Academy in general session. At the annual dinner at the Seelbach Hotel, Herman F. Willkie, of Jos. E. Seagram and Sons, spoke on "Alcohol Goes to War."

In addition to their divisional meetings the Kentucky Geological Society and the Kentucky Society of Natural History conducted field trips in the Louisville area. The latter society became an affiliate of the Academy.

The grants for aid in research of the American Association for the Advancement of Science were awarded to W. R. Allen and to D. R. Lincicome, both of the University of Kentucky. Officers elected for 1943–1944 are as follows:

President, L. A. Brown, Transylvania College.

Vice-President, Paul J. Kolachov, Jos. E. Seagram and Sons.

Secretary, Alfred Brauer, University of Kentucky.

Treasurer, Wm. J. Moore, Eastern Kentucky State Teachers College.

Representative on Council of American Association for the Advancement of Science, Austin R. Middleton, University of Louisville.

Councilor to Junior Academy, Anna A. Schnieb, Eastern Kentucky State Teachers College.

ALFRED BRAUER
Secretary

SPECIAL ARTICLES

THE "VITAMIN M" FACTOR[1]

EARLIER studies by Langston and associates[2] have demonstrated that monkeys which were maintained on diet 600, a modification of the Goldberger diet 268, developed nutritional cytopenia. This deficient diet supplemented with either 2 g of liver extract or 10 g of dried brewer's yeast daily maintained nutritional balance in monkeys. However, the basic diet supplemented with nicotinic acid, riboflavin and thiamine failed to alter appreciably the course of the deficiency manifestations. The term "vitamin M" was proposed for this factor present in liver and yeast which prevents nutritional cytopenia in the monkey. The identification and chemical isolation of additional members of the vitamin B complex suggested to us a study of whether diets supplemented more fully by the other members of the complex would simulate the activity of vitamin M, in preventing nutritional disequilibrium.

Methods and materials. Healthy young adult *Macaca mulatta* were employed in these studies. Three diets were used (Table I). A basic diet free of members of the vitamin B complex was substituted for the 600 diet, since the vitamin content could thereby be more accurately and easily controlled. Diet 1 consisted of the basic diet supplemented with 5 members of the B complex; diet 2 contained 5 other members of the complex in addition to diet 1; and the control diet 3 was made up of the basic diet supplemented with 2 cc of crude liver extract. All the supplements were dissolved in water and administered by means of a stomach tube every other day, except the liver extract which was introduced subcutaneously every other day.

TABLE I

EXPERIMENTAL DIETS

Diet 1
Basic diet

	Per cent.
Sucrose	68
Casein	18
Vegetable oil	8
Salt mixture U.S.P. number 2	4
Cod liver oil U.S.P.	2

Vitamin supplements:

	Daily rations mg
Thiamine hydrochloride	1
Riboflavin	1
Pyridoxin hydrochloride	1
Nicotinic acid amide	25
Calcium pantothenate	3
Ascorbic acid	25

Diet 2
Diet 1 with addition of:

	Daily ration mg
Choline chloride	50
Pimelic acid	1
Glutamine	1
Inositol	1
Sodium paraminohenzoate	50

Diet 3—Control
Basic diet plus 2 cc of liver extract every other day.

Results. All 6 of the monkeys on diet 1 and all 22 monkeys on diet 2 showed progressive weight loss, followed by lethargy, dryness of the coat and finally anorexia and weakness. Minor degrees of gingivitis appeared in about half the monkeys on both diets between the 21st and 44th diet days. As previously reported,[3] the animals on these dietary régimes developed leukopenia between the 4th and 15th weeks and displayed lowered resistance to experimental and spontaneous infections.[4] Significant degrees of anemia developed in less than half of the animals on diets 1 and 2.

Three monkeys each received limited supplements of a yeast residue containing folic acid.[5] They showed marked leucopoietic and clinical remissions during brief experimental periods.

Four monkeys on the control diet, supplemented with liver extract, exhibited none of the deficiency symptoms, in direct contrast to the other monkeys on the experimental diets, and gained weight and were in excellent health over a 6-month experimental period.

[1] This work has been aided by a grant from the International Health Division of the Rockefeller Foundation. Constituents of the special diets were generously furnished by the S.M.A. Corporation.

[2] W. C. Langston, W. J. Darby, C. F. Shukers and P. L. Day, *Jour. Exp. Med.,* 68: 923, 1938.

[3] H. E. Wilson, C. A. Doan, S. Saslaw and J. L. Schwab, *Proc. Soc. Exp. Biol. and Med.,* 50: 341, 1942.

[4] S. Saslaw, J. L. Schwab, O. C. Woolpert and H. E. Wilson, in press.

[5] B. L. Hutchings, N. Bohoros, W. H. Peterson, *Jour. Biol. Chem.,* 141: 521, 1941.

Summary. The factor included in liver extract ("vitamin M") which is responsible for maintaining nutritional and hematopoietic equilibrium in monkeys is (1) apparently not identified with the following constituents as at present isolated: riboflavin, thiamin, nicotinic acid, pantothenic acid, glutamine, pimelic acid, choline, sodium paraminobenzoate, inositol and pyridoxin; or (2) if it is any of these factors, the combined administration of the above respective fractions did not result in the effect obtained with liver extract when given by the parenteral route (hypothetical "M" factor).

The administration of a yeast residue, containing, among other unknown elements, folic acid, more closely simulated the effect of parenteral liver extract than any other material we have thus far had the opportunity to test.

Liberal amounts of the basic diet and fresh water were kept in the cages at all times. The supplements were suspended in water and fed by stomach tube except liver extract which was administered subcutaneously. Diet and supplements were supplied by the S. M. A. Corporation.

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INOSITOL A TUMOR GROWTH INHIBITOR

THE importance of inositol for normal growth was established by the investigations of Eastcott,[1] Woolley[2] and others. There are no reports to date on the influence of inositol on malignant growth.

In this communication we describe the results of experiments dealing with the action of inositol on tumor growth. For these studies a rapid test for tumor growth inhibitors was employed.[3] In this test the inhibition of tumor growth is judged by comparing tumor sizes and tumor weights of treated groups of mice with untreated ones in an experimental period of 48 hours.

In Table 1 a series of experiments is presented, in which varying doses of inositol were studied. From this table it is evident that intravenous injections of inositol inhibit tumor growth, the degree of inhibition depending on the dose injected. Since September, 1942, inositol in varying doses was used in 16 experiments on 400 animals with the corresponding number of controls. The results of these experiments were similar to those presented in Table 1.

TABLE 1

EFFECT ON TUMOR GROWTH OF FOUR INTRAVENOUS INJECTIONS OF INOSITOL IN VARYING DOSES GIVEN OVER A PERIOD OF 48 HOURS*

Group No.	No. of animals in each group	Dose of Inositol γ	Mean terminal tumor weight mg	Standard error
453	11	0 (control: saline)	470	25.6
452	18	38	436	22.8
451	14	50	350	33.6
450	10	75	270	34.1
449	7	100	246	41.1
448	5	150	215	26.4
447	5	250	222	9.8
446	5	1000	142	12.8

*Female Rockland mice transplanted with Sarcoma 180; start of the experiment 8 days after transplantation; mice kept on polished rice diet for the experimental period of 48 hours.

Subcutaneous or oral administration of inositol was ineffective. Equally ineffective were intravenous injections of l-inositol,[4] inosose,[4] crystalline factors of the vitamin B-complex (thiamine, riboflavin, pyridoxine, nicotinamide, pantothenic acid, p-aminobenzoic acid, biotin and choline). Sodium phytate[4] and lipositol[4,5] showed an inhibition similar to that of inositol.

CONCLUSIONS

Inositol was found to inhibit tumor growth. The degree of inhibition depends on the dose injected. Inositol, a pure crystalline substance, can be used as a standard of reference for testing tumor growth inhibitory factors.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

NEW OBJECTIVE METHOD FOR THE DETERMINATION OF THE CIRCULATION TIME

THE determination of the circulation time in animals and human beings has generally been associated with certain disadvantages. The various tests which require subjective cooperation on the part of the patient are open to many criticisms. Some of the disadvantages are evident in the case of children, deaf mutes, moronic or mentally sluggish individuals and

[1] E. V. Eastcott, *Jour. Phys. Chem.*, 32: 1096, 1928.
[2] D. W. Woolley, SCIENCE, 92: 384, 1940; *Jour. Biol. Chem.*, 139: 29, 1941.
[3] D. Laszlo and C. Leuchtenberger, Cancer Research, 1943. To be published.
[4] We are indebted to Dr. D. W. Woolley, of the Rockefeller Institute, New York, for generously supplying us with these substances.
[5] D. W. Woolley, *Jour. Biol. Chem.*, 147: 581, 1943.