The level of the transaminases in plasma and tissues, changes under various conditions of experimental and clinical stress and exercise as well as under pathological conditions. Andreotti et al. (1) reported transient increase in serum glutamic-oxalacetic (GOT) and glutamic-pyruvic transaminase (GPT) levels during a boxing match. Lending et al. (2) found that exposure of puppies under reduced atmospheric pressure conditions for 3 hr produced no significant effect on the plasma GOT level. Exposure to heat stress and muscular exercise also increased (3) the serum GOT and GPT levels of dogs as compared to their corresponding controls. Nerdrum and Berg (4) reported an increase in serum
GOT level 10 min after brief exertion, falling to normal within 45 min. Vanlerenbergh et al. (5) found that rats subjected to hypoxia showed a marked increase in serum GOT and GPT levels.

In the present investigation, the effect of exposure to simulated high altitude conditions on plasma transaminase, non-protein nitrogen (NPN) and total protein percentages have been studied both with and without the administration of an antistress drug, methylamphetamine. The aim of administration of methylamphetamine was to assess the efficacy as an antistress drug.

Materials and methods: Male albino rats, weighing approx. 200 g were divided into four groups of eight or more animals each. The drug (methylamphetamine hydrochloride) was given to the animals i.p. at a concentration of 2.0 mg/kg body wt. 30 min prior to drawing of blood or subjecting them to stress. The stress involved keeping the animals in a vacuum chamber for 3 hr at 350 mm of Hg. After the stress period, the animals were quickly anaesthetized with ether and blood was drawn by cardiac puncture into a bottle containing sodium fluoride. Total duration from taking out of high altitude chamber to collection of blood was approx. 7 min. Transaminase in blood was estimated colorimetrically according to the method of Reitman and Frankel (6). Non-protein nitrogen (NPN) in blood was estimated by the method of Folin and Wu (7). Total protein was estimated by Micro-Kjeldahl method (8). Groupings of the animals and their respective treatment were as follows:

Group I - without drug and without stress (under room condition).
Group II - with drug but without stress.
Group III - without drug but with stress.
Group IV - with drug and with stress.

Results and discussions: It may be noted from Table 1 that under normal room conditions when there is no stress (c.f. groups I and II) administration of methylamphetamine hydro-

<table>
<thead>
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<th>Table 1. Serum transaminases, NPN and total protein levels.</th>
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<td>Group</td>
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Significance:

* Values in all four groups are not significantly different (P > .05 for groups II, III & IV versus group I).
** Groups II & III are significantly different from group I (P < .001 for groups II and III versus group I), but not with group IV (P > .05 for group IV versus group I).
*** Groups II, III & IV are significantly different from group I (P < .05 for groups II, III & IV versus group I).
**** Values in all four groups are not significantly different (P > .05 for groups II, III & IV versus group I).
chloride (2.0 mg/kg body wt.) increases serum glutamic pyruvic transaminase (GPT) and NPN values quite significantly while serum GOT and total protein levels remain relatively unaffected.

Damage to organs which involves necrosis of cells or increased cell permeability can be expected to raise the serum enzyme activity (9). Serum GOT increases rapidly after myocardial infarction. Serum GPT is not usually elevated in myocardial infarction unless the lesion is large or there is associated liver damage. The drug methylamphetamine may be regarded as having a slight adverse effect on liver.

Similar significant rises in serum GPT and NPN levels from room condition figure may also be observed under conditions of stress (c.f. groups I and III) of reduced atmospheric pressure alone. One of the explanations suggested by Bedrak (3) for the elevated level of transaminases in the blood serum of animals exposed to physiological stress is a general increase of cellular permeability (10–13). Since administration of catecholamine raises the level of several serum enzymes (14), one may speculate that catecholamines which are released during hypoxic stress (15), may be responsible in part, for the increase in cell permeability. Similar postulations have also been made (15) that hypoxia increases serum enzyme levels by damaging cells and increasing cellular permeability, permitting the escape of certain enzymes into circulation. Cellular damage by hypoxia is evidenced by the development of pathologic changes in the heart and other organs after repeated exposures to high altitude (16). Administration of methylamphetamine (2.0 mg/kg) under altitude stress tends to lower the serum GPT levels (c.f. groups III and IV). Statistically speaking however, it is not significant whether or not the drug methylamphetamine does have an advantageous effect in combating altitude stress.

Under combined effect of stress and drug (c.f. groups I and IV) there was a slight but insignificant rise in serum GOT also as compared to the control.

It may be seen from Table I that the NPN levels are significantly higher in groups II, III and IV as compared to group I (control). Among these groups (II, III and IV) the variation in NPN levels was insignificant.

REFERENCES