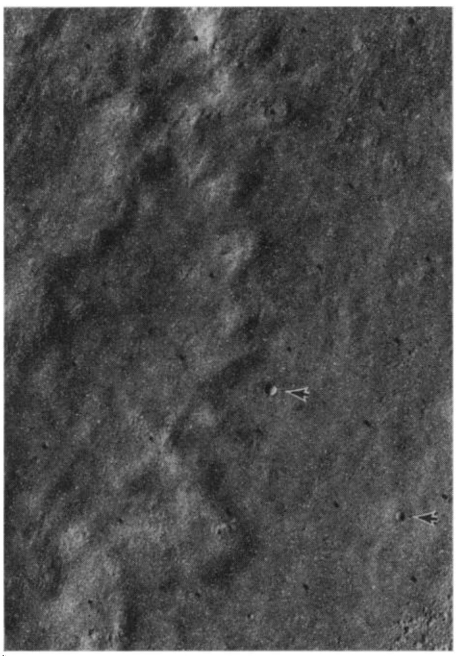
Letters

Dome or Crater?

In the report "Dust devils on Mars" (11 Oct, p. 175), images A and B on page 175 show two features identified as craters. I think, however, that the object in the lower right of the images is a dome. Illuminated from the left a concave structure is brighter on the right side. This is true for the central topographic feature, which is evidently a crater, but not for the feature on the lower right, which is brighter on the left side.



A dome found on a flat plain on which transitory vertical columns have been identified has interesting implications (*1*). The dome could have been formed by volcanic venting, and the presence of vertical columns may indicate that venting may be ongoing. One or more of the objects identified as dust devils may be caused by venting.

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REFERENCES

1. B. Murray, *Earthlike Planets: Surfaces of Mercury, Venus, Earth, Moon, Mars* (Freeman, San Francisco, 1981), pp. 178–179; 292–304; 331.

Response: We appreciate Breckenridge's comment. The figure caption, of course, should have read "features," not craters. We did consider venting, but we think that is not what is represented in the images for these reasons: (i) The clouds (dust devils) specifically do not correlate with positive relief features or with any other possible indications of vents. (ii) The plains, although probably originally of volcanic origin, have since undergone a great deal of sedimentation and erosion. Many positive relief forms in this area, and much of Mars, are of erosional origin. (iii) The impact crater density in this area is such that the plains appear to have been inactive for substantial amounts of geologic time. (iv) Many of the clouds occur on material clearly of nonvolcanic origin, such as crater ejecta blankets.

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Dragonfly Aerodynamics

The aerodynamics of dragonflies, discussed by C. Somps and M. Luttges (14 June, p. 1326), present an intriguing problem. I share the authors' conviction that an understanding of unsteady aerodynamics is essential for an understanding of insect flight. I also agree that dragonflies may use nonconventional mechanisms for producing lift.

Although Somps and Luttges mention the profound influence tethering an insect may have on the resulting flows, they do not emphasize this point. Because of the absence of a free-stream velocity and the imposition of an external force (acting through the mounting apparatus), the aerodynamics of the flight of a tethered animal differ greatly from those of a freely flying animal, even if the wing kinematics are exactly the same. This external force, due to the tethering, changes the balance of forces on the insect and hence the resulting flow pattern.

Although the flow conditions and resulting aerodynamic forces may be of interest in themselves, they do not reflect a normal operation in nature. For freely flying (at constant speed) or hovering insects, the mean aerodynamic lift must be equal to the animal's weight while the mean force in the direction of motion must be zero.

With this caveat in mind, I encourage the type of investigation mentioned in this report into new mechanisms of insect flight. I also believe that new and perhaps more interesting unsteady aerodynamics may be occurring in the case of freely flying insects (*1*). After all, insect flight evolved to operate most commonly in this unrestrained mode.

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REFERENCES

1. C. P. Ellington, *Philos. Trans. R. Soc. London Ser. B.* 305, 1 (1984).

Response: Although most insect flight modes have indeed evolved to serve the aerodynamic needs of freely flying insects, an effective means of escape, especially from conditions of being physically restrained, must have evolved as well. In eliciting flight episodes from tethered dragonflies, we were able to measure very high instantaneous lift forces. Such lift forces most likely reflect an escape type of flight mode. As such, the associated aerodynamic mechanisms are not necessarily less natural (or for that matter less interesting) than those associated with more frequently used flight modes. Also, flight characteristics of mating dragonflies attest to the robust nature of underlying lift-producing mechanisms.

As Yates argues, the more common flight patterns, such as hovering or fast forward flight, may be based upon different flow-wing interactions from those described for tethered flight. However, the extent to which these flows differ may not be as great as Yates suggests.

Recently, we have begun force balance and flow visualization studies on dragonflies tethered in a wind tunnel. Suprisingly, force balance measures and flow-wing interactions corroborate results obtained previously in the absence of a significant free-stream velocity. Furthermore, the correlation of flow field, wing, and force measures appears to be largely independent of free-stream velocities up to 10 feet per second.

As indicated in our original report, the dragonfly appears to use very energetic, unsteady, separated flows in support of lift-producing mechanisms. We should not exclude the possibility that such mechanisms operate independently of the free-stream velocity. Whether or not the inertial reaction between the wings and the fluid preclude a different flow pattern is not clear. However, the fact that flow patterns and high lift remain constant with changes in free-stream velocity may indicate that the basic force producing effects for dragonfly flight have been revealed. We agree with Yates that much remains to be done.

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Erratum: In an article by Colin Norman on research on AIDS vaccines, "AIDS virus presents moving target" (News and Comment, 20 Dec., p. 1357), it was stated that the official goal for getting a vaccine ready for general use has been put back to 2000. The plan, drawn up by the Department of Health and Human Services, in fact sets the goal of "eliminating transmission of HTLV-III infection" by 2000 and assumes that "It is unlikely that a vaccine or therapy to substantially limit transmission will be generally available before 1990."