advantages as accessibility, readily obtained power, good seeing, etc., in order to locate in a region where advantage in lack of clouds is probably spurious.

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DR. HESS has suggested—and given reasons for—the interesting possibility that the spatial distribution of nocturnal cloudiness may be quite different from that of daytime cloudiness. This is an important point that should be, and will be, investigated further. The most successful method of attack would seem to be to analyze only the cloudiness data taken at night at those times when the moon was above the horizon. Thin clouds, if present in an otherwise clear sky, should be visible at such times.

The limitations of the immediately available meteorological data that I had to use were acutely in mind when I wrote the paper, and, of necessity, my conclusion concerning the superiority of the Yuma region as the site for a photoelectric observatory was a qualified conclusion that needs further testing. Its superiority *seemed* to be so pronounced, however, that it was felt to be worth while to call attention to it in print, if only as the first approximation. If it turns out that the *nocturnal* cloudiness is about the same over a *large* area of the Southwest, the question of good seeing undoubtedly would be paramount. With a wider area to choose from, a better and more accessible site might perhaps be located.

The other points that I made in my paper seem to need no qualifications: namely, (1) that photoelectric photometry has become of fundamental importance in modern astrophysical research, (2) that the climatological requirements are different for it than for other types of astronomical observational routines, (3) that there is a widespread need among Midwestern and Eastern astronomers for photoelectric research opportunities in an excellent climate, and (4) that such an observatory could be established at a fraction of the cost of a very large reflector.

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The Aeropause

THE upper boundary of the atmosphere is commonly identified with that region of the exosphere where the uppermost geophysical phenomena—namely, the highest auroras—are occasionally observed. In terms of this concept the limit of the atmosphere is located at about 1000 km above the surface of the earth. The peak of the highest rocket trajectory attained so far—400 km—lies within the boundaries of the atmosphere. For all practical purposes of rocket engineering, however, the atmosphere ceases to exist at an altitude of 180–200 km. Unmanned rocket craft are routinely reaching beyond the physically effective regions of the atmosphere, and manned flights into the border region of the atmosphere and, eventually, space must be considered a definite possibility. Consequently, a new concept of the borders of the atmosphere seems necessary. This concept should be based on the functions which the atmosphere fulfills for man and craft, such as supplying breathing oxygen or aerodynamic lift and drag. A functional border between atmosphere and space is defined as that level at which the atmosphere fails as a supporting medium, and space-equivalent conditions begin. Depending on the particular kind of function, the corresponding limit is located at a certain altitude. From this point of view the following functional borders can be listed:

	Function	Altitude (km)
1.	Contributing to respiration	16
2.	Preventing boiling of body fluids	19
3.	Sustaining combustion of fuel	21–23
4.	Absorbing heavy primaries of cosmic radiation	21–36
5.	Absorbing solar ultraviolet between 210 and 300 mμ (Hartley band of O_3)	35–45
6.	Supplying aerodynamic lift	80–110
7.	Supplying diffuse daylight	100–140
8.	Absorbing meteors	110–150
9.	Interacting thermally with the craft (compression and friction heating)	160–180
10.	Interfering by air drag over long periods of time (permanence of satellite orbit)	200

In addition to these data it may be mentioned that the presence of ozone above the 13-km level can result in toxic concentrations of this gas in the cabin air, if the pressurization of the cabin is maintained by compressing ambient air.

Of course the borders so defined are more or less extended regions. Especially are the functions mentioned under 6, 9, and 10 dependent on the velocity of the craft, and the altitude data given are related to a velocity of the order of 8 km-sec. This velocity must be attained in order to establish a craft in a permanent satellite orbit around the planet. Above an altitude of 200 km there are only three factors of terrestrial origin that make the environment of the craft and its crew different from that found at any other point in interplanetary space: (1) the bulk of the earth, which shields off half the number of meteors and cosmic ray particles; (2) the magnetic field of the earth, which deflects cosmic ray particles below a certain magnetic rigidity, if they approach the earth in or near the equatorial plane; (3) the radiation reflected and emitted by the earth and its atmosphere.

The problems that arise in the operation of manned vehicles at very high altitudes and eventually in free space are of an extremely diverse and complex nature. Their solution requires contributions from meteorology, geophysics, astronomy and astrophysics, cosmic ray physics, aerodynamics, radiobiology, physiology, aviation medicine, general medicine, bioclimatology, and human engineering.

Owing to the many different fields involved, semantic difficulties must be anticipated; particularly, the term "upper atmosphere" is misleading, since it conveys different meanings in the various fields such as meteorology, geophysics, and aviation medicine. For the common benefit it appears expedient to coin a new term for designating the regions of the atmosphere where—in terms of manned rocket flight—the conditions of conventional aviation blend into those of actual space flight. To this end the term "aeropause" is suggested. The aeropause is defined as that region of the atmosphere where its various functions for man and craft begin to cease and space-equivalent conditions are gradually approached. The concept of the aeropause appears to be quite useful in modern aviation; it circumscribes the area characterized by certain factors of environment that are distinctly different from those found in the area of conventional aviation or of space. The aeropause encompasses approximately the region between the 20- and 200-km levels.

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Lipochondria of Living Nerve Cells

IN A recent letter to *Nature* A. J. Dalton (*1*) reports the identification of the Golgi apparatus in mammalian duodenal and liver cells by the aid of the electron microscope following their fixation and sectioning. Similarly, there has been a recent tendency to report observations of the Golgi apparatus in fixed tissues after examination with the phase-contrast microscope (*2–5*). Of the authors mentioned, Barer alone was careful to point out that, although use was made of a new observational technique, fixation artifact remained in the tissues under examination.

After a cell is killed and fixed with chemical substances, then dehydrated, embedded in wax, and sectioned, it would seem that delicate intracellular structures must inevitably be distorted to some degree, with the possible production of artifacts. Whether we then stain these sections with dyes in order to render their details visible with the ordinary microscope or, instead, view the unstained sections with the electron or phase-contrast microscope seems unimportant, since the basic objection—the possibility of fixation artifacts—remains.

Clearly, the enigma of the Golgi apparatus can only be resolved by reference to the living cell. It is unfortunate that the electron microscope cannot be used for the study of living tissues, and in this respect Dalton's observations are necessarily limited. On the other hand, the phase microscope can and has been used in an attempt to see the Golgi apparatus in freshly isolated cells suspended in indifferent media (*6–9*).

Since 1946 the writer has been concerned with the phase microscopy of nerve cells of both vertebrates and invertebrates. Ever since Golgi's original observations on the Purkinje cells of the owl, the neuron has remained the classical site for the study of the internal reticulum. Here one can observe a large, elaborate Golgi apparatus, provided one kills and fixes the cells by means of appropriate technical methods. However, intensive study with the phase microscope has failed to reveal anything corresponding to the elaborate internal reticulum in living neurons. Instead, these studies have provided strong confirmation of the existence in the living nerve cell of the bodies described by John R. Baker, of Oxford, in 1944 and since named by him "lipochondria." These bodies are clearly distinguished by their reactions to vital dyes and can be readily observed by any person possessing a compound microscope, suitable dyes, and slides and needles for teasing tissues.

As the classical Golgi apparatus fails to reveal itself in living cells, it is tempting to assume that the lipochondria form part of the living counterpart to the "apparatus" of the dead and treated cell. This suggestion is strengthened by the knowledge that the lipochondria are osmiophilic, and it seems very likely that they act together with the mitochondria as centers, or foci, for the netlike nonspecific deposition of osmium and silver within the fixed cell during the prolonged immersion of the tissues in the impregnating fluids (*8*).

Much work remains to be done on this fascinating problem, but it is questionable whether any real advance in cytoplasmic cytology is likely to come from the employment of methods such as those of Dalton and Gatenby. The fixed preparation is seldom more than a caricature of the living cell, and it does not matter much how we view it—whether by the ordinary microscope or by the electron microscope. We must study living cells instead of searching with new tools in the wreckage of the cell following death and dehydration. The fresh and novel approach to cytology that has come from Baker's laboratory has already produced many new facts concerning cell organellae and promises to continue to do so. The time may well come when the Golgi apparatus will be discussed merely as an interesting reaction that can occur in a cell when it is subjected to certain chemical and physical conditions.

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