

broached, along with the physical and chemical principles of prop, turbo, and pure jet engines. The possibilities go on ad infinitum, and I found that even the flightiest coeds were occasionally able to apply solid science to their subsequent everyday living.

Since it was necessary to use three lecture periods per week, plus a 2-hour discussion-demonstration period under a competent instructor, this parallel with Reif's findings may indicate that any philosophical differences might lie in the fact that Berkeley students have possibly changed!

CHARLES G. DANFORTH
3612 Angelus Avenue,
Glendale, California 91208

Science at Small Colleges

In an attempt to determine the optimum size of the science faculty at a small liberal arts college, I recently obtained data from the academic deans of 20 small, private colleges (1), all carefully selected for their widely accepted excellence in the liberal arts. A summary of my findings follows, presented in the form of an "ideal" college, and based on arithmetic means.

The composite small liberal arts college enrolls 1150 students and has a total faculty (full-time equivalents) of 120, and thus 9.6 students per faculty member. Of the total faculty, 30 (or 25 percent) are scientists (2). The scientific disciplines are divided as follows: mathematics 7.6, biology 7.5, chemistry 6.8, physics (plus astronomy) 6.3, and geology (plus geography) 1.8 (3).

It is my fervent hope that liberal arts colleges continue to maintain vigorous science divisions, particularly so that science offerings for nonmajors can be strengthened and made more attractive. This is particularly urgent for we are not only in a period of diminishing college-wide science course requirements but also in an era in which so many of man's most fundamental problems require scientific literacy in order to be coped with intelligently.

ARTHUR H. WESTING
Department of Biology, Windham
College, Putney, Vermont 05346

References and Notes

1. Percentage of total faculty in science: Amherst, 26; Bowdoin, 26; Carleton, 23; Davidson, 27; Earlham, 30; Hamilton, 23; Haverford, 29; Kenyon, 20; Middlebury, 21; Mt. Holyoke, 20; Pomona, 27; Reed, 27; Swarthmore, 26; Trinity, 25; Union, 35; Wabash, 33; Washing-

ton and Jefferson 30; Wesleyan (Connecticut), 20; Wheaton, 20; and Williams, 22. These colleges are scattered among 12 states; their average age is 170 years; 12 are male, 6 coed, and 2 female.

2. It is interesting that this 25 percent proportion appears to be independent of student enrollment, of student-to-faculty ratio, or of whether the school is coed or all male.
3. There is no geology offered in 8 of the schools; the average for the 12 that do is 2.8.

Campus Signs and Times

Nelson's excellent article on desegregation in state universities (6 June, p. 1155) seems to reveal greater significance in what it leaves unsaid than in what it says. Is the university the place to correct the inequalities of the past, or is remedial action needed in those primary and secondary schools which produce disadvantaged applicants? It just does not make sense to lower the standards to accommodate a very few. This amounts to the debasing of the intellectual currency upon which the excellence of this country is founded.

It is a hard fact to accept but the truth is that there are a large number of blacks and other minorities for whom it is just too late. It's deplorable but it is nevertheless true. Bestowing instant Ph.D.'s will not in any way alter the situation. The place to begin is to take immediate steps to insure that by the time a student reaches university level he or she either is qualified for admission or clearly is not. Starting at the end and working back toward the beginning is a pretty irrational approach.

KENNETH R. COBURN
11110 Luxmanor Road,
Rockville, Maryland 20582

I certainly agree with Wheeler's letter (30 May) when he states: "Personally, I favor the California proposal of fencing off and allowing on campus only faculty and students with identification, except I would enforce a shave, haircut, and louse inspection at the gate."

A standardized uniform should also be required for those allowed on campus. This would permit easy recognition by the guards in their observation towers. Faculty and students would then be free to devote their full time to academic matters and would not be bothered by such annoyances as thinking.

PHILLIP PLATO
School of Public Health, University
of Michigan, Ann Arbor 48104

Pliny's Pheromonic Abortifacients

Montagu (Letters, 21 Mar.) quotes Pliny the Elder (1) and asks what was burned in Roman lamps that caused abortion. I believe the answer is in Pliny. He describes 15 materials reputed to make a pregnant woman abort. All of them work at a little distance or could be prepared as powders or fumes. The following comments on the pheromones are Pliny's (somewhat shortened), given with his book and chapter references:

Sight alone causes the abortion.

1) Female sea-hare. This can be prevented if the woman wears a bracelet containing any part of a male sea-hare, 32:1.

Passing near or stepping over causes abortion.

2) Cyclamen, or sow-bread, 25:9.

3) *Onosma*, 27:12.

4) Menstrual secretions of other women. This also works when smeared on the vulva. Pliny refuses to believe the courtesans, Lais and Elephantis, because they contradict each other about the virtues of colewort, myrtle, or tamarisk quenched (dipped) in menstrual blood, 28:7.

5) A viper, 30:14.

6) A raven's egg, 30:14.

7) The serpent, *Amphisbaena*, if dead—a live one carried by the woman protects her from abortion. However, a dead one preserved in salt insures a safe and easy delivery, 30:14.

8) Castoreum, or stepping over the beaver that bore it. It was enough if the castoreum or beaver was carried over her, 32:10.

Odor or fumes of the substance cause abortion.

9) Galbanum in suffumigation (after onset of premature labor). Or as a cataplasm, or smeared on a pessary of hellebore. Drunk in wine it relieves prolonged labor—drunk in wine with myrrh it causes the extrusion of a dead fetus. Holland notes that according to Dioscorides the galbanum was taken with vinegar rather than wine, 24:5.

10) Dragon. The seeds of this plant induce abortion by their smell. Anointing the vulva with dragon induces abortion according to Diodotus, the physician, 24:16.

11) Fumes, from an "asses house" (donkey's stable?), passing up into a woman's body, 28:19.

Taken in drink or an unspecified manner causes abortion.

12) Cypirus, petie-glader, or sword-grass, 21:18.

13) Warts or lichens from the leg of a horse powdered and drunk in water, 28:19.

14) Slough of a snake. But, when taken with wine and frankincense, it aids labor, 30:14.

15) Sisymbrium. Women going with child must take heed how they eat sisymbrium (cress, thymbraeum, water-mint) unless the fruit of their bodies be dead within them, for if it be but applied outwardly, it will send it forth, 20:22.

Many of these substances might have been put in the flame of an ordinary Roman lamp and used to fumigate a room or a woman. Castoreum was sometimes used with powdered shell-fish (ostracium or onyx—Pliny was not sure what these were), or with perfume as a suffumigant to treat pain in the womb. Galbanum was used regularly as incense and still is. It is one of the ingredients that the Lord directed Moses to put in the incense used before the decrees in the tent of meeting, *Exodus* 30:34-38. Thus, castoreum or galbanum may have been the abortifacient in the smoke of Roman lamps.

For moral reasons Pliny probably has omitted other drugs that abort, 25:3. He asks about "those Greeks": "What color and pretense had they to set down medicines and receipts to cause women to slip the untimely fruit of their womb . . . I am not for them that would send the conception out of the body unnaturally before the due time: they shall learn no such receipts of me, neither will I teach any how to temper an amatorius cup, to draw either men or women into love, it is no part of my profession." Also he would have nothing to do with magic or witchcraft.

If putting out common lamps in the customary way usually induced abortion then there would have been few viable births. Obviously there was something extraordinary about the Roman lamps that induced the abortions or perhaps the account is exaggerated or incomplete. In my opinion, Pliny, in spite of his denial has given items that depend on magic for their operation. Possibly "magic" has changed its meaning over the centuries.

HOWARD MCCULLY

Four Hermosa Place,
Menlo Park, California 94025

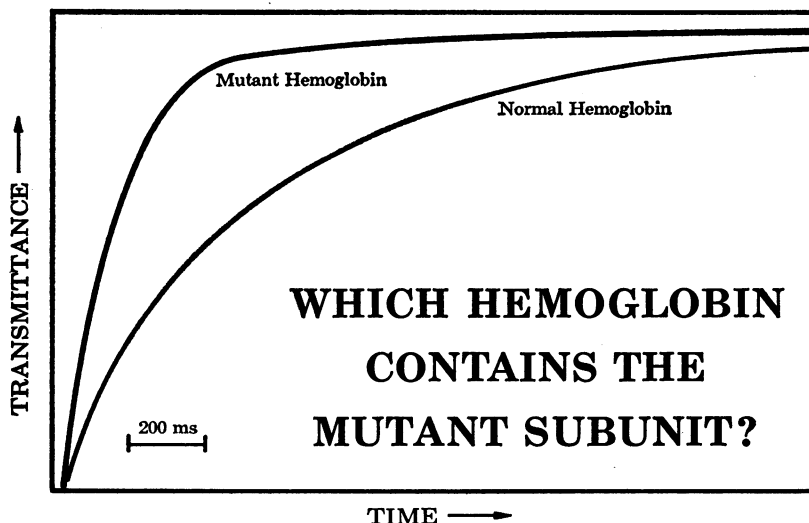
References

1. Gaius Plinius Secundus, *The Historie of the World*, P. Holland, Transl. (Islip, London, 1634, 1635), in two volumes, apparently printed in 1601 except for the title pages.

18 JULY 1969

CHEMICAL PROFILES

... drawn by Durrum

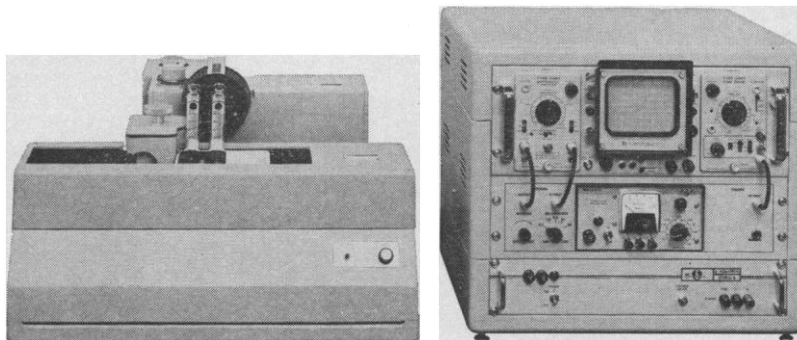


Even a minor molecular rearrangement can have a dramatic effect on chemical activity. These profiles* recorded by a Durrum-Gibson Stopped-Flow Spectrophotometer reveal a 40-fold difference in azide-hemoglobin reaction rates. One reaction is with normal hemoglobin, the other with a mutant containing alpha-chain tyrosine residues in place of the usual proximal histidines.

Equilibrium constants would not have hinted at this difference; only kinetic tests with the Durrum-Gibson instrument permit the use of this new technique for classifying mutant types.

The Stopped-Flow Spectrophotometer is a versatile, general-purpose system that is widely used to determine the kinetic characteristics of reactions with half-times in the 5-millisecond to 50-second range. A temperature-jump accessory is available for studies involving even faster reactions, down to 10 microseconds or less. The accessory is uniquely designed to allow combination T-Jump/stopped-flow studies of pseudo-equilibrium reactions.

For complete information on the D-100 Series Stopped-Flow Spectrophotometer and its applications, contact . . . **Durrum Instrument Corporation, 3950 Fabian Way, Palo Alto, California 94303, Phone (415) 321-6302.**



*AS REPORTED BY HENRY F. EPSTEIN AND LUERT STRYER IN VOLUME 32 (1968) OF THE JOURNAL OF MOLECULAR BIOLOGY.

D DURRUM