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  J. W. B. Hershey, Application Note DS-711. Beckman Instruments, Spinco Division, 1987.
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  D. P. Weeks et al., Anal. Biochem. 152, 376-385 (1986)
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  M. G. Peterson and J. F. B. Mercer, Eur. J. Biochem. 160, 579-585 (1986)
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  J. P. Segrest et al., Beckman TL-100 News 1:2, 1-2 (Dec. 1986)
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  T. Zysset, Ther. Drug Monit. 9, 433-438 (1987)
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  H. K. Naito, Applications Note DS-693. Beckman Instruments, Inc., Spinco Division, 1986.
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  D. L. Gard and M. W. Kirschner, J. Cell Biol. 105, 2203-2215 (1987)

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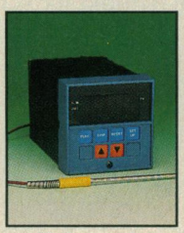

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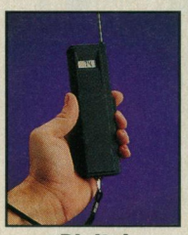

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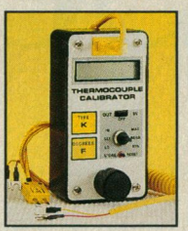

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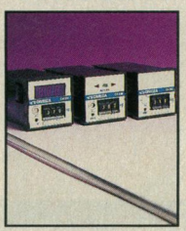

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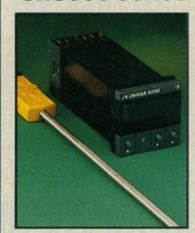

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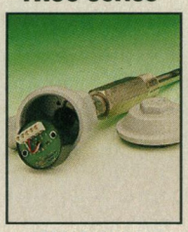

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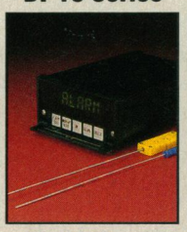

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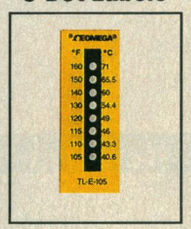

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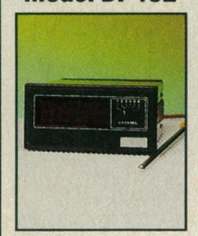

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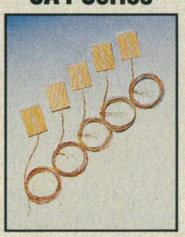

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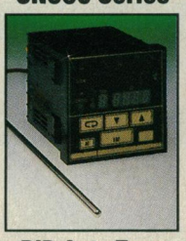

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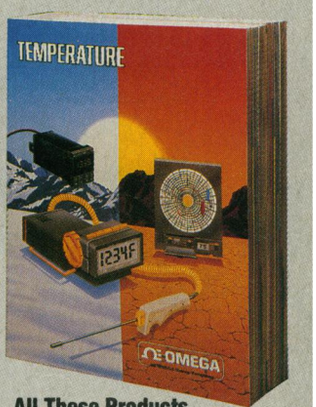

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COVER Adult mudpuppy (*Necturus maculosus*). This large aquatic salamander has been used frequently in physiological studies because cells throughout its body are exceptionally large. The eyes of this animal are used to show that glial cells in the retina normally buffer light-evoked changes in intraretinal potassium concentration. See page 578. [Photograph by W. B. Pavlik, Department of Psychology, University of Georgia].

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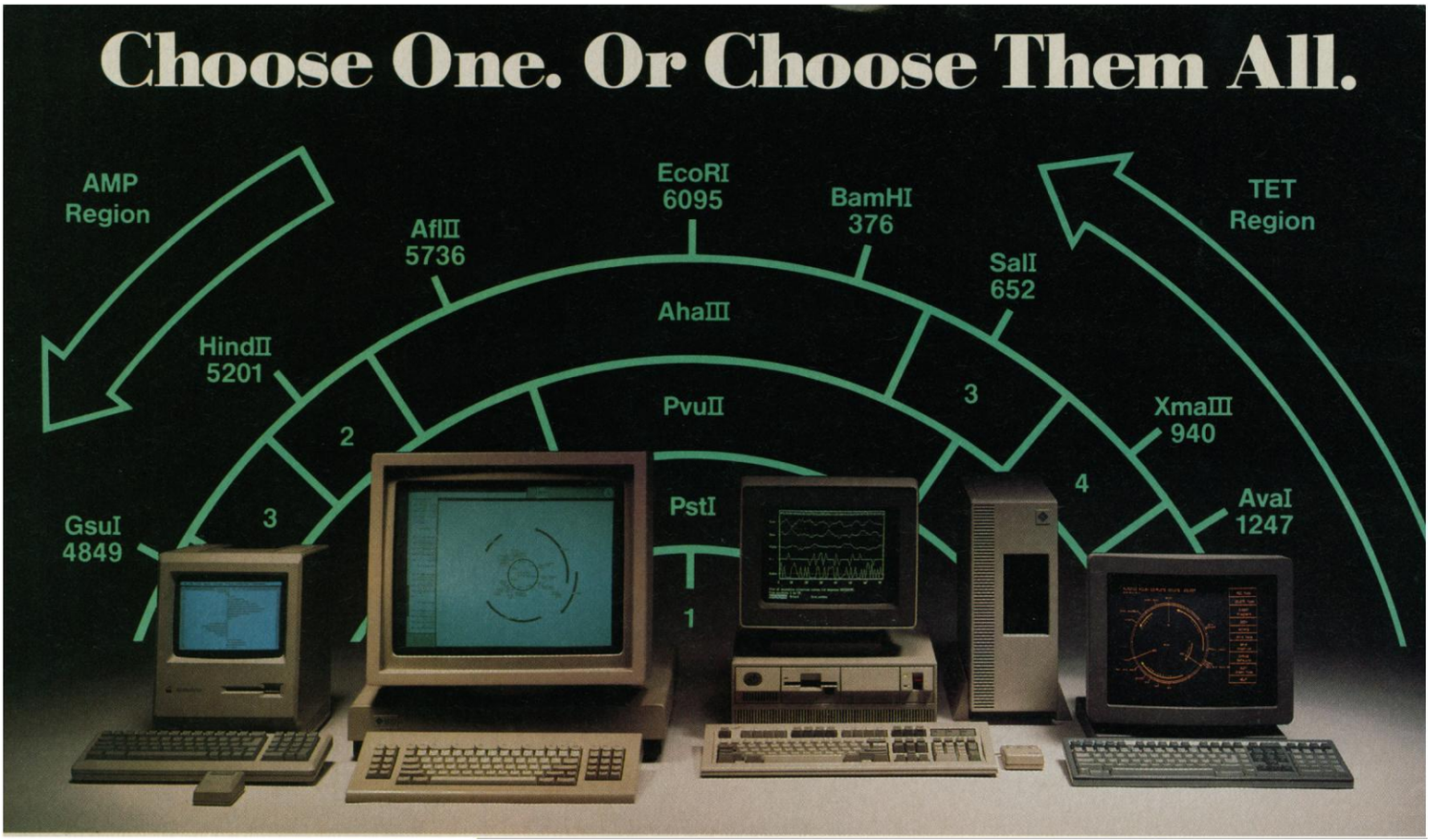

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This Week in
SCIENCE

C_5 in the stars

In the envelope surrounding the star IRC+10216 there are molecules that consist of linear chains of five carbon atoms—C_5 (page 562). This star is the prototype of a mass-losing carbon star: such a star is a cooling red giant that, late in stellar evolution, expels material from its envelope. The infrared spectrum of IRC+10216 was recorded with ground-based instruments—telescope and spectrometer—at Kitt Peak National Observatory. A high resolution vibration-rotation spectrum attributable to C_5 was recorded and is in good agreement with laboratory measurements (see below). The data suggest that between each pair of atoms the bond lengths are approximately equal (1.283 angstroms). Bernath *et al.* speculate that the formation of C_5 and carbon chains of other lengths depends directly or indirectly on photochemistry: such chains may be generated from carbonaceous materials that have fragmented as a result of the absorption of photons and they may also be the building blocks of such materials. C_5 is a factor of 11 less abundant than C_3, which had earlier been detected in this star. The carbon chains appear to form in the cooler outer part of the circumstellar shell unlike other carbon compounds—CO, C_2H_2, HCN, and CS—that are present throughout the envelope.

C_5 in the laboratory

Carbon chains, rings, and clusters are found not only in association with stars but also as components of soot. Thus an understanding of pure carbon compounds is of interest both for astrophysical chemistry and for combustion chemistry. The infrared spectroscopic signature of C_5 was recorded in the laboratory by Heath *et al.* (page 564), confirming the identification of C_5 recorded from the star IRC+10216 (see above). The major difficulty of studying carbon clusters—generating large chains—was overcome through the use of supersonically cooled carbon; through laser vaporization of graphite, C_5 chains were produced and their infrared rotation-vibration absorption spectra were recorded at high resolution. The chains appear to be linear and to be symmetric around a center; the data support the theoretical values of carbon-carbon bond lengths at approximately 1.283 angstroms. Carbon chains of other lengths should be amenable to generation and study by these procedures.

Combination drug therapy for AIDS

Infections with HIV-1 have acute and chronic phases. Thus Poli *et al.* recommend that a comprehensive clinical approach to controlling the AIDS virus should include attacks on the virus in both phases (page 575). They have studied how two drugs, AZT and IFN-α, affect HIV-1 replication in chronically infected cells in tissue culture. Two cell lines were used: one is a monocytic line (monocytes are known reservoirs for HIV) and the other is a T cell line (T cells are both virus reservoirs and virus "factories" during acute infections). Both cell lines normally produce small amounts of virus: the monocytes make defective noninfectious particles and the T cells produce infectious virions. However, both cell lines could be induced to produce large amounts of virus. IFN-α blocked the induced release of the viruses from each of the chronically infected lines; AZT did not. AZT, in contrast, prevented acute HIV infections in susceptible cells. Thus, if a proper balance of these drugs could be struck, it might be possible to block both the de novo infection of cells with HIV-1 and the release and spread of the virus from chronically infected cells.

Plant cell fates

Most of the epidermal cells of plants are committed to an epidermal future fairly early in ontogeny. Exceptions to this rule, however, are the epidermal cells that form carpels in some plants; carpels are the structures that enclose ovules of flowering plants. Siegel and Verbeke studied how carpel epidermal cells of Madagascar periwinkles redifferentiate to parenchymal cells (page 580); the two cell types are different in shape, in the density of their cytoplasms (epidermal cells have dense cytoplasms whereas parenchymal cells have many vacuoles), and in their planes of division. Through cell manipulations that exposed carpel epidermal cells to diffusible factors, the epidermal cells could be made to redifferentiate to parenchymal cells, whereas cells that had been removed from such exposure were stopped from redifferentiating. The diffusible factors could be trapped in agar barriers from which it should be possible to elute and characterize them.

Making neuronal connections

How nerve cells link up and fire during development affects how the electric circuitry of the nervous system will later operate (page 585). Nelson *et al.* show that early electric stimulation increases the strength and number of synapses (electrical connections) between neurons. In a three-chambered dish, sensory neurons in "peripheral" chambers sent axons beneath the barriers to link up with spinal cord neurons in the "central" chamber; in this way, nervous system circuitry was partially reconstructed in vitro. After the physical connections had been established, axons of the sensory neurons were electrically stimulated (or not) for several days. Stimulation promoted the attachment of axons to the central neurons; it also enhanced the amplitude of the excitatory potential in the central cells. Competition between stimulated and unstimulated sensory neurons that were linked to the same central cell apparently diminished the strength of the connection on the nonstimulated side. Thus, the developing nervous system is a pragmatic system: links that are actually made determine what the final functional architecture of the circuitry will be.

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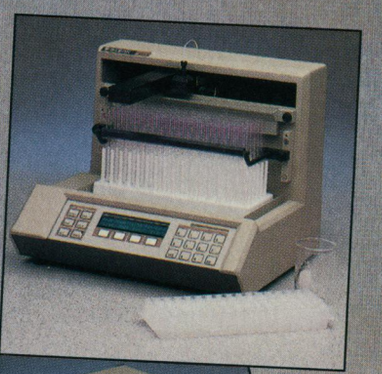

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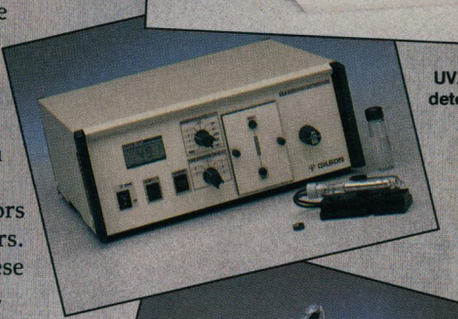

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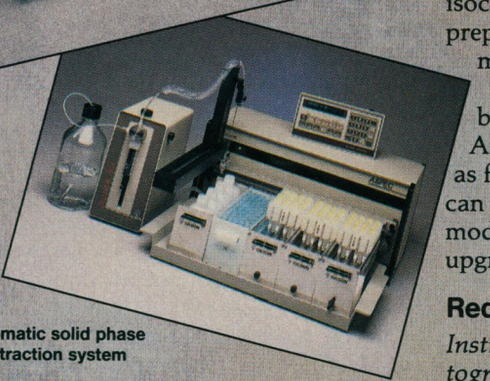

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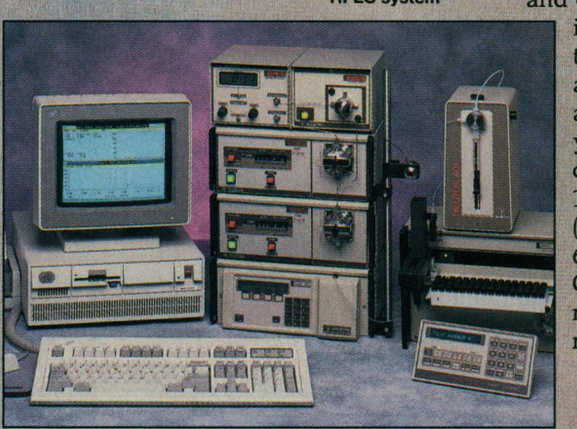

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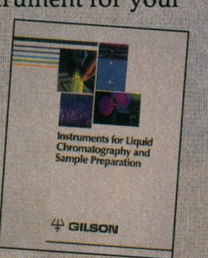

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SCIENCE

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Drunk Driving and Statistical Morality

The picture pulls at the heartstrings: a grieving family at the side of a daughter in a coma. It appeared last week in the newspapers, as one more victim of a drunk driver was counted. She joins a growing group, including many killed and others seriously injured. The best estimates are that 50% of motor vehicle accidents, which kill more people each year than were killed during all of the Vietnam War, are caused by drunk drivers. In too many such cases the driver is a repeater whose license was not revoked for previous offenses, despite a law on the books, by a kindly but muddleheaded judge who did not understand statistics.

What may be called "statistical morality" is the precept that a given course of action that may cause some harm to individuals now will result in greater benefit to more individuals in the future. Tests of a new drug or vaccine on a limited number of volunteers, half of whom are given placebos, is one example. A tough law on drunk driving is another. It is inevitable that such a law will cause some hardship on offenders who are subjected to an automatic sentence, whether it be prison, suspension of a driver's license, or a large fine. Careful consideration of the punishment to make the penalty commensurate with the crime must be made at the time that the law is designed, but once the law is enacted, every judge who suspends a sentence should be aware that he or she erodes the deterrence effect and ensures that some future victim will pay for the mercy shown.

Mercy to the lawbreaker in the dock is frequently justified by the argument, "We can't do anything more to help the victim, so let's not be too mean to the criminal." In fact, the overwhelming purpose of punishment is to deter the next act, and not, as claimed by some who wish to confuse the issue and whip up sentiment for the criminal, an act of vengeance. The murderer, the drunk driver, the rapist—all appear in court after committing an act that cannot be undone. Society correctly says that, if convicted, they must pay the penalty to diminish the chances of the future murder, driving incident, or rape. Deterrence depends on the sureness of punishment. Unfortunately, there are far too many sitting on judicial benches who do not understand this and who rationalize that "in this case, the defendant will suffer undue hardship if the penalty is enforced." The argument of being kind to the violator today is often rationalized on the basis that one does not know the name and telephone number of the victim who will be injured and therefore it is not our responsibility. Such thinking is truly immoral because it allows a sanctimoniousness in the present to obscure the harsh reality that a future victim will certainly become a statistic. To some extent the future injury will be caused by the failure to implement a carefully thought-out law.

In some Scandinavian countries, penalties for drunk driving are so severe that revelers select in advance a driver who abstains from alcohol during an evening of merriment. In the United States there are tough laws on the books in many states, but these laws are so often overstepped by judges that the impression is created that they are easy to evade. That leads to exactly the situation that we have today; far fewer people here are deterred from drinking and driving than is the case in other countries.

Statistical morality implies that a painstakingly structured procedure will minimize the total victim count in our society. It requires that the initial plan be well considered but, once implemented, there should be no exceptions based on the false assumption that small deviations today are less serious than the consequences to the unnamed but statistically certain victims of the future. Statistical morality applies to tests for drugs and vaccines–for instance, the administration of a vaccine like the whooping cough. It is known that when this vaccine is given to 1 million children about 100 will have serious side reactions, including death. When public outcries led to a cancellation of the public requirement for vaccination in England, the number of deaths from whooping cough climbed so alarmingly that the vaccine requirement was reinstated. Statistical morality would say, "Require the test—more people will be saved." Those who believe that "we are only responsible for what we cause" would have said, "No. We are not responsible for the deaths caused by nature's scourges, only for those caused by the vaccine we required." Morality in the new age should state that the errors of omission are as important as the errors of commission. The more we know about risks, whether from drunk drivers or vaccines for whooping cough, the more we will require a statistical morality that ensures the least harm to the most people.

—DANIEL E. KOSHLAND, JR.

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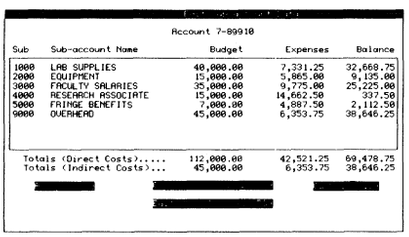

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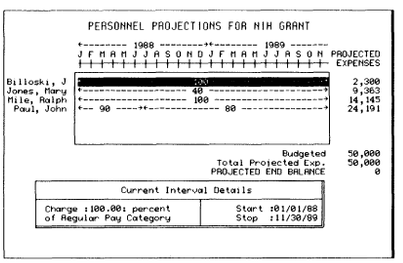

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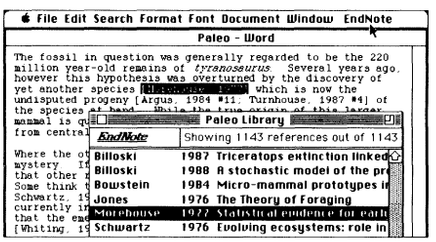

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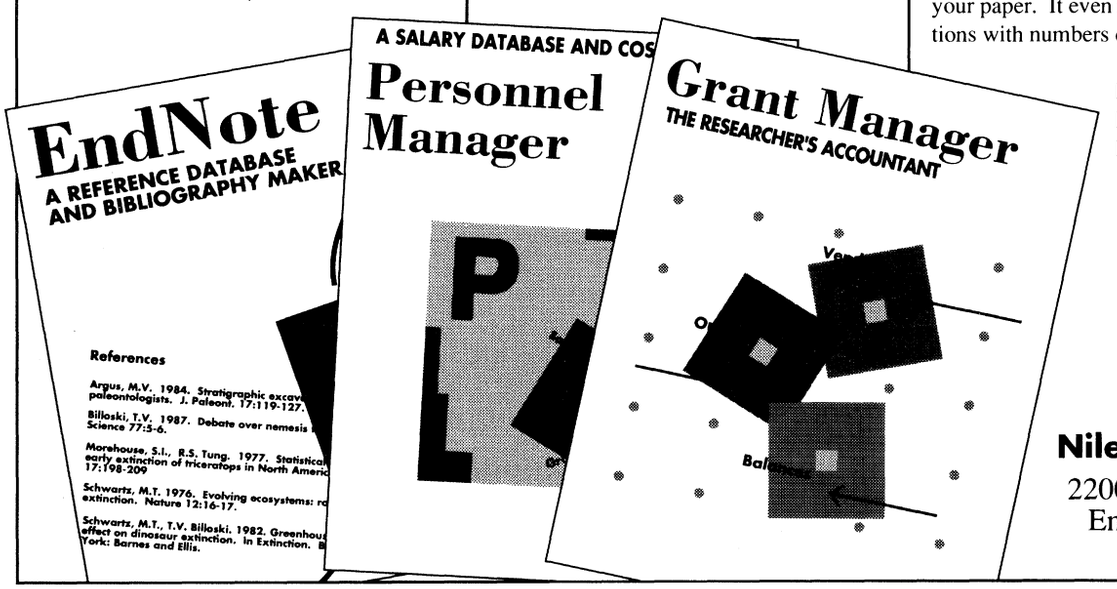

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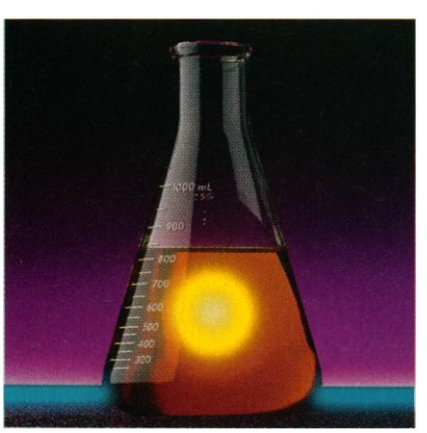

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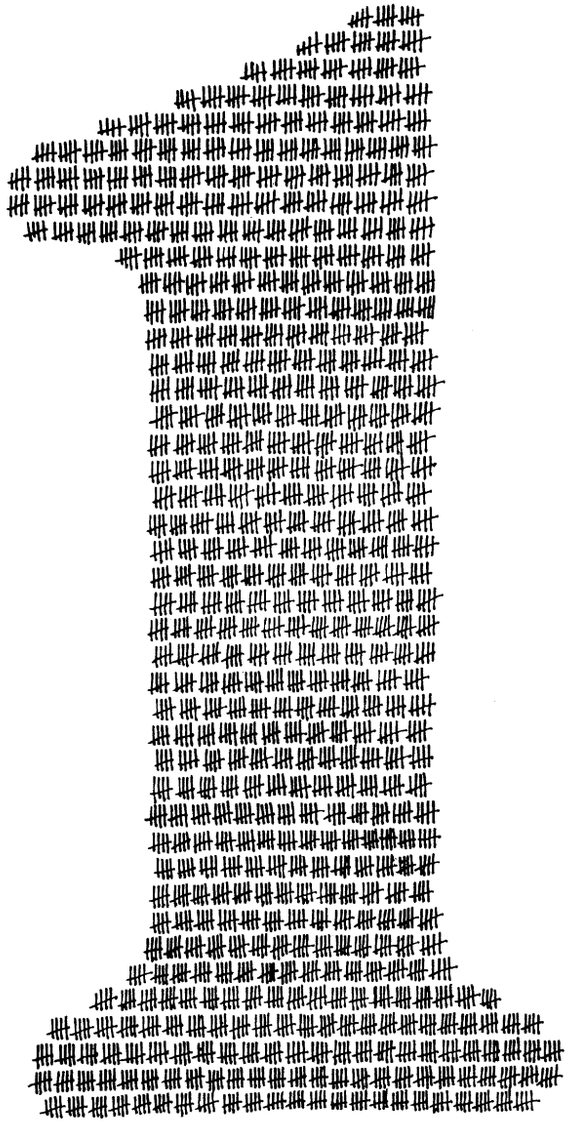

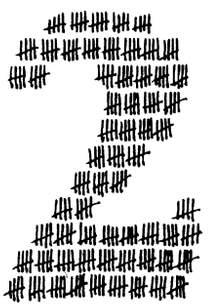

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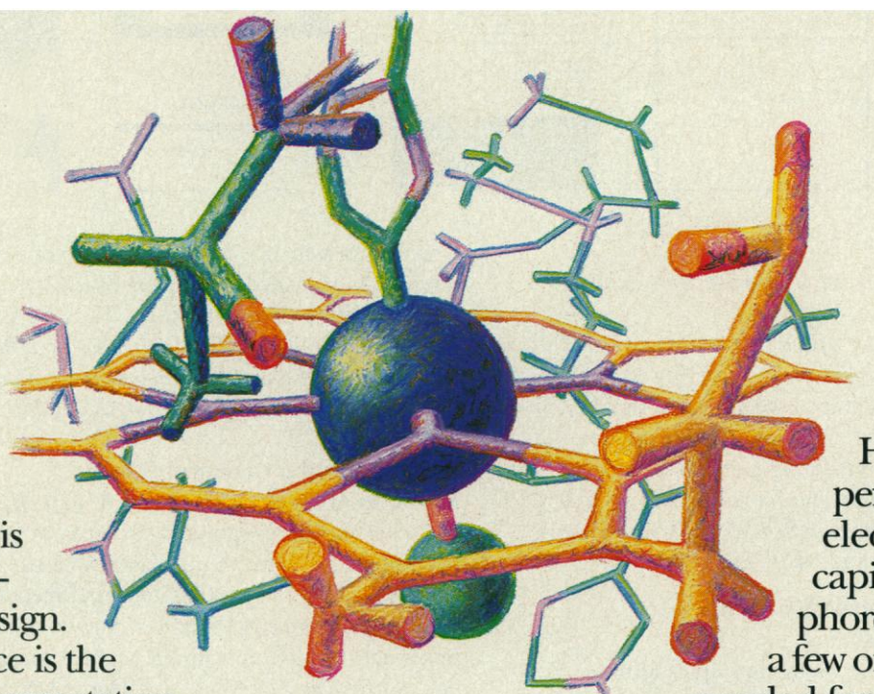

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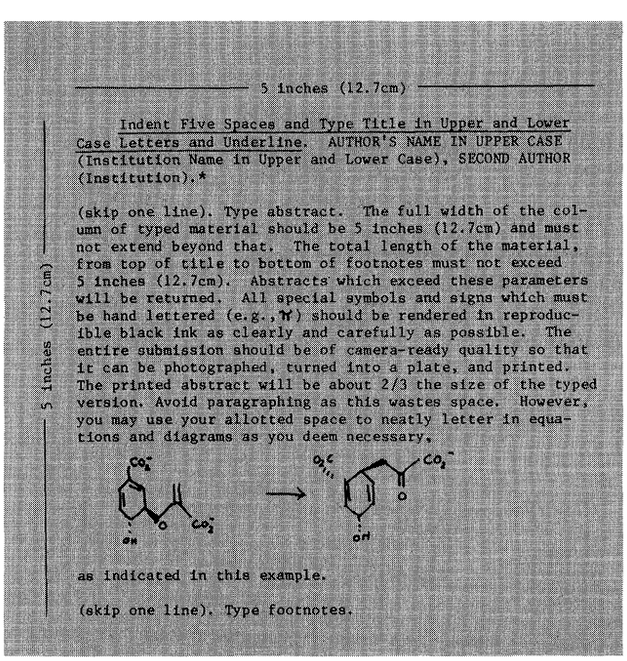

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