complex, on the other hand, is stable at pH 7.0 and does not precipitate proteins, but probably exists as a fine colloid or aggregate. Under these circumstances it would be unusual if these two forms were handled by the body in the same manner and/or at the same rate.

A distinct species difference is present relative to this metal. The rat, for example, tolerates some 10 times more gallium citrate than the dog, according to studies in progress. Man probably fits somewhere between these two species.

References

1. DUDLEY, H. C., MADDOX, G. E., and LARUE, H. C. *J. Pharmacol. Exptl. Therap.*, **96**, 135 (1949).
2. DUDLEY, H. C., MUNN, J. I., and HENRY, K. E. *Ibid.*, **98**, 105 (1950).
3. DUDLEY, H. C. Naval Med. Research Inst. Proj. Rept. NM 011 013 No. 6.
4. KING, E. R., and PERKINSON, J. D., JR. *Texas Repts. Biol. Med.* (Winter 1950).
5. KING, E. R., *et al.* Unpublished data.
6. BLANCO, R. E., and PERKINSON, J. D., JR. Abstrs., Div. Biol. Chem., Am. Chem. Soc. 117 Meeting, Chicago (1950).
7. DUDLEY, H. C. Abstrs., Div. Med. Chem., Am. Chem. Soc. 116 Meeting, Atlantic City (1949).
8. BRUNER, H. D. An Expendable Cage to Separate Urine and Feces of Rats in Tracer Experiments. Oak Ridge, Tenn.: Tech. Inf. Div., AECU (in press).
9. MARINELLI, L. D., QUIMBY, E. H., and HINES, G. J. *Am. J. Roentgenol. Radium Therapy*, **59**, 260 (1948).

Inhibitory Action of Adrenalin on Growth of Rat Sarcoma[1]

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In an earlier study (*1*) it was found that tumor tissue, when minced with adrenal gland prior to implantation into susceptible rats, failed to grow because of some substance present in the gland. The inhibition of the growth of tumor grafts took place regardless of whether the adrenals were obtained from normal, tumor-bearing, or tumor-immune rats. The present study is concerned with the action of one of the hormones of the adrenal gland—namely, adrenalin—on the growth of tumor tissue.

The adrenalin used was in the form of a sterile solution containing 1 mg of epinephrine in 1 ml of sterile physiological salt solution to which 0.1% sodium bisulfite and 0.5% chloretone[3] were added as preservatives.

Rats of the Lewis and King A inbred albino strains, and native tumors that were 100% transplantable in rats of their own strain, were used.

Four types of experimental procedure were utilized: Implantation of minced viable tumor tissue to which solutions of adrenalin had been added; intratumoral injections of solutions of adrenalin; injections of adrenalin around small tumors growing in susceptible rats; and injections of adrenalin into the subcutaneous tissue 2–3 hr, 3 days, 7 days, and 10 days prior to implantations of tumor grafts into the same site.

Control experiments were carried out using additions of physiological salt solution, of 0.1% sodium bisulfite, and of 0.5% chloretone in place of adrenalin with the minced tumor tissue implanted into susceptible rats.

The results showed that additions of adrenalin (½ ml to 2–3 ml saline) to equal parts of minced tumor tissue inhibited its growth in 13 of the 25 rats that survived an injection of 2 ml of the suspensions. In some instances the grafts grew to some extent, but this initial growth soon regressed. The addition of physiological salt solution or of 0.1% sodium bisulfite in saline to minced tumor tissue did not inhibit the growth of the tumor tissue, but the addition of solutions containing 0.5% chloretone prevented the growth of the tumor cells.

All the rats in which tumors were injected with adrenalin diluted with salt solution died within 24 hr. When aqueous solutions were injected intratumorally the majority of the treated rats survived. Thirty-four rats in which tumor grafts had grown for 6 days were given 8–12 intratumoral injections, at 3-day intervals, of ½–1 ml of adrenalin diluted in 1 ml sterile distilled water. They exhibited the type of damage that takes place when growing tumors are treated with extracts prepared from tumor by means of 95% alcohol, and that results in oncolysis and development of tumor-immunity in 100% of the treated rats (*2, 3*). The treatment with adrenalin, however, resulted in absorption of tumors in only 20 of the treated rats; of the other 14 rats, 9 died from adrenalin; in 5 rats, the tumors continued to grow.

Injections of adrenalin around growing tumors resulted in death of the majority of the treated rats. Atrophy and absorption of tumors, however, did take place in 7 of the 22 treated rats that survived.

The results brought about by injections of adrenalin into the subcutaneous tissue of a given region prior to implantation of tumor grafts depended upon the interval of time allowed to elapse between the injection of adrenalin and the implantation of the grafts. The grafts failed to grow in 21 of the 34 rats that were engrafted 2–3 hours after the injections of adrenalin; on the other hand, they grew in 5 of the 13 rats following a lapse of 3 days; in 6 of the 9 rats after a lapse of 7 days, and in every one of the 11 rats engrafted 10 days after the subcutaneous injections of adrenalin.

All the rats in which tumors were absorbed, as well as those in which tumor grafts failed to grow, were implanted 3 weeks later with grafts of viable native tumor tissue (challenge grafts) at a distance (left side) from the area previously treated (right side) to test their susceptibility to tumor growth. The challenge grafts failed to grow in 11 of the 13 rats in which suspensions of minced tumor and adrenalin had not grown; in 13 of the 20 rats in which treated tumors had been absorbed following intratumoral injections with adrenalin; in the 7 rats in which tumors atrophied following damage to their circulation by injec-

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[2] With the technical assistance of Peter Demchur.

[3] Commercial product of Parke, Davis & Company.

tions of adrenalin around the tumors; and in 9 of the 21 rats in which the subcutaneous tissue had been damaged by injections of adrenalin prior to implantations of tumor grafts. The challenge grafts grew in the 6 rats in which chloretone had inactivated the tumor tissue implanted on the right side. The results showed that resistance to growth of subsequent grafts of native tumor tissue had become established in 40 of the 61 rats treated with adrenalin in the experiments described. The tumor inhibitory action seemed to be caused by damage to the vascularization of the tumor tissue, followed by its absorption.

The characteristic loss of hair previously noted in rats that received minced adrenal glands (*1*) took place in these rats treated with adrenalin.

References

1. LEWIS, M. R., APTEKMAN, P. M., and KING, H. D. *J. Immunol.*, **61**, 315 (1949).
2. APTEKMAN, P. M., LEWIS, M. R., and KING, H. D. *Ibid.*, **52**, 77 (1946).
3. LEWIS, M. R., *et al. Ibid.*, **60**, 517 (1948).

Erythrocyte Aggregation Factor in the Plasma and Serum of Patients with Acute Lupus Erythematosus

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It is the purpose of this preliminary communication to report a phenomenon heretofore not described, namely, aggregation of washed "O" group Rh-positive erythrocytes in a mixture of egg white and fresh plasma and serum obtained from patients with acute lupus erythematosus. The aggregation phenomenon occurs following refrigeration for ½ hr.

The erythrocyte aggregation factor is not destroyed by activating the plasma or serum at 56° C for 30 min. Strong positive plasma or serum kept at room or refrigerator temperature for 10 days gave weak to negative reactions; when kept in the frozen state for one month, positive reactions were obtained which compared favorably with the original result.

The plasma and serum samples containing the erythrocyte aggregation factor also produced the so-called L. E. cell phenomenon (*1–3*).[2] No red blood cell aggregation occurred in a control series of plasma and serum samples obtained from 150 normal subjects.

The test is carried out as follows. Fresh egg white is filtered through 2 layers of gauze, and 10 ml of the filtrate is diluted with 90 ml of physiological saline solution. The egg white is placed in the refrigerator for 24 hr. Group "O" Rh-positive erythrocytes are washed in saline solution, and a 10% suspension is made and stored in the refrigerator for 1 day.

To assure an even mixture of the egg white, the solution is shaken, and 1 ml is placed in a Wassermann tube. To the egg white 0.5 ml of test plasma or serum and 1 drop of the red blood cell suspension are added. The tube is shaken until the erythrocytes are well dispersed. The test is then placed in the refrigerator for ½ hr. Upon removal, the test is centrifuged at 2,000 rpm for 1 min. The tube is gently shaken until the red blood cell button is completely broken up. A positive test shows easily visible clumps of erythrocytes. A normal control is simultaneously shaken along with the test, since the reading is started when the erythrocytes in the control are homogeneously dispersed.

A 5-tube quantitative test may be set up, and the degree of clumping recorded as 1, 2, 3, and 4+, adding amounts of plasma or serum corresponding to the test-tube number—that is, 1 drop in the first tube, 2 drops in the second tube, and so on.

A positive test may be kept in the refrigerator for several days without an appreciable breaking up of the red blood cell clumps. The clumps disappear when the test is placed in a water bath at 56° C for 1 min or at 37° C for 5–10 min. The erythrocyte aggregation phenomenon can be reinduced by placing the test in the refrigerator for ½ hr, then centrifuging and shaking as above.

Whether the cold phenomenon reported here and the so-called L. E. cell phenomenon are produced by the same factor, and whether this factor is common to diseases other than lupus erythematosus, are being investigated.

References

1. BERMAN, L., *et al. Am. J. Clin. Path.*, **20**, 403 (1950).
2. HARGRAVES, M. M. *Proc. Staff Meetings Mayo Clinic*, **24**, 234 (1949).
3. HASEBRICK, J. R., and BORTZ, D. W. *J. Investigative Dermatol.*, **13**, 47 (1949).

Insect Transmission of Western X-Disease of Peaches[1]

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Western X-disease has been reported as the most serious virus disease of peaches in the northwestern United States and British Columbia (*1*). Similar diseases occurring on peach have been described under the name leaf casting yellows in California (*2*) and X-disease in northeastern United States and adjoining areas of Canada (*3*). The disease on peach in

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