only a small minority of approximately 20 experiments described are likely to be capable of making a positive identification of the most favored particle candidate.

Currently, the only theory that predicts a new weakly interacting massive particle and provides estimates of its range of mass and interaction rates is supersymmetry. The experimental challenge is to differentiate—to a precision of 0.1% to 1%—between low energy nuclear-recoil events from dark matter interactions and background electron-recoil events from gamma and beta decay. Only two of the techniques mentioned in the article appear to have such capability. One is the Ge detector of the Cryogenic Dark Matter Search (CDMS) collaboration, which simultaneously measures both thermal energy and ionization. The other is the planned liquid-xenon detector (the U.K. Dark Matter Collaboration—a University of California, Los Angeles–U.K. collaboration), which will simultaneously measure both scintillation and ionization.

It is likely that larger detectors with even more powerful discrimination will be needed to prove conclusively the existence of WIMP dark matter. While this is a daunting task, the discovery of supersymmetric particles in the galactic dark matter could bring particle physics back to the realm of "small" experiments—analogous to the birth of particle physics in the early cosmic-ray studies.

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Biology Department Splits

I was less than astounded to read of the sundering of Yale University's biology department along "levels of analysis" (W. Roush, News & Comment, 14 Mar., p. 1556), as the tensions that led to the split were already evident in the late 1970s and early 1980s, when I was a graduate student there. Graduate students always feel ill used—it is a crucial part of the graduate experience—but in our case [firmly planted in what would now be the Department of Ecology and Evolutionary Biology (EEB)], we were convinced that the molecular-cellular graduate students were getting better stipends and other privileges. Our faculty may have felt the stresses about hiring and publications alluded to in the article, but we were not privy to them.

The good news about the split for everyone is that interdepartmental collaboration is feasible, at least for graduate students: I interacted much more with members of the Department of Geology and Geophysics than with the suborganismal wing of the Department of Biology. I hope, in addition, that the new EEB department will do well with its increased sovereignty.

The bad news, as the article points out, is the disservice done to undergraduate education. Unless Yale has changed immeasurably since my days there, the vast majority of the majors in molecular, cellular, and developmental biology intend to enter the health professions. It is difficult to imagine a student adequately prepared for medical study who has never taken a course in comparative anatomy or physiology, which I assume would be the province of the EEB department (although, in fact, organismal biology seems to fall obviously into neither camp). On the other hand, EEB undergraduates who have also succumbed to the pre-med siren song would presumably be lacking a foundation in the molecular mechanisms of disease.

I hope that a wise spirit prevails at Yale and at other universities who will counsel undergraduate majors in any area of biology to take the classes they need to understand the full sweep of life, regardless of current or future departmental boundaries.

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Honeybee Thermoregulation

In the report "Achievement of thermal stability by variation of heat production in flying honeybees" (4 Oct., p. 88), Jon F. Harrison *et al.* conclude that "variation in heat production may be the primary mechanism for achieving thermal stability in flying honeybees, and this mechanism may occur commonly in endothermic insects." Their conclusions are based on results derived from bees said to be in "high-intensity, agitated flight." It is difficult to achieve uninterrupted flight in a confined space (*1*). We and others (*2*), have long wrestled with this problem. Harrison refers to "agitated flight" (presumably by shaking the vessel so bees would remain airborne) or "undisturbed hovering." We doubt that "agitated flight" represents "high-intensity flight." Given the experimental conditions, it is likely that bees interrupted their flights frequently for several hundred milliseconds at a time. At low ambient temperatures, they would have shivered during interruptions, elevating apparent metabolism during flight.

We observed bees flying without interruption in a wind tunnel (*3*), with realistic lifts and thrusts only at wind speeds of several meters per second and with optical patterns simulating appropriate ground speeds. We observed only short bursts of flight when the bees' thorax temperatures were between 36° and 40°C. Bees shivered between flights at ambient temperatures below 35°C. Above 35°C, their muscle potentials (and active energy expenditure) stopped completely during flight interruptions.

Hovering flights could only have lasted for a few seconds in the small vessels used by Harrison *et al.* Muscle activity before and after the short hovering bouts must have affected the measurements, even when the flow rates of air through the respiratory vessels were fast.

Variation of heat loss and heat production are, of course, not mutually exclusive. However, the data presented by Harrison *et al.* do not show regulation of heat production for thermoregulation during flight.

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Harrison *et al.* find an inverse relation between metabolic rate and ambient temperature for both agitated and undisturbed honeybees in flight. They conclude that honeybees may accomplish thermoregulation primarily by varying heat production. These findings are not consistent with those of several other laboratories. Also, there appears to be internal inconsistency in the reported data.