Paleozoic Foraminifers

Drake (*1*) notes that deep-sea drillings by the *Glomar Challenger* showed the existence of oceanic Jurassic sediments with a considerable thickness of older sediments beneath. He suggests that studies of pre-Cretaceous radiolarians need to be advanced because these are known from the Paleozoic record, but that coccoliths and foraminifers are not known prior to the Jurassic. While the presence of coccoliths in the Paleozoic is questionable (*2*), the use of foraminifers as Paleozoic index fossils has long been established.

Well-preserved forams have been found in Ordovician, Silurian, and Devonian rocks (Kerionammina, Bifurcammina, and Semitextularia); *Endothyra baileyii* is present in astronomically large quantities in the middle Mississippian; and the fusulinids are among the most important indices for Pennsylvanian and Permian strata (see *3*).

While radiolarian studies might add another dimension to the understanding of pre-Jurassic abyssal sediments, there are already plenty of known Paleozoic microfossils which could aid in deciphering the oceanic stratigraphy.

JULIAN KANE
JANICE GARRISON, JANE WYTZKA
Garden City Senior High School, Garden City, New York 11530

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Marihuana Effects amid Great Expectations

Weil *et al.* in their pioneering double-blind study of marihuana effects on naive subjects (*1*) report that most subjects were able to guess whether they had received placebo or marihuana cigarettes. This distinguishing between placebo and marihuana in a double-blind experiment ought to mean that subjects could perceive effects of the drug contained in the experimental cigarettes. However, the experiment reported did not entirely rule out the possibility that cues for distinguishing placebo from marihuana came not from effects of the drug but from differences in the taste of the cigarettes.

I read the contents of the experimental and placebo cigarettes used by Weil *et al.* as follows: placebo: hemp stalks, tobacco, mint; low dose: 0.25 g marihuana, tobacco, mint; high dose: 1.0 g marihuana, mint.

Weil *et al.* do not specify the quantities of tobacco filler or mint, but difference in taste between the high dose and either low dose or placebo is reported by their subjects. Perhaps smaller taste differences existed between low dose and placebo. Minimizing taste differences among cigarettes might be better accomplished by keeping both tobacco and mint fractions constant for all cigarettes, varying only the relative amounts of marihuana and hemp stalks in a constant fraction of cigarette content.

More importantly, even if subjects distinguished marihuana from placebo only on the basis of physiological effect, the fact of the discrimination bears on the interpretation of the study. A subject who receives marihuana and who perceives that he has received marihuana is a subject whose behavior will be determined, not only by the dosage-dependent physiological state, but by expectations attendant upon seeing the state as caused by marihuana. Thus, naive subjects of Weil *et al.* had previously avoided marihuana in part because they expected nonpositive effects from the drug. In accord with their expectations, naive subjects experienced no highs and produced deficits of attention and performance. The single naive subject who experienced a high had expressed eagerness to get high. On the other hand, the chronic users expected highs and were further set to demonstrate that marihuana did not decrement performance for such tasks as driving. Again in accord with expectations, chronic users showed consistent highs and no impairment, or even improvement, on performance tests.

The results seem consistent with the view that a marihuana-determined physiological state becomes the occasion of important effects of learned expectations and sets. In a culture permeated with debate over the merits of marihuana, even naive subjects will have expectations about marihuana effects; naiveté indicates only that the expectations are likely to be predominantly negative. As long as subjects can discriminate placebo from marihuana on any basis, the effects of marihuana on performance cannot be easily untangled from the web of marihuana *plus* expectations actually observed on performance tests.

CLARK R. MCCAULEY
Department of Psychology, University of Pennsylvania, Philadelphia

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I agree that the effects of marihuana are not easily untangled from expectations and that placebo studies are difficult. The real problem is not with naive subjects, however. In our study, all cigarettes contained the same amount of mint, and the placebo and low-dose cigarettes contained the same amount of tobacco. The naive subjects did not make a decision about what they thought they had smoked until after the tests were completed and then they had to think about it. I watched them fill out their questionnaires, and most did not find it easy to decide. Therefore, I do not think their performance on the tests was significantly influenced at the time by any assumptions as to what they had smoked—at least no more so than in any other placebo study.

The main difficulty is the use of placebos with subjects who smoke marihuana regularly. Since the administration of the drug takes time and since users are accustomed to judging quality of the drug during administration by the rapidity of onset and intensity of symptoms, a conventional placebo is unworkable. These subjects may accept a placebo cigarette as marihuana if the taste is close, but they will quickly decide that it is "worthless" marihuana.

Despite all these problems, it is still possible to draw reasonable conclusions from our experiments. For instance, regardless of the set of user subjects, the experiment showed that they *were* able to compensate fully for whatever marihuana does to brain function—at least on the tests we used.

ANDREW T. WEIL
Mount Zion Hospital and Medical Center, San Francisco, California

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