

equivalent d-c drift is 5 mv/hr (maximum) and the temperature coefficient of d-c output voltage is 1 mv per degree Celsius. A negative capacitance circuit is provided which improves the overall frequency response of the amplifier but unavoidably adds noise to the input signal if large stray capacitances are compensated. Signals of 40 μ v through 7 Mohm (microelectrode in saline) can be faithfully reproduced.

The amplifier has been tested in physiological experiments in which microelectrodes (0.5 to 3 μ) were used to record resting and action potentials (extracellular) from neurons in frog spinal cord, chicken cerebellum, isolated monkey brain (2), and nerve fibers in vitro. The IGFET amplifier gave consistently better overall results than a variety of commercial electrometer amplifiers (vacuum tube and transistor types) that were used to make the same measurements.

Many other applications for this device and simple associated circuits have already been found. I believe the unusual features of this amplifier make it suitable for routine use in many types of research; it seems to answer the needs of large laboratory instruction classes where 10 to 20 amplifiers are needed and the cost of commercial devices is prohibitive.

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25 July 1966

"Neutral Hydrogen Survey of Andromeda Galaxy": Addendum

Edward Argyle (1) has called our attention to the fact that van de Hulst, Raimond, and van Woerden (2) postulated the existence of a neutral hydrogen ring in M31 in their article published in 1957. We regret that we (3) did not point this out in our report. Their inference, however, was based on peaks found along only a single axis through the ring. Roberts' survey (4) was the first to be made, in a nearly continuous manner over much of the galaxy with sufficiently high resolution, to demonstrate clearly this ring struc-

ture and the marked deficiency of neutral hydrogen inside. Our survey (3) confirmed this result and was the first to delineate the ring completely around the nucleus.

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22 August 1966

Phyletic Position of Tree Shrews

Although much of the recent evidence on the taxonomic position of the tree shrew argues strongly against including the Tupaiodea in the Lemuriformes, the new findings still fail to establish whether or not the tree shrews are closer phyletically to Primates than to any other extant mammalian group. If the Tupaiodea diverged from the Primates very early in the evolution of the Primates, the tupaiids would show hardly any more affinities to the recent groups in the rest of the Primates than to the extant members of any other mammalian order. The data reviewed by Campbell (1) emphasize the distinctiveness of the tupaiids rather than their relatedness to either primate or insectivore types.

Campbell suggests that the extensive visual system in tree shrews and primates may have resulted from convergent evolution. It is of interest that serological studies on primate lens proteins reveal pronounced affinities among loroid, tarsier, and higher primate lenses. However, these studies demonstrate divergence of tree shrew lens proteins from those of primates comparable to that between lens proteins of non-primates and primates (2).

The serological data on serum proteins, gathered since the Burg Wartenstein conference on Classification and Human Evolution, further emphasize the distinctiveness of the tupaiids. Antiserums produced in rabbits to hedgehog serum and to tree shrew serum, while yielding strong homologous reactions, yield very weak reciprocal cross-reactions and unlike the chicken

antisera fail to detect any special correspondence between tupaiids and erinaceoids. Indeed, the precipitins to albumin in the antiserum to tree shrew serum develop larger cross-reactions with human albumin than with hedgehog albumin and the other nonprimate albumins tested (3). Thus the original data (4) obtained with chicken and rabbit antisera to human albumin, and confirmed by Hafleigh and Williams (5) suggesting that *Tupaia* has serum albumin more like that of primates than insectivores, is now directly demonstrated.

The data of Dr. B. H. Hoyer, cited by Campbell, on the homologies of polynucleotide sequences as judged by competition of various primate and nonprimate DNA fragments with those of humans are compatible with the possibility that the Tupaiodea branched off from the base of the Primates. If they did, they should not be expected to show much more relatedness to man than would the nonprimate mammals. Thus the value of 28 percent competition for tree shrew DNA compared to 20 percent for nonprimate mammalian DNA's might prove to be highly significant.

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References and Notes

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4. M. Goodman, *Human Biol.* **34**, 104 (1962); *Ann. N.Y. Acad. Sci.* **102**, 219 (1962).
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29 July 1966

Surveyor I Location

By attempting to correlate the positions of summits of lunar hills, situated beyond the horizon of Surveyor I, with features given on the Aeronautical Chart and Information Center map of the area, Jaffe *et al.* (1) derive a loca-

Table 1. Surveyor landing sites.

Derived from	Site	
	South latitude (deg)	West longitude (deg)
Photo correlation	2.57 \pm 0.02	43.34 \pm 0.02
Tracking data	2.49	43.32