other hand, because transformed mouse cells cannot propagate independently (unlike chicken and rat cells), leukemia virus may be needed for the propagation of sarcoma virus or the infection of nearby cells, or both, to produce a recognizable focus. Further work is needed to clarify this system.

These data indicate that the inability to initiate focus formation without leukemia virus as helper is not a general characteristic of the murine sarcoma virus but is specific for its action in mouse cells. In reference to transformation of rat cells, murine sarcoma virus resembles Rous sarcoma virus. Our observations point out the necessity of defining a sarcoma virus only in terms of its action in the particular host cell infected and the necessity of recognizing inherent differences in the ability of that cell itself to express this viral activity.

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Arsenic in Detergents: Possible Danger and Pollution Hazard

Abstract. *Arsenic at a concentration of 10 to 70 parts per million has been detected in several common presoaks and household detergents. Arsenic values of 2 to 8 parts per billion have been measured in the Kansas River. These concentrations are close to the amount (10 parts per billion) recommended by the United States Public Health Service as a drinking-water standard.*

Considerable attention is being focused on the detrimental effects man has or can have on his environment. We report on the possible effects of some common household detergent products on water quality. In an investigation by emission spectrography of the trace element composition (Fe, Mn, Cr, Ni, Co, Zn, Sr, Li, SiO_2, and B) of three enzyme presoaks, three heavy duty enzyme detergents, one heavy duty detergent, and one detergent aid, we found continual spectrographic evidence of the presence of arsenic in most of the samples. Because the amount of arsenic was close to the detection limits of the spectrographic method, the more sensitive silver-diethyldithiocarbamate method was used (*1*) for the quantitative determination.

Waste waters of these detergent products can easily enter the water system and therefore contribute to water pollution. We analyzed detergent samples, water from the Kansas River, and water entering and leaving the water and sewage treatment plants in Lawrence, Kansas; the concentrations of arsenic in many of the detergent products were high enough to pose a pollution problem and a potential health hazard to people using them constantly.

A problem of serious water pollution also exists (Tables 1 to 3). The U.S. Public Health Service gives tolerances of 10 ppb (recommended) and 50 ppb (mandatory) of arsenic in drinking water (*2*). We have calculated the concentrations of arsenic to be expected in tubs of typical washers of 10-, 30-, and 60-gallon capacities (1 gallon = 3.8 liters) (Table 2). Especially important are the high amounts of arsenic in two presoaks. When used as directed, the arsenic concentration of the different household laundry aids greatly exceeds that recommended for drinking water. While a "tub of suds" is not used for drinking, the danger clearly exists that arsenic can be absorbed through unbroken skin. Another side effect of arsenic is the possibility of skin rashes and other types of contact dermatitis skin reactions in sensitive people (*3*). For example, the presence of arsenic at 50 ppm inhibits the healing of wounds (*4*). The medical literature reveals remarkably little about the long-term effects of such contact with arsenic. There is also evidence of the accumulation of arsenic in the livers of mammals (*5*). The fixing of arsenic in human hair after the use of arsenic-containing detergents was reported as early as 1958 (*6*). Arsenic is added to the system by the use of detergents in everyday wash chores. This usage contributes to the amount of arsenic in river waters. In areas of repeated usage, this concentration (3 to 8 ppb for the Kansas River) can be expected to rise in the near future with continued use of detergent products containing arsenic. Arsenic is a cumulative poison which builds up slowly in the body. According to some medical sources, long-term arsenosis may not be detectable for 2 to 6 years or longer. To our knowledge, no previous data on arsenic concentrations in the Kansas River are available.

To ascertain whether the arsenic was being added in the water-usage cycle, we measured the arsenic concentrations at different points in the water-distribution system (Table 3). Blind sets of

Table 1. Concentrations of arsenic in certain detergents and presoaks. Abbreviations are: EP, enzyme presoak; HDED, heavy duty enzyme detergent; DA, detergent aid; HDD, heavy duty detergent; and SD, single determination.

Detergent type		Arsenic concentration (ppm)	
		Average	Range
A.	EP	34	31–43
B.	HDED	32	SD
C.	HDD	9	8–10
D.	HDED	15	SD
E.	HDED	41	38–45
F.	EP	7	6–9
G.	DA	2	1–3*
H.	EP	59	51–73

* Lower limit of detection.

Table 2. Approximate concentrations of arsenic in wash water. The results were calculated from the concentration of arsenic in dry detergent and the manufacturer's directions, assuming no arsenic from any other source than the stated detergent. All values are given in parts per billion.

Detergent	Container			
	10-gallon washer	30-gallon washer	60-gallon washer	1-gallon presoak basin
A	50–60	20	10	130–150
B	30–40	30	20	
C	10	10	5	
D	20	20	10	
E	50	40	20–30	
F	10	2–4	1–2	20–30
G*	2.5	1.5	0.5–1.0	
H	70–100	25–35	10–20	170–250

* Lower limits of detection.

Table 3. Arsenic concentration (ppb) in water in Lawrence, Kansas. The U.S. Public Health Service mandatory maximum is 50 ppb; the recommended maximum is 10 ppb.

Sample	Average	Range
Input Lawrence water plant	3.1	2.6–3.6
Lawrence tap water*	0.4	0.4–0.5
Raw sewage (Lawrence plant) input	2.7	2.0–3.4
Treated sewage (Lawrence plant) output to river	1.8	1.5–2.1
Kansas River at Lawrence	3.3†	
Kansas River at Topeka‡	8.0	

* Lawrence water treatment includes "cold-lime softening"; the value of 0.4 ppb is at the lower limit of detection. † Single determination. ‡ (8).

the seven samples studied were sent to four independent laboratories, and arsenic analyses were requested. While the results were not duplicated exactly, the general pattern of findings was not altered.

For an internal check on our method, several samples were run a sufficient number of times to obtain an estimate of the coefficient of variation, which we determined by the range method (*7*). The precision of samples —individually sampled and wet ashed —was within that given for the silver-diethyldithiocarbamate method for intralaboratory results (*1*). Even with variations in sampling and ashing, the precision was well within that given for interlaboratory results by Standard Methods (*1*). There was also good agreement between the silver-diethyldithiocarbamate and emission-spectrography data.

The treatment processes now used in many sewage or waste effluent plants do not remove the arsenic. However, two common water-treatment methods were tested on a laboratory scale. At an initial arsenic concentration of 200 ppb, these limited tests indicate an arsenic removal factor of 85 percent for cold-lime softening treatment and 70 percent for charcoal filtration treatment. Nevertheless, in river systems in which the water is heavily reused (for example, the Ohio River), a potential danger does exist and warrants further study. The present concentration of 2 to 8 ppb of arsenic in one river system is too close to the recommended 10 ppb.

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Extraoptic Celestial Orientation in the Southern Cricket Frog Acris gryllus

Abstract. *Celestial orientation and setting of the biological clock in the southern cricket frog* Acris gryllus *can be cued by light stimuli received by extraoptic receptors in the brain. These extraoptic photoreceptors may also be used in learning new orientational directions. A mechanism for a light-activated biological clock is discussed.*

Frogs and salamanders can use celestial cues to orient correctly on a compass course (*1*). Such compass-course orientation require a learned component, that is, a particular shoreline, and a celestial cue in conjunction with a timing mechanism phased to local time. Several workers have shown that blinded amphibians may continue to exhibit normal motor and physiological responses to light cues. Blinded newts *Taricha rivularis* are able to home over relatively great distances (*2*). Although the mechanism by which these blind animals homed was attributed to olfactory cues, it has since been shown that rough-skinned newts *Taricha granulosa* can home by use of extraoptic photoreceptors (EOP) (*1*). In situations which precluded the use of olfactory cues, blinded *T. granulosa* continued to orient correctly on a compass course. Eyeless slimy salamanders *Plethodon glutinosus* are able to phase-shift circadian locomotor rhythms in response to changes in light-dark (LD) cycles (*3*).

These and other experiments have shown that light reception in a number of animals may be mediated by EOP as well as with the eyes (*4, 5*). The ability of salamanders to home and orient correctly and to shift circadian locomotor rhythms in response to LD cycle changes indicates that EOP-mediated cues can be used as direction-finding mechanisms and to reset the biological clock.

The site of EOP has been a point of interest for some time. Although a dermal light sense has been shown in all the major metazoan phyla, its function appears to be primarily involved with phototactic responses (*5*). Recently the pineal complex (pineal-parietal organs in reptiles and fish; pineal-frontal organs in frogs and toads) has received increasing attention as the site of EOP in lower vertebrates. Cytological and electron micrograph studies of amphibian pineal complexes have shown both photoreceptive and secretory cells in the