Riassunto

Viene studiata la formazione del flavin-adenin dinucleotide (FAD) da parte di cellule di fegato di animali normali e diabetici per allossana a partire da flavin mononucleotide (FMN).

Le cellule dell'animale normale possono sintetizzare il FAD direttamente dal FMN, mentre le cellule dell'animale diabetico possono effettuare questa sintesi dal FMN, solo se viene aggiunto anche ATP.

Tale sintesi è possibile solo se viene conservata l'integrità cellulare. Viene descritto un procedimento per la preparazione delle cellule isolate di fegato.

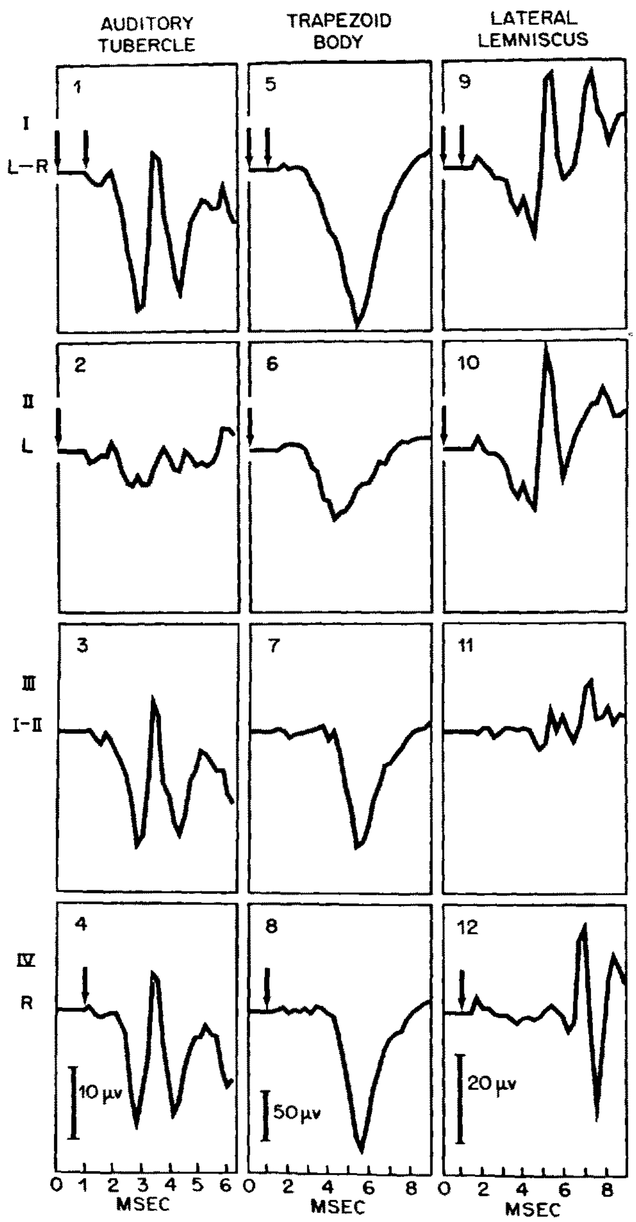
Binaural Interaction in the Medulla of the Cat[1]

The ability to locate the source of a sound in space is considered to depend upon the interaction of neural impulses originating at the two ears. Binaural interaction has been shown in the responses of the auditory cortex[2], but it is not yet known at what level of the auditory system interaction first occurs. JEFFRESS[3] suggested that the inferior colliculi are probably the site of the first binaural interaction, and interaction has recently been demonstrated at this level[4]. There does not seem to be any clear evidence in the literature of binaural interaction below the colliculi. KEMP and ROBINSON[5] interpreted their experiments at the lateral lemniscus as showing no binaural interaction at that level. A preliminary report indicated that binaural interaction might occur in the cochlea itself, impulses being transmitted over a cochleo-cochlear tract[6], but later work has not confirmed this[7].

We have sought to determine whether binaural interaction occurs at the auditory tubercle, the trapezoid body, the superior olivary complex, and the lateral lemniscus. We have not found evidence of interaction at the tubercle, but we have found significant evidence of interaction at the 3 other stations.

Methods. If the two ears are represented at a particular region by independent populations of neural units, then the response to stimulation of both ears should equal the sum of the responses to monaural stimulation of the separate ears. If a significant deviation from equality is found, then we conclude that interaction between the responses of the two ears has occurred and that the ears are not represented by independent populations.

In our experiments, the ears were stimulated independently of each other with brief click stimuli. The intensity of the clicks was usually set between 30 and 40 db above threshold, so that crosshearing was avoided. The amplified electrophysiological responses were recorded photographically from the face of a cathode-ray oscilloscope. To record from the auditory tubercle, a gross electrode was placed on the dorsal surface of the tubercle. To record from the other stations, a needle, insulated except at the tip, was inserted into the medulla. The brains were preserved for histological determination of the exact sites of recording; the histology has not yet been done, and the positions of the needle tip have been determined provisionally from external measurements.



Electrophysiological responses to click stimuli recorded at the auditory tubercle, the trapezoid body and the lateral lemniscus. Each graph is the average of 8 to 10 successive responses. Each of these electrode locations was taken from a different animal. The tubercle and lemniscus locations were on the right side; the trapezoid location was in the midline.

The subjects were ten adult cats, anesthetized with Nembutal or with Dial in urethane. Seven animals were used in experiments at the tubercle; five, including two of the former group, were used in experiments at the other stations.

[1] This research was aided by a grant from the National Science Foundation.

[2] F. BREMER, in *La Surdité, sa Mesure et sa Correction* (Maloine, Paris, 1952), p. 151. – M. R. ROSENZWEIG, J. comp. Physiol. Psychol. *47*, 269 (1954).

[3] L. A. JEFFRESS, J. comp. Physiol. Psychol. *41*, 35 (1948).

[4] P. D. COLEMAN, unpublished doctoral dissertat. Univ. Rochester, 1953. – M. R. ROSENZWEIG and E. J. WYERS, J. comp. Physiol. Psychol. *48*, 426 (1955).

[5] E. H. KEMP and E. H. ROBINSON, Amer. J. Physiol. *120*, 316 (1937).

[6] R. GALAMBOS, W. A. ROSENBLITH, and M. R. ROSENZWEIG, Exper. *6*, 438 (1950).

[7] W. A. ROSENBLITH and M. R. ROSENZWEIG, J. Acous. Soc. Amer. *23*, 583 (1951).

The photographed oscilloscopic traces were projected in a microfilm reader, and the amplitude of each response was measured at approximately every 0·25 ms along the trace. Seven to ten successive traces were recorded under each stimulus condition, so that a relatively stable average could be obtained.

Results. The Figure presents graphs of such averages for responses recorded at 3 stations. Responses to monaural stimulation of the left ear are given in the second row, and responses to stimulation of the right ear, in the fourth row. The time of arrival of the electrical pulse at the earphone is indicated by an arrow above the trace. The responses graphed in the top row were obtained by stimulating both ears, the left ear 1 ms before the right ear[1]. We tested for interaction by subtracting the graphs in row II from those in row I and then determining whether the differences (row III) were equivalent to the responses in row IV. For a given electrode position, failure of the graph in row III to equal that in row IV is evidence of binaural interaction.

Examples of responses of the auditory tubercle are given in the graphs in the first column of the Figure. No interaction is indicated, since the graph in square 3 is almost identical with that in square 4. Even small differences, if consistent, may be significant, so we computed t tests for some of the differences to determine whether any evidence of interaction could be found. The responses of the tubercle tended to be smaller and more variable than those of the other stations, and only a small number of traces had been recorded under each condition. Nevertheless, at some electrode locations a difference of about $^1/_{10}$ in amplitude would have been significant at the 0·01 level of confidence. Actually, the differences observed showed no consistency as to sign, and where the responses were stable, the differences tended to be very small. If any binaural interaction occurs at the auditory tubercle, it probably affects less than $^1/_{10}$ of the amplitude of the response that can be recorded from the dorsal aspect of the tubercle.

At midline positions in the trapezoid body, we found evidence of binaural interaction at some electrode locations and no evidence of interaction at others. When interaction was found, as in square 7, the amplitude was often reduced about $^1/_5$ when measured at the latency of the peak of the normal response (square 8). In this example, a t test showed the interaction to be significant at the 0·01 level of confidence, and similar cases were found with other animals. Sometimes significant interaction was found at one electrode location, while in another trapezoid location, nearby in the same animal, evidence for interaction was slight and not significant. Trapezoid responses were studied at 8 electrode locations in 5 animals.

At most electrode locations in the region of the superior olivary complex, significant interaction was found, and the amplitude of the response was reduced by perhaps $^1/_3$ in these cases. Olivary responses were measured for 8 electrode locations in 4 animals.

At the lateral lemniscus, the binaural interaction is often sizeable, and it is highly significant. An example is given in the third column of the Figure, where the amplitude of the response in square 11 is considerably smaller than that in square 12. The interaction at the lemniscus often reduces the amplitude of the main deflection by some $^2/_3$. Responses at the lemniscus were measured at 10 electrode locations in 5 cats.

The latencies of the responses provide further information concerning the order of the neurons in which interaction occurs. When the electrode is on the right auditory tubercle (as in the example in the Figure), the response to stimulation of the right ear usually shows a surface-positive (downward) deflection with a peak latency[1] of about 1·7 ms and a surface-negative deflection with a latency of about 2·4 ms; presumably these represent first- and second-order neurons. The response of the left ear has a positive deflection with a latency of about 2·9 ms. At the other tubercle, the latencies are, of course, reversed. At both the trapezoid body and the superior olivary complex, the latency is about 4·3 ms, and the main deflections presumably represent third-order neurons. The lateral lemniscus has a complex response with a small positive peak at about 4·3 ms, a larger negative peak at 5·2 ms, and a large positive deflection at 5·8 ms. At the inferior colliculus, the first large deflection occurs at about 4·3 ms and the second peak is at 5·2 ms. (The latencies vary somewhat with the exact stimulus intensity used.) Thus, third-order fibers show binaural interaction in the trapezoid body, the superior olivary complex and the inferior colliculus. Neurons of higher order in the lemniscus exhibit a greater magnitude of interaction. First- and second-order neurons in the tubercle do not show any significant evidence of interaction.

Anatomical evidence for convergence of fibers from the two ears in the superior olivary complex has recently been provided by STOTLER[2]. He found that cell bodies in the medial ("accessory") superior olivary nuclei receive fibers from the two cochlear nuclei. The third-order cells of the medial superior olivary nuclei project homolaterally in the lateral lemniscus, and each such cell represents both ears. These findings would support the observation of binaural interaction in the olivary complex and in the lateral lemniscus, but they do not indicate why interaction was also found in the trapezoid body. However, RASMUSSEN[3] had previously reported that the accessory nuclei project to the contralateral as well as to the homolateral lemniscus and that the fibers cross contralaterally in the trapezoid body. Considering that binaural interaction seems to be found rather widely in the region of the superior olivary complex, we would expect that further sites of binaural convergence may be found in the medulla besides the medial superior olivary nuclei.

M. R. ROSENZWEIG and A. H. AMON

Department of Psychology, University of California, Berkeley, August 15, 1955.

Résumé

L'étude de l'orientation latérale dans l'audition binaurale a déjà montré une interaction binaurale dans les réponses électrophysiologiques de l'écorce cérébrale et des tubercules quadrijumeaux inférieurs. Nous avons cherché le niveau le plus bas d'une telle interaction. S'il

[1] We also stimulated in the opposite order ($R \to L$) and varied the time intervals between paired stimuli. In a further publication, we will treat binaural interaction in the medulla as a function of the interval between paired stimuli.

[1] Latency will be specified in terms of the peak rather than the start of a deflection. The peak provides a more stable measure and it represents a central tendency in a population of responding units. In measuring the latency from the electrical pulse at the earphone, 0·3 ms is subtracted to allow for the acoustic stimulus to reach the eardrum.

[2] W. A. STOTLER, J. comp. Neurol. *98*, 401 (1953).

[3] G. L. RASMUSSEN, J. comp. Neurol. *84*, 141 (1946).

existe une interaction binaurale aux tubercules acoustiques, elle doit être très faible. Par contre, nous avons trouvé une interaction réelle dans le corps trapezoïde, l'olive supérieure et le lemniscus latéral. Une base anatomique de l'interaction binaurale a été découverte récemment au noyau médial de l'olive supérieure où se trouve une convergence des fibres des deux noyaux cochléaires.

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PRO EXPERIMENTIS

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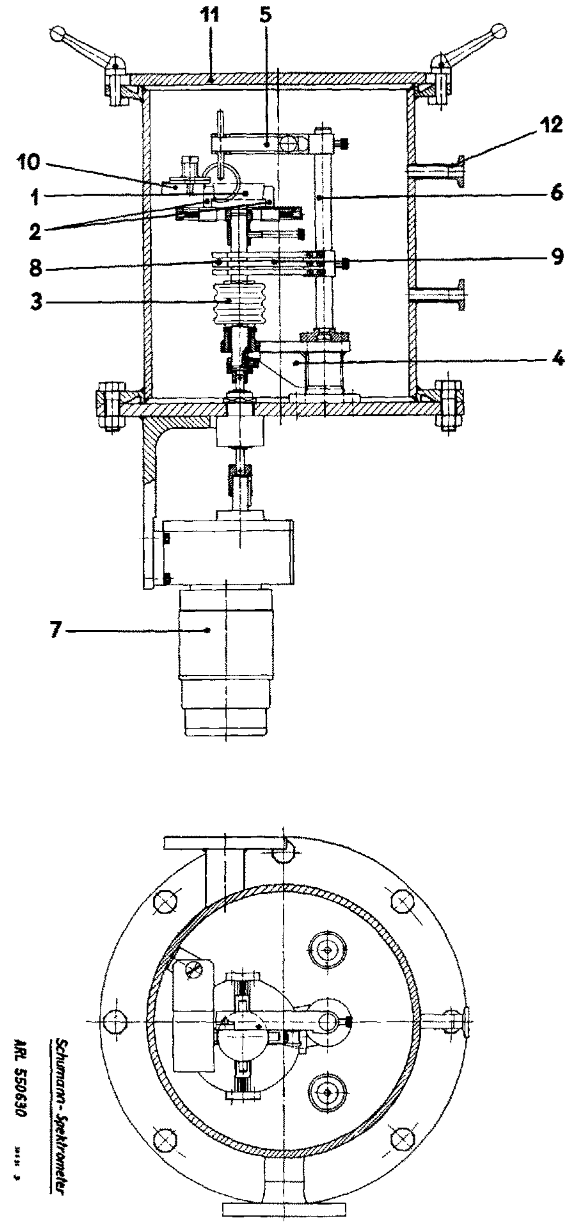
Ein Funkenstativ mit rotierender Elektrode

Oft ist es vorteilhaft, bewegte Elektroden zur spektrochemischen Untersuchung einzelner Elemente in Eisenlegierungen zu verwenden, da zum Teil die Nachweisempfindlichkeit erhöht wird und gewisse Struktureinflüsse eliminiert werden können. KOCH und ECKHARD[1] benutzten diese Technik für Spurenuntersuchungen in Stahl. Die Abfunklinie bildet dabei eine räumliche Spirale.

Das hier zu beschreibende Funkenstativ wurde für tellerförmige Stahl- und Gussproben entwickelt für Durchmesser von 30 bis 80 mm. Die Probe (*1*) wird von vier Backen (*2*) gehalten. Diese Backen werden in einem Schwalbenschwanz geführt. Der Probenhalter ist auf einem Porzellanisolator (*3*) montiert. Das ganze Gebilde wird durch ein Lager auf der Konsole (*4*) abgestützt. Der Gegenelektrodenhalter (*5*) wird von einer Steatitsäule (*6*) getragen und kann längs dieser Säule verschoben werden. Ein Motor (*7*), dessen Drehzahl von 1 bis 50 U./min variiert werden kann, lässt die untere Elektrode rotieren. Die Hochspannungszuführung zum rotierenden Teil geschieht auf drei Kollektoren (*8*) mit sechs Kupferbürsten (*9*), die je mit einer Stahlfeder gegen den Kollektor gepresst werden. Der Elektrodenabstand kann mit einer einschwenkbaren Lehre (*10*) eingestellt werden. Der ganze Funkenstand ist in einem vakuumdichten Gehäuse aufgebaut, da er zunächst entwickelt wurde für den Gittervakuumspektrographen von LÜSCHER[2] und in einer Stickstoff- oder Argonatmosphäre arbeiten kann. Der Deckel (*11*) ist mit zwei Griffen entfernbar, damit ein rasches Auswechseln der Proben möglich ist. Zwei Flansche (NW10) sind angebracht für die Zu- und Ableitung von Stickstoff oder Argon, damit sowohl in



einer ruhenden, als auch in einer strömenden Atmosphäre abgefunkt werden kann.

E. LÜSCHER

Applied Research Laboratories, Lausanne, den 5. August 1955.

Summary

A new Arc Spark Stand is described in which the sample electrode can be rotated in the shape of a plate.

[1] Private Mitteilung von S. ECKHARD, Max-Planck-Institut für Eisenforschung.

[2] E. LÜSCHER, Diss. (im Druck).