

letters

when action is taken to restore balance *does not* contribute to regaining balance, but that some other mechanism is responsible, such as a change in body configuration or a subtle movement of the point of support at the floor.

Physicists will agree with Newton that if there is no unbalanced force acting on a body at rest, no manipulations of the body can change the location of the center of mass. Further, if there is an unbalanced force on the body, the center of mass must be accelerated. If a horizontal force on the body from the floor is the only horizontal force acting on the body, then the center of mass *must* be moved. Suppose the center of mass is initially displaced to the right of the vertical axis through the point of support at the floor, creating an unbalanced situation. Appropriate manipulations of the body will create a net horizontal force on the feet toward the left, which, being the only horizontal force acting on the body, will move the center of mass back toward the balanced condition.

Lam claims that because the force from the floor acts through the pivot point, it cannot create a torque around that pivot point and therefore the position of the center of mass is unaffected. Further analysis shows that the center of mass may be displaced even though the torque around the pivot point is zero. Such is the subtlety of dealing with rotations of nonrigid bodies!

Consider an example in which the center of mass of a dancer almost in balance on one foot lies to the right of a vertical axis through the support at the floor. When the upper body bends rapidly toward the right, the feet tend to move toward the right but are prevented from slipping by the friction force from the floor acting to the left on the feet. The clockwise motion of the upper body represents a clockwise contribution to the total angular momentum around the pivot point on the floor. Other parts of the body will be accelerated in a counterclockwise direction around the pivot, so that the total angular momentum of the body around the pivot remains zero. Because the rotating upper body is farther from the pivot axis than is the center of mass, the net result will be that the center of mass actually moves to the left (a counterclockwise rotation around the pivot) without ever creating a nonzero net angular momentum around the pivot point. Of course there is a net angular momentum around the center of mass, but we know that the angular momentum depends on the choice of rotation axis.

Dancers and others who have experimented with their own body motions

will readily report that it is possible to regain or to lose balance while the point of support at the floor does not move. Many observed dance movements, such as a *tombé* or a multiple-turn *pirouette* on balance, would otherwise be quite impossible!

KENNETH LAWS

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7/85

Identifying 'the first'

I wish to echo Manuel Cardona's complaint about the practice of stating that a calculation or experiment is "the first" (December, page 9). Physics is a symphony, not a brass band with everyone blowing his own horn.

This is the second time that a complaint on this matter has been reported, but it is the first time anyone has reported that it was the second time that a complaint on this matter has been reported.

The author has additional reports in progress.

JAY KANGEL

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12/85

Educating teachers

Your editorial of January 1985 (page 160) focused upon the need to improve science education but did not discuss the quality of ideals and instruction within American graduate schools.

If we see smoke, we trace it to find the fire. Why then don't we trace poor science teaching back to inappropriate ideals and training in our graduate schools? It is because professors in our graduate schools profess impersonal ideals that misdirect our attention to shield themselves from being exposed as not facilitating learning!

In a letter in *PHYSICS TODAY* (January 1983, page 116) I asked readers for information pointing to any graduate physics department that was genuinely dedicated to preparing physics graduate students to fulfill their future instructional responsibilities as professors of physics in colleges and universities. I have not yet heard of any. There apparently are none! A recent article makes¹ a related comment about our American training of high-school physics teachers.

It is no wonder that personable, bright science students of all ages are "turned off" by impersonal science teachers. Sensitive students rarely survive impersonal science teachers later to become science professors with integrity.

Research scientists' impersonal ideals trickle down through our whole

science-education system. Teaching professors guided by these impersonal research ideals systematically block the personal information feedback loops that are essential for educating professors in the personal dynamics of learning and failure. We don't need better technologies or larger commitments of resources to impersonal ideals. We need instead more personable ideals that can unite us into a global community with both personal and communal integrity.

Almost all of the writings about the crisis in science education miss the central issue: Unless there is a revolution in the ideals of graduate science professors, we will not resolve our crisis in science education, nor will we survive.

Reference

1. D. Bower, P. Kenealy, *et al.*, *Phys. Teach.* **30**, 6 (1985). See the last paragraphs of the article.

PAUL A. SMITH

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10/85

Gravitational-constant data

During the last few years, I have prepared¹ two versions of a research bibliography on measurements of the Newtonian gravitational constant, G . The measurements indexed in these documents are of the absolute value of G and its variation with respect to time, intermass spacing, test-mass temperature, charge content, state of quantization and so forth. I am preparing to publish updated versions of these bibliographies in *Metrologia* presently, but before doing so I want to be certain that they are as complete as possible. Therefore if anyone reading this has made a measurement of G of one kind or another and has it written up but not published, or published obscurely (as in a technical or industrial report, uncataloged thesis or dissertation, or low-circulation conference report), please send me the appropriate reprints or preprints so that I can reference them.

Reference

1. G. T. Gillies, *The Newtonian Gravitational Constant: An Index of Measurements*, Int. Bureau of Weights and Measures Technical Report, Rapport BIPM-82/9 (July 1982). G. T. Gillies, *The Newtonian Gravitational Constant: An Index of Measurements—1983 Edition*, Int. Bureau of Weights and Measures Technical Report, Rapport BIPM-83/1 (February 1983).

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