eration of a semilogarithmic pH calculator. This yields the term $(pA - pB)$ in place of the usual log B/A; in all subsequent equations or graphs the terms may be used interchangeably. The usage was retained in the second report in formulating two nomograms for glycyl aminotricarballylic acid. If the pH range of the straight lines of Fig. 1 be extended beyond four pH units, the apparent discontinuities noted by Levy do not appear. When, as in the d'Ocagne nomogram (Fig. 2), the pH scale runs from 2 to 10, no breaks occur.

The physicochemical questions concern the number of ionic species required for a given polyelectrolyte. Since each titrable group involves two forms, a proton-donor A and an acceptor B, the number of *mathematically* possible species s is 2^n, where n is the number of titrable groups and pK's. For glycyl aminotricarballylic acid, n is 4 and s is 16. When n is 10, s is 1024; when n is 20, s exceeds 10^6. Proteins may contain 100 or more titrable groups; when n is 100, s is about 10^{30}. This is more than 10^6 moles; if a molecular weight of 10^5 is assumed, the weight is about 10^8 kilograms. Obviously, only an infinitesimal fraction of the mathematically possible species can or should be considered.

The number of equations necessary to represent a complex polyelectrolyte is much nearer to n than to s. For glycine, n is 2 and s is 4. One of these is the uncharged neutral molecule present to the extent of about one molecule in 10^8. The curve requires two equations, relating three ionic species. When n is 4, s is 16. If these are tabulated for glycyl aminotricarballylic acid, 8 or 10 of the 16 forms are found to be of very low probable occurrence, as for example the uncharged neutral molecule. The curve may be described by four pK values relating five ionic species. For higher values of n, s becomes successively 32, 64, 128, and so on. For most purposes the distribution of charge is given by n equations and pK values, relating $(n+1)$ ionic species. A generalized nomogram is derived on this basis.

Levy, apparently well content with algebraic formulations, considers nomograms superfluous. Others, seeking elegance, find nomograms useful and rewarding. In a system containing several polyelectrolytes, algebraic formulations and curvilinear diagrams become inadequate. In biological systems there are large numbers of simultaneous reactions involving not only hydrogen ions but also other cations and anions. There are also numerous oxidation-reduction reactions which depend on pH. Algebraic formulations consist of numerous simultaneous equations. When the number exceeds five or ten, it is difficult for one not using visual aids to coordinate all the simultaneous processes. Geometrical transformation to curved polydimensional surfaces is difficult and does little to clarify the relations. Formulation of the equations as straight lines and construction of nomograms go far toward simplifying these problems. This is a well-established procedure in many branches of science. At certain levels of complexity two-dimensional linear nomograms become preferable not only to alegbraic formulations but also to curved polydimensional surfaces or their projections.

I find no statement in either of my reports asserting nonexistent advantages over standard methods. In the second, the entire emphasis was placed on the construction of a simple linear d'Ocagne nomogram illustrative of general methods for complex problems. By these methods diagrams based on three rectangular coordinates are easily transformed to nomograms with three or more parallel coordinates.

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New Products

The information reported here is obtained from manufacturers and from other sources considered to be reliable, and it reflects the claims of the manufacturer or other source. Neither Science *nor the writer assumes responsibility for the accuracy of the information. A coupon for use in making inquiries concerning the items listed appears on page 518.*

■ TRIAXIAL ACCELEROMETER has three piezoelectric sensing elements in mutually perpendicular planes within a 5/8-in.^{3} block weighing 1.4 oz. First resonance frequency is 30 kcy/sec. Sensitivity is 5 mv/g. Dynamic range is 1000 g, and transverse sensitivity is less than 5 percent. Temperature range is $-65°$ to $+220°$F with maximum sensitivity change ± 10 percent. Frequency response is 2000 cy/sec ± 5 percent with a 1000 megohm load. (Endevco, Dept. 9)

■ BAND-ELIMINATION FILTER is designed to reject any frequency between 20 and 20,000 cy/sec and to pass other frequencies between d-c and 100 kcy/sec. A direct-reading dial tunes over the full range. Input and output impedances are 600 ohm. Dynamic range is more than 120 db, and the rejected frequency is reduced by more than 40 db over most of the range. The filter is a passive circuit requiring no power supply. (Allison Labs., Dept. 12)

■ COLORIMETER ACCESSORY is a sample spinner that makes it possible to measure reflectance of samples of fabrics with directional weaves and of threads, yarns, and synthetic fibers wound on cards. The sample holder is a manually spun flywheel with concentric retaining rings for mounting the sample. (Instrument Development Laboratories, Dept. 16)

■ COMPUTER-MODULE TESTER performs automatically static and dynamic tests on a "go" or "no go" basis. Up to nine tests or test programs, including speed, response and continuity, may be performed on each module circuit. The equipment is said to be capable of testing switching response as fast as 10 mμsec and as slow as 500 mμsec with precision ± 3 percent or ± 3 mμsec, whichever is greater. (Atronic Products Inc., Dept. 17)

■ NEUTRON SOURCE CONTAINER is an aluminum vessel 35 in. long and 23 in. in diameter filled with 350 lb of paraffin. For nuclear-physics teaching, a neutron source can be positioned in the container at the level of its two cadmium lined ports, to produce a collimated beam of neutrons. The equipment includes source-handling tongs, two detector mounts, and a variety of foils, foil holders and Lucite spacers that fit the two cadmium-lined port drawers. (Nuclear Chicago, Dept. 20)

■ OSCILLOSCOPE permits observation of very short pulses that are repetitive. The instrument uses a stroboscopic sampling technique whereby successive pulses are sampled at different points. The samples taken over a period of about 1 msec are amplified and displayed on the screen of an ordinary low-frequency cathode-ray tube. Sampling time is said to be 0.0004 μsec, sensitivity greater than 5 mm/mv. Pulses can occur at random as well as periodically (Lumatron Electronics, Inc., Dept. 22)

■ TRANSISTOR-AMPLIFIER RELAY is said to require less than 10 μw for positive relay actuation. Standard contact arrangements are single pole, double throw or double pole, double throw for contact loads up to 3 amp at 115 v a-c or 29 v d-c, noninductive. Various contact materials are available. Bias voltage requirement is 16 to 25 v d-c. Sensing currents 10 times normal are tolerated. Temperature range is 32° to 122°F. (General Automatic Corp., Dept. 26)

■ TEMPERATURE MEASUREMENT SYSTEMS cover the range from $-320°$ to $+2000°$F with resistance-temperature transducers. The systems are of modular design with bridges and power supply. Resistance variations are changed into voltage variations with 5-v full-scale output for direct reading or input to recorder. System accuracy up to $\pm 0.1°$F is available. (Cardinal Instrumentation Corp., Dept. 35)

■ PHOTODIODE is a diffused *n-p-n* silicon diode that allows current to flow when either junction is illuminated. Any biasing voltage up to 50 v will operate the device. Response is up to 1200 μa for 1200 ft-cas. Current in the dark is less than 0.5 μa. The device is 0.5 in. long and 0.085-in. in diameter. A minute glass lens is located at the end opposite the leads. Temperature range is $-55°$ to 125°C. (Texas Instruments, Dept. 11)

■ FUNCTION GENERATOR accepts input in the form of a double pencil-drawn curve on ordinary graph paper and produces electrical output signals proportional to the ordinate as a function of time representing the abscissa. The graph is carried on a drum that can be adjusted to rotate once in 10 to 300 sec. A servo-driven stylus follows a null position midway between the two pencil lines that define the function. Parts of the curve may be erased and changed at will. Controls include a hold button that stops drum rotation and a reset knob that permits advancing or reversing the drum during a hold period. (Research, Inc., Dept. 19)

JOSHUA STERN
National Bureau of Standards, Washington, D.C.

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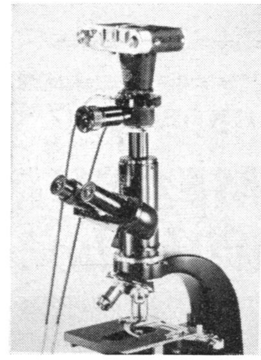

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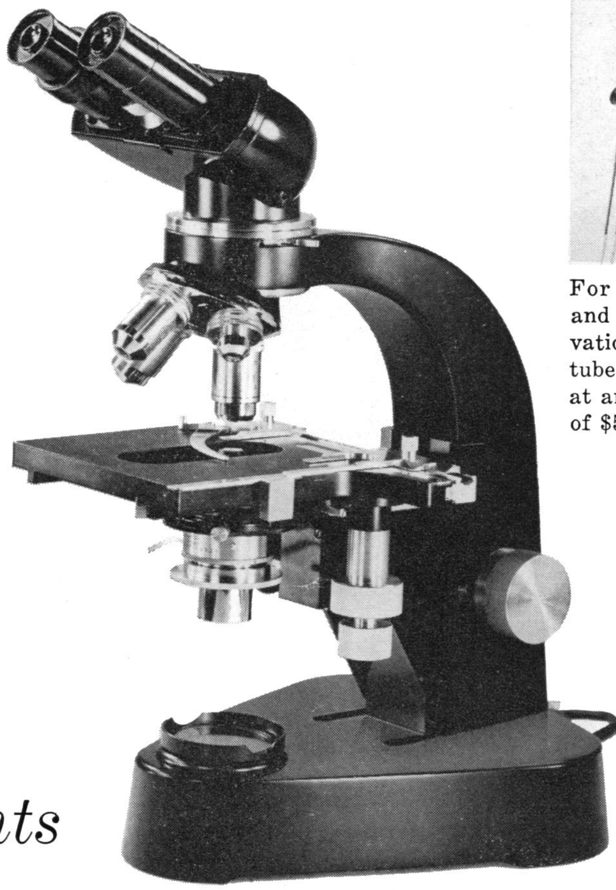

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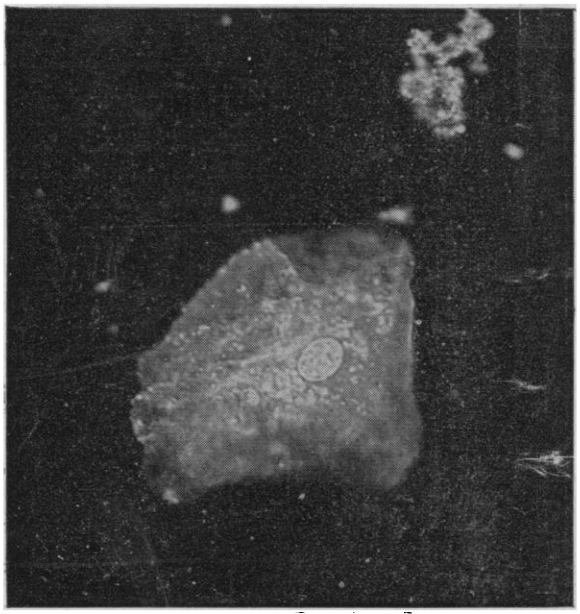
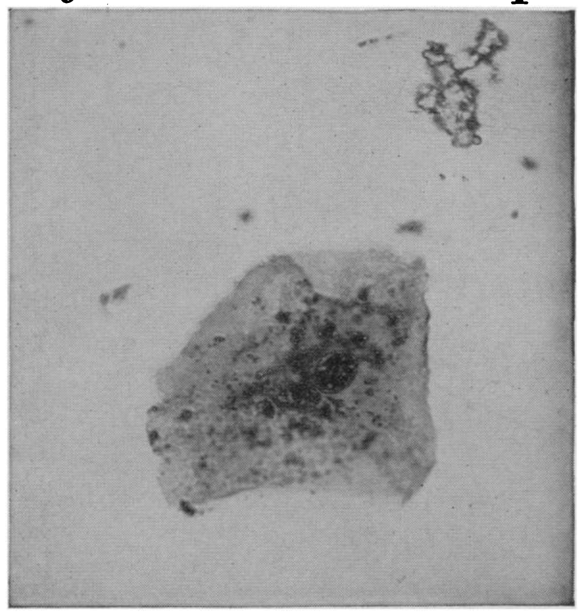


1. First, as shown in the photomicrograph* above, the microscope analyzer was rotated until the background was brought to extinction. Readings were taken directly from the analyzer scale. Averaged settings resulted in reading of 70.4°.



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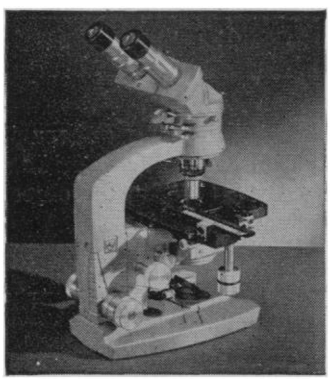

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