendritic inhibitory synapses have been suggested to operate between mitral and granule cells in the olfactory bulb (OB), no reports are available on mechanisms of input control at the level of third order neurons in the afferent olfactory pathway. The present experiments were designed to

explore the possibility that pre-synaptic depolarizing phenomena could be operative at the prepyriform cortex (PP_1) of the cat.

Material and methods. In Nembutalized animals, electrical stimulation of both OBs and of the right PP_1 cortex was made through bipolar semi-microelectrodes (10–20 μm tip diameter; 0.5 mm tip separation); evoked responses were recorded from the left PP_1 cortex by means of metal microelectrodes (0.5–1 μm tip diameter; 100–250 Kohm resistance). The left lateral olfactory tract (LOT) was exposed following eye enucleation and removal of the medial orbit wall; fiber excitability was tested with WALL's[4] technique.

Results and discussion. Amplitude and area surface of the negative, post-synaptic component of the field potentials evoked in the left PP_1 cortex by OB stimulation were consistently reduced by single and repetitive (4–5 pulses; 300 cycles/sec) conditioning stimuli to both the contralateral OB and PP_1 cortex (Figure 1 A). In addition the faster, positive pre-synaptic wave was also depressed,

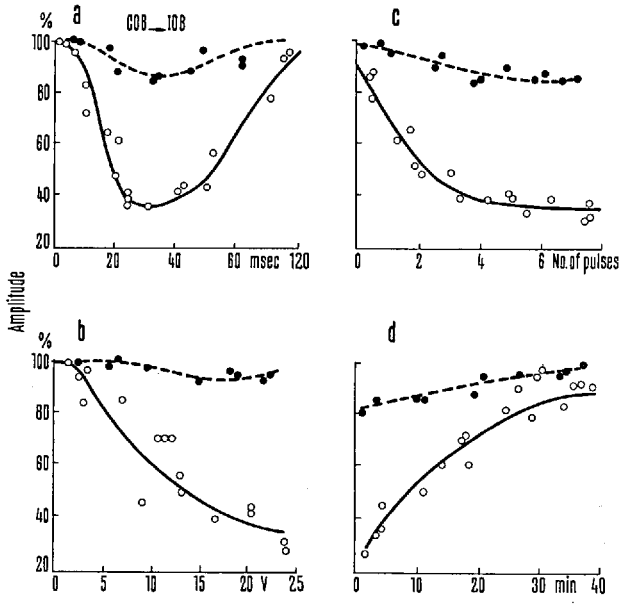

Fig. 1. Amplitude variations in a prepyriform field potential evoked by single shock stimulation (8.5 V, 0.7 msec, 1/sec) to the ipsilateral OB, to different experimental procedures. Positive (pre-synaptic) and negative (post-synaptic) components are represented by filled and open circles, respectively. In A, amplitude of test response is plotted on the ordinate against different intervals after repetitive conditioning stimulation to the contralateral OB (300 C/sec, 4 pulses, 8 V). B shows percent amplitude of test responses relative to intensity of conditioning pulses. C, same as B, only relative to number of priming stimuli. In D, time course of disinhibition in a prepyriform test response, following an i.p. injection of Picrotoxin (1.5 mg/kg). The PP_1 potential evoked by ipsilateral OB stimulation was originally depressed to 24% of its control value by conditioning stimuli to the opposite bulb; conditioning-test stimulus interval was maintained constant at 47 msec. Abscissa: time in min after injection.

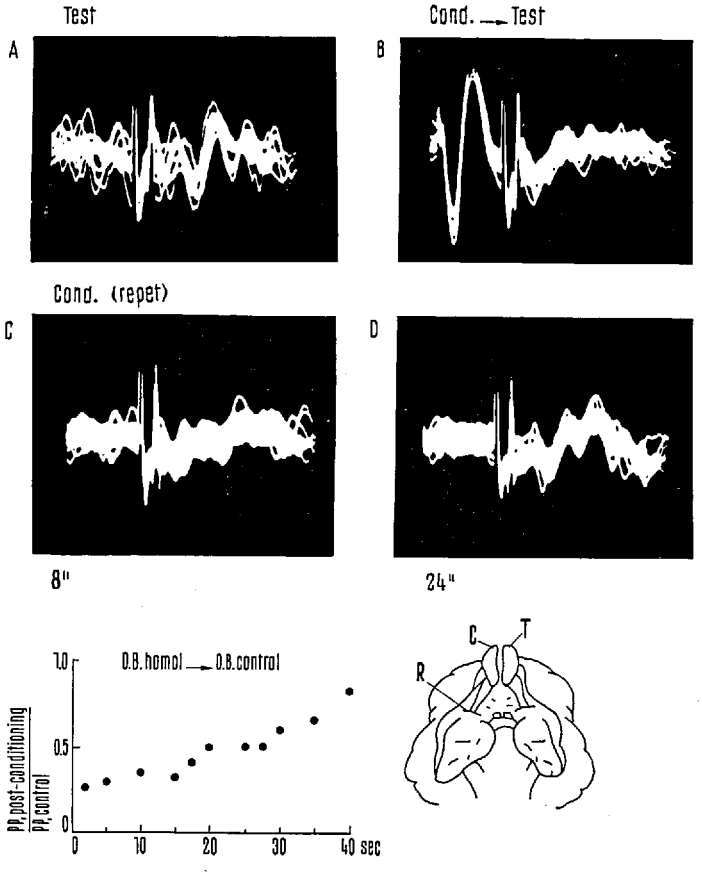

Fig. 2. Effects of single and tetanic conditioning stimuli to left OB on a right prepyriform test response evoked by ipsilateral OB stimulation (12 V, 1 msec, 1 c/sec). Upper row, left: control test response. Upper row, right: single shock conditioning stimulus applied to the left OB (10 V, 0.6 msec); inhibitory effect on test responses. Lower row, left and right: test responses 8 and 24 sec, respectively, following end of a conditioning tetanic stimulus (100 c/sec, 8 V, 4 sec duration) to the right OB. Graph shows time-course of inhibition when conditioning stimulus is tetanic; zero time on the abscissa corresponds to end of tetanus. Inset: C and T, conditioning and test electrodes; R, recording site. Calibrations: beam duration is 200 msec; in B, the first potential is 0.7 mV high.

which can be interpreted as a sign of terminal depolarization[5,6]. The degree of negative wave inhibition was exponentially related to both the intensity and number of conditioning pulses (Figure 1B and C). Latency of onset was 10–15 msec, peak 30–60 msec, declining phase 70 to 100 msec, and total duration approximately 150 msec. Reciprocal effects were also disclosed, i.e., right PP_1 test responses could be blocked by contralateral OB conditioning volleys and vice-versa (Figure 2A and B). Inhibition lasted several seconds when conditioning stimuli were applied as short tetani (100 cycles/sec; 2–3 sec duration) (Figure 2C and D). Mechanisms of primary afferent depolarization (PAD) have been held responsible for such prolonged depression[7], presumably by inducing inhibitory effects of the pre-synaptic type.

Antidromic potentials elicited in the LOT bundle by stimulation of ipsilateral PP_1 cortex were increased in a 10–40% proportion when single or repetitive conditioning pulses were delivered to the contralateral OB or PP_1 cortex (Figure 3A, B, C and D), thus revealing an increased excitability in the LOT preterminals. The neurophysiological data were supported by pharmacological studies: inhibitory effects of conditioning volleys on PP_1 test responses were cancelled following an i.p. injection of 1.5 mg/kg of Picrotoxin (Figure 3E, F and G). These results suggest that PAD of LOT pre-terminal axons, generated by conditioning stimuli to the opposite OB and PP_1 cortex, was mainly responsible for the depression of test potentials; they do not preclude, however, that a direct, post synaptic inhibitory activity of the Renshaw type could mediate in the blocking of the field potentials, since PAD is only an indirect evidence of pre-synaptic inhibition. Results with Picrotoxin, which is presumably ineffective in blocking post-synaptic inhibition, and the time course of the inhibition, similar to the duration of the slow negative P-type wave evoked by PP_1 conditioning pulses (Figure 3H) are in favor of pre-synaptic depolarizing activity. In our studies, however, polarity of this wave was reversed in relation to similar positive P-waves recorded from the pons surface and trigeminal complex. This discrepancy can be explained by the fact that evoked activity was recorded in our cases from the deep soma layer of the PP_1 region and about 500 μm medial to the superficial LOT axons[8]. Since field potentials at this point are mostly generated by a system of core conductors oriented in a ventra-lateral-dorsomedial direction (the general layout of the superficial pyramidal neurons being normal to the surface), the superficial LOT fibers would act as sources for the deep, medial sinks; this extracellular flow of current should then be recorded as positivity from the surface and negativity from the pyramidal cell layer. A similar disposition has been reported in the trigeminal complex, and as predicted, phase reversal of the positive P-wave recorded from the surface took place within the nucleus[9].

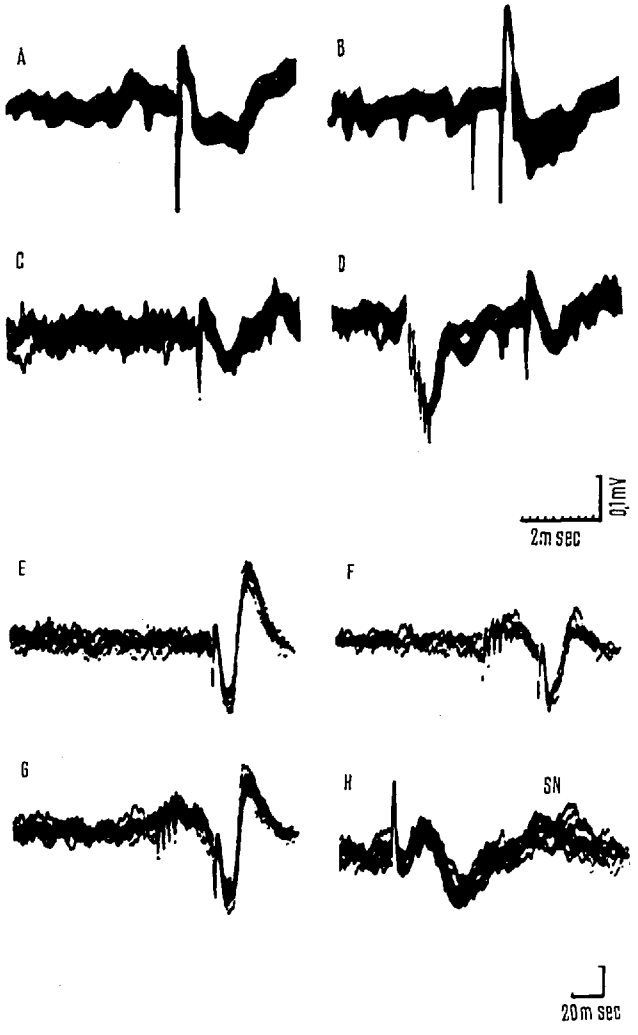

Fig. 3. A and C: antidromic compound action potentials recorded from the LOT in response to stimulation of ipsilateral prepyriform cortex. Stimulating voltage is 2.5 × threshold in A, and just above threshold in C. B and D: increase in antidromic direct response after single and repetitive conditioning stimuli to contralateral PP_1 cortex; C–T interval is 8 msec in B, 30 msec in D. E: prepyriform field-potential evoked by ipsilateral OB stimulation (7 V, 0.5 msec, 1 c/sec). F: same as E, but preceded by tetanic stimuli to contralateral PP_1 cortex (11 V, 4 pulses, 300 c/sec). G: same as F after 35 min of an i.p. injection of Picrotoxin (1.5 mg/kg). H: focal biphasic potential followed by a slow, negative wave (SN) recorded in left PP_1 cortex in response to contralateral PP_1 stimulation. Voltage calibration is 0.2 mV for the last 4 traces.

Resumen. El efecto de estímulos condicionantes sobre el potencial evocado del área prepiriforme fué estudiado en gatos. La estimulación del bulbo olfatorio y de la corteza prepiriforme contralateral provocan inhibiciones de larga duración (> de 100 mseg); estas pertenecen al tipo presináptico a juzgar por la depolarización aferente primaria (DAP) de los terminales axónicos y los efectos desinhibitorios de la picrotoxina.

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