days. This suggested the possibility of the mothers having contracted the infection by feeding and accordingly the brain of the last one was tested by passage to other mice and found to contain virus. In addition, grown mice of both sexes were allowed to feed on moribund or dead, newly born mice previously infected with virus by the intracerebral route and in 2 of 7 instances the mice died or were sick 7 days after feeding. From these, virus was obtained from the brain by passage to grown mice. A few experiments performed so far, in which mice have been allowed to eat infected adult mouse brains, have all failed to result in clinical infection. This is in agreement with the findings of Brodie.[1]

The importance of the observation that adult mice can be infected by eating the bodies of infected, newly born mice, is that this mode of entry may have epidemiological significance. It is the only mode of entry so far described in which this infection has been transmitted from mouse to mouse by some natural means and not by inoculation. It is particularly important in conjunction with the fact that the wild mouse is susceptible to the virus.

10666 P

Relation of Methionine, Cystine and Choline to Renal Lesions Occurring on Low Choline Diets.

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In a previous report[1] it was demonstrated that a severe pathological state characterized by hemorrhagic degeneration of the kidneys occurs within 10 days in young rats maintained on a low choline diet. This deficiency was prevented by choline. It was suggested that proteins relatively high in methionine and low in cystine possessed a choline-sparing action since the deficiency was produced more readily on diets containing fibrin than on those containing casein. Subsequent work has confirmed the earlier suggestion that choline might prevent the renal lesion resulting from the addition of cystine to a purified diet containing casein. Furthermore, it has been found

[1] Brodie, M., PROC. SOC. EXP. BIOL. AND MED., 1935, **32**, 1647.

[1] Griffith, W. H., and Wade, N. J., in press.

that the addition of methionine to a diet containing fibrin completely protected the rats.

Normal kidneys were found in 40 g rats fed the following diet for 10 days: casein, 15; salt mixture, 4; calcium carbonate, 1; codliver oil, 5; lard, 35; agar, 2; sucrose, 32, and yeast, 6. Hemorrhagic kidneys invariably occurred if 0.3% cystine was added but not if 0.1% choline was added in addition to the cystine.

Hemorrhagic kidneys resulted if the protein of the above basal ration consisted of fibrin, 4; casein, 8, and dried egg white, 3. The addition of 0.04% choline or of 1% dl-methionine completely protected the rats.

The ratio of the 2 amino acids, methionine and cystine, is not the only factor which determines the choline requirement. This became evident from the fact that hemorrhagic lesions were produced on the 15% casein diet by decreasing the level of choline in the diet through substitution of vitamin concentrates for the codliver oil and yeast and through lowering the fat content to 10%. Furthermore, the effect of a fibrin diet in producing the renal lesions was no longer evident if the fibrin was decreased from 15 to 5%. It is suggested that the absolute amount of either methionine or cystine, as well as the ratio of the 2, plays an important rôle in the interrelationship of these 2 amino acids and choline.

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Nitrogen-Containing Carcinogenic Compounds.

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Of all the heterocyclic nitrogen compounds studied, up to the present, none has been related to the carcinogenic hydrocarbons, such as methylcholanthrene, to the extent of containing an anthracene or phenanthrene nucleus. In view of the pronounced carcinogenic action of these hydrocarbons and in view of the fact that certain nitrogen compounds *not* related to these hydrocarbons have been found to be carcinogenic it seemed advisable to study the carcinogenic effect of heterocyclic nitrogen compounds related to these hydrocarbons to the extent of containing an anthracene or phenanthrene nucleus. Further, since certain indole derivatives which are not related to the car-