Passage of the strain of virus from two monkeys (representing each chimpanzee, respectively) produced characteristic poliomyelitis in two additional monkeys and was negative in mice, guinea pigs and rabbits. The evidence is clear therefore that poliomyelitis virus appeared in the stools of both chimpanzees in the period immediately after ingestion of food and fly-bait, and also at later periods, 20 days after the last feeding in 1 case, and 3 to 14 days in the other. This suggests the likelihood that the chimpanzees acquired subclinical infections or carrier states and that virus multiplied in them. Although virus was continually eliminated by the chimpanzees for periods of about 1 and 2 months, respectively, it is impossible to state from the present data whether the North Carolina materials were solely responsible or whether materials B, C and D, collected in New York and Connecticut, also contributed.

Discussion: The results of these experiments indicate that food exposed to flies at the homes of poliomyelitis patients in an epidemic area may acquire a quantity of poliomyelitis virus sufficient to produce in chimpanzees by oral administration a non-paralytic infection or asymptomatic carrier state. The question concerning the origin of the virus has three possible answers: the food became contaminated with virus (a) prior to its being exposed at the homes, (b) at the homes by means other than flies or (c) at the homes by flies. With respect to (a), the fact that the bananas were peeled and the skins discarded at the homes makes it unlikely that the bulk of the food was contaminated beforehand, although the sugar and water can not be ruled out. In regard to (b), it is possible that contamination of food occurred by handling or by droplets expelled from an individual's sneezing or coughing, although virus has yet to be demonstrated in human saliva or droplets. On the other hand, the fly-bait, situated beneath a fly-trap which was anchored firmly to the ground, was protected by coarse wire screen and was consequently less accessible to certain other agents such as human beings. The balance of probability would seem to favor fly-contamination at the homes.

The observation that food exposed at infected homes within an epidemic area was found to contain virus, serves as additional evidence to support the following *working hypothesis,* which has been tentatively adopted to guide future investigations along these lines. Human poliomyelitis may be transmitted by a number of different routes. Although the disease may occur at any time of the year the tremendous concentration of cases during the warm season is the result of increased dissemination of virus. This may depend on various factors including something which facilitates the contamination of food by insects such as flies. This is based on the fact that flies have been shown to carry virus and also, as probably indicated in this experiment, to contaminate food.

A further step in the testing of this hypothesis will be to conduct a controlled experimental study on the effect of reducing the number of flies during epidemics of poliomyelitis.

Summary: Poliomyelitis virus has been detected in food exposed to flies at homes of poliomyelitis patients within an epidemic area. This was achieved by feeding such exposed food to chimpanzees which developed subclinical infections or asymptomatic carrier states ascertained by positive stool tests in rhesus monkeys.

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THE EFFECT OF DIETARY PROTEIN INTAKE ON THE XANTHINE OXIDASE ACTIVITY OF RAT LIVER

SARETT *et al.*[1] and Unna *et al.*[2] found that the riboflavin level of rat liver is lowered during low protein ingestion. The latter investigators also showed that the ability of the liver to inactivate estradiol *in vitro* was likewise reduced. We have observed the same phenomena of lowered liver riboflavin level from rats on low protein diet. To study this problem further, we started investigating the effect of dietary protein level on the xanthine oxidase activity of the rat liver when we were forced to discontinue the problem due to the urgency of other work. We believe our results, although very preliminary, are worth reporting.

Rats 10 to 12 weeks old were used. One group was kept on an adequate stock diet, while three other groups were fed diets of the following composition: protein, x per cent.; cerelose, 90-x per cent.; salts, 4 per cent.; hydrogenated cottonseed oil, 4 per cent.; and cellulose (pulverized Cellophane), 2 per cent. A daily supplement of 40 γ each of thiamin, riboflavin and pyridoxine, 100 γ calcium pantothenate, 250 γ nicotinic acid, 6 mg choline and one drop of 1,000A–400D feeding oil was given in supplement cups. All diets were fed *ad libitum.* The total protein content of the four diets was: group 1 (stock), 25 per cent.; group 2, 20 per cent., from casein; group 3, 10 per cent., from soybean oil meal; and group 4, 10 per cent., from corn distillers' solubles.

Xanthine oxidase activity was estimated by the method of Axelrod and Elvehjem[3] adapted to the

[1] H. P. Sarett and W. A. Perlzweig, *Jour. Nutr.*, 25: 173, 1943.

[2] K. Unna, H. O. Singher, C. J. Kensler, H. C. Taylor, Jr., and C. P. Rhoads, *Proc. Soc. Exp. Biol. and Med.*, 55: 254, 1944.

[3] A. E. Axelrod and C. A. Elvehjem, *Jour. Biol. Chem.*, 140: 725, 1941.

Warburg respirometer. All determinations were made in duplicate.

From Table 1 it is seen that the measured xanthine oxidase activity of rat liver is decreased approximately 50 per cent. when the protein in the animals' diet is reduced from 25 per cent. to 20 per cent. When the protein level is lowered to 10 per cent., the measurable xanthine oxidase activity is almost (if not completely) lost.

TABLE 1

EFFECT OF PROTEIN INGESTION ON LIVER XANTHINE OXIDASE ACTIVITY

Group	Number of determinations	Xanthine oxidase activity* Range	Average
Stock—25 per cent. protein	4	1,190–1,690	1,420
20 per cent. casein	4	675–918	745
10 per cent. soybean oil meal	4	0–168†	42
10 per cent. distillers' solubles	5	0–100†	20

* Xanthine oxidase activity is given in cu. mm of oxygen taken up in one hour (during the linear portion of the reaction—endogenous uptake subtracted) per gram of dry weight of tissue.

† In several instances the O_2 uptake for the endogenous sample was slightly greater than for the sample with added xanthine.

We wish to thank Miss M. Mueller for assistance in this study.

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THE INHIBITING EFFECT OF QUINONES ON THE GROWTH OF PENICILLIUM NOTATUM

IN the past few years different investigators have studied the inhibitory effect of certain substances on fungi,[1] both saprophytic and pathogenic. Special attention has been given to the inhibitory effect of antibiotic agents, as tyrothricin, pyocyanine and hemipyocyanine on pathogenic fungi.[2] The remarkable antibacterial action of quinones has attracted the attention of various authors.[3,4,5,6] These substances, especially vitamin K, have been suggested as a preventive agency against dental caries,[7,8,9] on account of their capacity to prevent the formation of acids in the buccal cavity.

While investigating the metabolism of *Penicillium notatum*, we became interested in studying the effects of certain quinones on the growth of this mold. The following quinones have been used: 2-methyl-1,4-naphthoquinone, hydroquinone and benzoquinone. We also included β-methylnaphthalene in view of its structural similarity to vitamin K.

The substances were added in the desired concentrations to the Czapek-Dox medium which was sterilized by the Seitz filter; the pH was 6.5. The flasks were inoculated with the strain of *P. notatum* 9178 and incubated at 25° C. Results are given in Table 1.

TABLE 1

THE INHIBITING EFFECT OF QUINONES ON THE GROWTH OF PENICILLIUM NOTATUM

	Chemical substances added (mg per 100 ml Czapek-Dox medium)					
	50	25	10	2.5	1.25	0.625
2-Methyl-1,4-naphthoquinone	0	0	0	0	0	1
Hydroquinone	0	0	0	0	1	3
Benzoquinone	0	0	0	1	2	3
β-Methylnaphthalene	2	3	3	3	3	3

0 = no growth; 1 = limited growth; 2 = regular growth; 3 = abundant growth.

In our experiments all the three quinones, even when highly diluted, revealed their capacity of inhibiting the growth of *P. notatum*. The synthetic vitamin K was more active than the other two quinones. Since hydroquinone and benzoquinone have no vitamin activity, our results also suggest that this inhibitory action is a quinone function independent of the capacity to act as vitamin.

β-methylnaphthalene, in spite of being structurally so similar to 2-methyl-1,4-naphthoquinone, had no inhibiting effect on the growth of the mold.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

FILTRATION OF CITRATED PLASMA

IT has long been apparent that filtration is the only safe and effective method for the sterilization of citrated plasma. However, all previous work has shown that it is practically impossible to filter large amounts of plasma through the usual bacterial filters.

[1] J. E. Kempf and W. J. Nungester, SCIENCE, 100: 411, 1944.

[2] J. L. Stokes, R. L. Peck and C. R. Woodward, *Proc. Soc. Exp. Biol. and Med.*, 51: 129, 1942.

[3] S. A. Waksman and H. B. Woodruff, *Jour. Bact.*, 44: 373, 1942.

[4] A. E. Oxford and H. Raistrick, *Chem. and Ind.*, 61: 189, 1942.

[5] A. E. Oxford, *Chem. and Ind.*, 61: 128, 1942.

[6] W. D. Armstrong, W. W. Spink and J. Kahnke, *Proc. Soc. Exp. Biol. and Med.*, 52: 136, 1943.

[7] L. S. Fosdick, O. E. Fancher and J. C. Calandra, SCIENCE, 96: 45, 1942.

[8] J. C. Calandra, O. E. Fancher and L. S. Fosdick, *Jour. Dent. Res.*, 23: 31, 1944.

[9] W. D. Armstrong and J. W. Knutson, *Proc. Soc. Exp. Biol. and Med.*, 52: 307, 1943.