of dissolved radon from tissues where it has accumulated previously when conditions for clearance were less favorable. The practical implications of the present findings are that exhaled air for radon determination should be collected with the subject supine and the sampling should be done after he has been lying down for about 45 min.

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Ion Exchange Effect on Alkaline Phosphatase of Serum with Reference to Cancer[1]

Adolph Bernhard and Louis Rosenbloom

Achelis Laboratory, Lenox Hill Hospital, New York City

The utilization of ion exchange resins has been rather limited in clinical biochemistry (*1–4*). As far as we know, no detailed investigation of the effect of ion removal upon the alkaline phosphatase in human sera has been published. We report here the results of our studies on the effect of ion exchange upon the alkaline phosphatase of the serum of normal, of noncancerous, and of cancerous individuals.

The sodium form of analytical grade Amberlite IR-120 (H),[2] was prepared and dried in an oven at 37° C. The dry resin is suspended in distilled water immediately preceding use, and 1.5 ml of the resin is transferred to a 3-ml micro filter funnel with fritted disk of coarse porosity (Pyrex 36290). The excess water is aspirated by suction applied to the stem of the funnel. The serum is introduced into the funnel. The rate of flow should not exceed 1 ml/min, and not more than 8 ml is allowed to pass through the resin; the first 0.5 ml is discarded. The following determinations were made on the serum before and after passing it through the ion exchange resin: total protein (*5*), calcium (*6*), magnesium (*7*), sodium and potassium,[3] pH with the glass electrode using the Beckman model G pH meter, alkaline phosphatase using adenylic acid as the substrate (*8*), lipase (*9*), and diastase (*10*).

A comparison of the analyses of the resin treated serum and the untreated serum showed no changes in the total protein; more than 95% of the calcium and all the magnesium and potassium were removed. There was also a slight lowering of the pH of the serum. There were slight increases in the sodium. There were no demonstrable changes in the lipolytic or diastatic activity. There was a loss of alkaline phosphatase activity in the resin treated serum as a result of ion exchange.

The results of our experiments indicate that concomitant with the removal of divalent ions from the serum by a cation exchange resin there is a diminution of alkaline phosphatase activity, designated as Kase-Mg, both in the serum of noncancerous persons, and in those with a malignant tumor (Table 1). Since elevated serum alkaline phosphatase values are generally accepted as indicating either bone disease or liver damage, such cases were excluded from our series. The nonmalignant group was composed of 16 normal males and females, 5 cases of pregnancy, and 32 others known to be free from neoplastic disease.

The cancer group consisted of 46 individuals with some form of neoplastic malignant disease, in whom the diagnosis was confirmed by biopsy or post-mortem examination. The phosphatase was determined before surgical intervention or other treatment was instituted. These cases classified according to the site of the tumor are as follows: liver and pancreas 4, genitourinary system 18, gastrointestinal tract 20, breast 3, lung 3, and miscellaneous 3.

There is greater diminution of alkaline phosphatase activity of the serum of patients with neoplastic malignant disease, which cannot be entirely attributed to the fact that the initial alkaline phosphatase of the serum is usually increased in cancer, as shown in a previous communication (*8*); a comparison of the means of the Kase-Mg of the cancer and nonmalig-

TABLE 1

STATISTICAL ANALYSIS OF ALKALINE PHOSPHATASE ACTIVITY OF HUMAN SERUM AS A RESULT OF ION EXCHANGE

	No. of patients	All phosphatase values in mg%			
		Control phosphatase	Resin-treated phosphatase	Loss in phosphatase Kase-Mg	% change in Kase-Mg
Normal and nonmalignant	53				
Mean		2.3	1.45	0.85	37
Stand. Dev.		0.7	0.55	0.37	11
Range		1.0–4.5	0.5–3.1	0.1–2.2	7–52
Cancer	46				
Mean		5.0	2.9	2.1	44
Stand. Dev.		3.4	2.15	1.69	12
Range		1.9–18.7	0.8–10.8	0.6–5.8	28–80
Cancer with low alkaline phosphatase	13				
Mean		2.5	1.4	1.1	44
Stand. Dev.		0.3	0.27	0.31	11
Range		1.9–2.9	0.9–1.9	0.6–1.8	29–67

[1] Under a grant from the Lewis Memorial Fund.

[2] Rohm and Haas, Philadelphia.

[3] Flame photometer, Process Instruments Photometer, Brooklyn, N. Y.

nant group shows a statistically significant difference when the p value is calculated by the method of Fischer (*11*). This difference applies both to the absolute loss, and in terms of percentage of original phosphatase activity. In the 13 cases of cancer in which there was a low initial serum phosphatase (Table 1), a comparison of the Kase-Mg mean of this group with that of the noncancerous group also showed a statistically significant difference. Nine of the 13 patients with low initial phosphatase activity had malignancies of the gastrointestinal tract.

In 25 cases, no definite relationship between loss of phosphatase activity and changes in pH values was apparent under our experimental conditions. The addition of serum or resin treated serum to the buffered substrate employed resulted in no change in the pH of the substrate.

When serum was incubated with substrate for 24 hr, the dephosphorylation was 6-fold greater than that obtained in a 2-hr period, while that of the deionized serum was only twice as great as found in the 2-hr period. It is evident that the rate and amount of enzyme activity is definitely affected by the cation removal.

It is generally accepted that all phosphatases and phosphate-transferring enzymes require a metal for activation. However, as stated by Lehninger (*12*), an activating or inhibiting effect produced by a metal *in vitro* does not necessarily define a physiological function of the metal in question.

In order to determine the effect of adding the ions removed by the cation exchanger, K^+, Ca^{++}, and Mg^{++} were added, as the chloride, to the buffered substrate in the same concentration found in serum. Only the addition of Mg^{++} had any activating effect upon the phosphatase activity of the resin treated serum, causing a resurgence which approximated that of the original phosphatase under consideration. It appears that removal of Mg^{++} from serum has some inhibitory effect on the phosphatase activity. The Mg^{++} removed from the serum of both the normal and cancerous groups is of the same order of magnitude; therefore, it seems probable that alkaline phosphatase, as it exists in serum, consists of at least one magnesium activated fraction. This fraction designated as Kase-Mg is the one found to be statistically significant in the cancer group. Recently Gomori (*13*) has shown that alkaline phosphatases of the intestine consist of three fractions; two of these fractions were rapidly inactivated while acting on the substrate in the absence of Mg^{++}, whereas all three have different and specific rates of activation by Mg^{++}.

When serum is passed through a cation exchange resin there is a dimunition of alkaline phosphatase of both nonmalignant and cancerous individuals. The serum from patients with a malignant tumor seems to show greater loss of activity. The fraction involved is a magnesium activated one.

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Comments and Communications

Aphids Carried by Wind Currents

THE footnote on page 714 of SCIENCE, 116 (1952), regarding the possibility of aphids being carried by wind currents from the west to Puerto Rico, apparently requires an answer.

This is not a matter of opinion, but rather of fact, and my original statement as to wind direction was based on close to 30 years' residence in Puerto Rico, most of the time at Río Piedras. The most conspicuous industrial landmark there is Central Vannina southwest of town. When it begins grinding sugar-cane in December or early January, the noise of its continuous operation, against the prevailing northeast trade winds, comes rather faintly to the town. But toward the end of the grinding season in late May and June, the wind direction may be reversed sometimes for several days at a time, and the noise of grinding becomes very noticeable. Householders are especially annoyed by the deposits of flaky, black soot of burned bagasse from its stack, which float down on washing hung out to dry. After the grinding season is over, in summer and early autumn, fierce rainstorms may be expected from the west and northwest, as one learns by experience after having to rescue furniture from a porch on the west side of the house.

The first outbreak of the green peach aphid on tobacco in Puerto Rico, observed by Mario Pérez at Cidra on January 3rd, 1951, was already sufficiently severe to have been noted by growers several weeks previously and quite possibly had required a considerable period of build-up to have reached conspicuous outbreak proportions. Of the weather that autumn, Glenn Stallard, Meteorologist in Charge, Airport Station, Santurce, Puerto Rico, in a letter to the writer dated January 22nd, 1953, states: