

Table II. Comparative *in vitro* activity of the antibiotic produced by Ac₂435 with some of the known tetraene antibiotics

Test organism	Minimum inhibitory concentration ($\mu\text{g/ml}$) of				
	Ac ₂ (435)*	Nystatin	Pimaricin	Rimocidin sulphate	Amphotericin A
1. <i>Candida albicans</i>	18.5	35.0	34.0	18.0	16.0
2. <i>Candida tropicalis</i>	17.0	42.2	40.0	16.0	17.5
3. <i>Saccharomyces cerevisiae</i>	6.0	18.5	16.0	15.0	6.0
4. <i>Saccharomyces ellipsoidus</i>	6.5	18.0	20.0	8.0	15.0
5. <i>Torula</i> sp.	5.0	18.0	12.0	12.0	13.4
6. <i>Aspergillus niger</i>	10.0	45.0	17.0	25.0	10.0
7. <i>Aspergillus oryzae</i>	30.5	100.0	100.0	100.0	18.0
8. <i>Alternaria solani</i>	16.0	35.0	30.2	26.0	12.0
9. <i>Curvularia lunata</i>	4.5	8.0	10.0	15.0	4.0
10. <i>Fusarium oxysporum</i>	20.0	100.0	35.0	20.0	32.0
11. <i>Glomerella cingulata</i>	8.0	10.0	4.0	25.0	4.5

* Purified antibiotic for comparison.

matographic and counter current distribution studies. The UV absorption spectrum had a maxima at 288, 305 and 320 m μ , indicating the presence of a conjugated tetraene structure. Comparative assays with known tetraene antibiotics have been carried out against yeast and several other fungi, and the results are given in Table II. The toxicity test of the antibiotic was carried out on mice in which S.C. LD₅₀ was 400 mg/kg of the body weight.

Zusammenfassung. Ein neues antifungales Antibiotikum, *Streptomyces* sp. Ac₂(435) wurde mit breitem Spek-

trum isoliert. Die aktive Substanz ist ein amorphes, nicht-kristallines weisses Pulver, das in Wasser mässig löslich ist. Die Substanz ist lichtempfindlich und bei 100°C inaktiv. Vergleichsproben mit bekannten Substanzen ergaben eine Tetraenverbindung.

ASHALATA PAL and P. NANDI

Department of Microbiology, Bose Institute, Calcutta (India), December 3, 1963.

Ciliated Smooth Muscle Cells in the Uterus of the Rat

In the course of a study on the action of steroid hormones upon the fine structure of the uterine smooth muscle cell of the spayed rat, a relatively large number of cilia was observed. Since, to our knowledge, only one report exists¹ upon the occurrence of cilia in smooth muscle cells, and the significance of their appearance in such an apparently abnormal site is at present only speculative, a brief description of them in the smooth muscle cells of an organ in which they have not been noticed before seemed warranted.

The observations were performed on the uteri of 30 castrated adult albino rats which were routinely fixed in 1% Osmium tetroxide buffered at pH 7.4 and embedded in Araldite. Thin sections obtained with an LKB Ultratome were stained with potassium permanganate and observed with a Philips 100 B electron microscope.

The general appearance of the cilia is similar to that previously described in the smooth muscle cells of other organs¹. Generally, only one cilium could be observed in a single cell, but occasionally two cilia located close to each other could be seen. Most of the cilia appeared close to the nucleus, deeply embedded in the cell, but at times they were close to the cell surface, with most of the shaft in the intercellular space.

In our observations the cilia assumed different appearances. Generally, they were observed as being composed of a basal body from which a short shaft buds into a small vesicle. The shaft measured at least 200 m μ in width and its length was variable according to the orientation of the section. The largest one found measured 2.5 μ . In transverse sections the cilia appeared to be composed of 9 double fibres arrayed peripherally around an area of very low electron density. In no case was evidence of central fibrils found. The structure of the basal body resembled that of the centriole, and the peripheral fibres of the cilia appeared to be continuous with those of the basal body. No basal plate could be seen between the ciliary shaft and the basal body. Most of the cilia were surrounded by a clear space of variable width limited by a membrane which in favourable sections appeared continuous with the plasma membrane. In this case the plasma membrane invaginated until the level of the junction between basal body and cilium. At this place the clear space is wider than the remainder which surrounds the shaft. Generally, the cilia appeared close to a centriole.

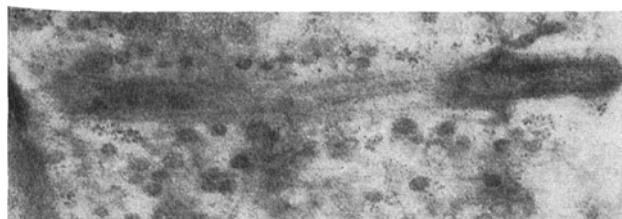
In the ultra-thin sections and small cellular areas observed with the electron microscope, a quantitative estimation of the abundance of cilia in the uterine smooth

¹ S. SOROKIN, J. Cell Biol. 15, 363 (1962).

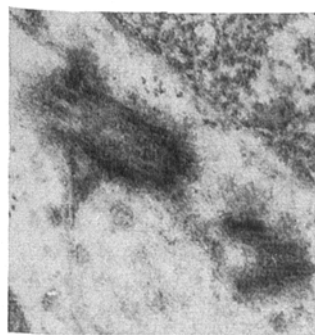
muscle cells appears unreliable. However, a numerical evaluation could be performed if the frequency of their appearance is compared with that of a structure which presumably occurs in all smooth muscle cells, such as the centriole. Accordingly, a systematic survey was performed at random in over 1200 sections, and every time

a centriole or a cilium appeared, it was photographically recorded. The results of this count are summarized in the Table. Although no statistical methods have been employed, it can be assumed that cilia appear at least as frequently as centrioles. Our results are highly suggestive of each smooth muscle cell having at least one cilium.

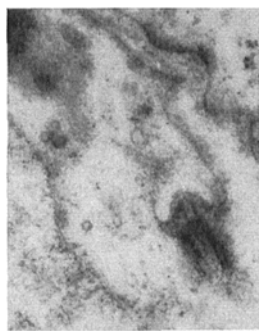
Single cilia	42
Single centriole	37
Cilia associated with centriole	39



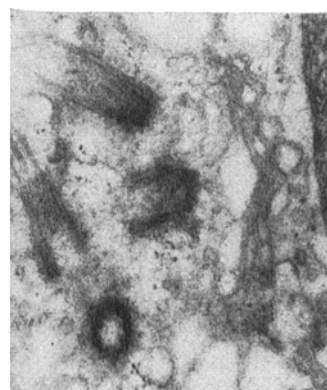
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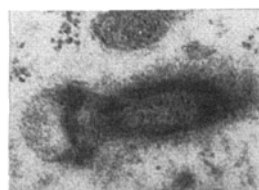
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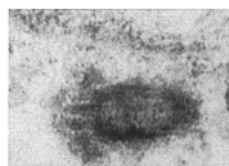
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Fig. 1. Cilium with a long shaft. The clear space surrounding the cilium appears wider at the level of the junction between basal body and cilium. $\times 32500$.

Fig. 2. Cilium and associated centriole. A part of the cilium protrudes into the intercellular space. $\times 43000$.

Fig. 3. Cilium with a small shaft budding into a clear space limited by a membrane which appears continuous with the plasma membrane. $\times 32500$.

Fig. 4. Two cilia with associated centrioles. $\times 32500$.

Fig. 5. Basal body and small shaft protruding into a clear space. $\times 43000$.

Fig. 6. Basal body with small bud. No definite clear space can be seen. $\times 43000$.

Cilia lacking the two central filaments have been reported in fibroblasts and smooth muscle cells¹, in parenchymal cells of the adenohypophysis², in the islets of Langerhans³, in neurosecretory neurons⁴ and in Schwann cells⁵. The significance of the appearance of cilia which lack the axial filaments in cells where they have not been suspected before is at present only speculative. BARNES² and MUNGER³ suggested that they might perform a sensory function, based on the similarity with the 9+0 pattern of cilia associated with photoreceptor structures. But, as SOROKIN¹ and GRILLO and PALAY⁶ have pointed out, there are no fundamental reasons for assigning such a function to cilia which lack the axial filaments. However, the fact that most of the smooth muscle cilia appear intracellular, and that when they protrude from the cell surface they are surrounded by a semi-solid intercellular matrix, makes it difficult to assign to them a motile function.

Although no definitive evidence exists, it is tempting to speculate that in smooth muscle the cilia might perform a sensory function acting as the receptors of the contractile stimulus. This would be supported by the fact that in smooth muscle the conduction of the contraction stimulus is performed through the plasma membrane of adjacent cells⁶. In this way the cilia could be structures capable of carrying the contraction stimulus to the cell's interior.

However, we think that, despite their frequency, the possibility cannot be discarded that the occurrence of cilia in the uterine smooth muscle cells of the rat represents anomalies of development or vestiges of the ciliated cells of the Müllerian duct.

Zusammenfassung. Das Auftreten von Cilien der glatten Muskelzellen des Rattenuterus wird beschrieben. Auf Grund der Häufigkeit dieser Cilien im Vergleich zu den Zentralkörperchen wird angenommen, dass jede glatte Muskelzelle wenigstens eine Cilie besitzt, die eine Sinnesfunktion erfüllen könnte.

R. LAGUENS

Comision de Investigación Científica de la Provincia de Buenos Aires, La Plata (Argentina), January 17, 1964.

² B. G. BARNES, J. Ultrastruct. Res. 5, 453 (1961).

³ B. L. MUNGER, Amer. J. Anat. 103, 275 (1958).

⁴ S. L. PALAY, Anat. Rec. 139, 262 (1961).

⁵ M. A. GRILLO and S. L. PALAY, J. Cell Biol. 16, 430 (1963).

⁶ G. BURNSTOCK and C. L. PROSSER, Amer. J. Physiol. 199, 553 (1960).