that one gram of nitrogen from the lactalbumin ration had the same nutritive effect as 1.08 gm. of nitrogen from the casein and cystin ration.

The carcasses of the lactalbumin-fed animals showed higher percentage of nitrogen storage than those of the casein-fed animals and it was calculated that one gram of food nitrogen from the lactalbumin ration promoted the same storage of nitrogen as 1.39 gm. of food nitrogen from the casein ration.

It was concluded that lactalbumin at an 8% and a 12% level of protein intake showed better growth and better nitrogen retention in rats than did casein at those levels, and it had the same or slightly better nutritive value as casein supplemented with cystin, and it was thus found to be a superior protein of high nutritive value for maintenance and growth.

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Effect of Various Salts on Hemolysis and Skin Necrosis Produced by Staphylococcus Toxin.

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Volk and Lipschutz[1] apparently were the first to study the action of hypertonic salt solutions on staphylococcus hemotoxin. The salts used were NaCl, Na_2SO_4, $MgSO_4(NH_4)_2$, SO_4 and $BaCl_2$. It was their opinion that staphylococcus toxin was not destroyed but that the hemolytic action was inhibited in the presence of hypertonic concentrations of the neutral salts with one exception and that was with $BaCl_2$.

Recently one of us has studied the effect of NaCl on the hemolytic and skin necrotizing factors in staphylococcus toxin.[2, 3] It was found that a hypertonic solution of NaCl inhibited the degree and rate of lysis of rabbits' red blood cells. When a 5% concentration of NaCl was injected intradermally in rabbits prior to the intradermal injection of staphylococcus toxin skin necrosis was inhibited at the site of toxin injection.

The above observations suggested a further study of the effect of

1 Volk, R., and Lipschutz, B., *Wien. klin. Wchnschr.*, 1903, **16**, 1394.

2 Rigdon, R. R., *J. Infect. Dis.*, 1937, **60**, 25.

3 Rigdon, R. H., *Arch. Path.*, 1936, **22**, 763.

TABLE I.

Effect of Various Salts on Hemolysis Produced by Staphylococcus Toxin.*

Salts	Hemolysis: Salt + R.B.C.			Hemolysis: Salt + R.B.C. and Staphylococcus Toxin		
Concentration	M/1	M/2	M/4	M/1	M/2	M/4
NH_4Cl	4	3	—	4	4	—
NH_4Br	4	2	—	4	4	—
NH_4F	0	2	4	0	3	4
NH_4NO_3	4	3	—	4	4	—
$(NH_4)_2SO_4$	±	0	3	3	4	4
NH_4CnS	4	4	4	—	—	—
$(NH_4)_2HPO_4$	0	3	2	4	4	4
$(NH_4)_3Cit$	P	P	P	—	—	—
$(NH_4)_2Ox$	4	4	4	—	—	—
$NH_4Lact.$	4	4	4	—	—	—
$NH_4Acet.$	4	4	4	—	—	—
LiCl	0	0	0	3	4	4
LiBr	1	0	0	2	4	4
$LiNO_3$	±	0	0	±	3	4
Li_2SO_4	0	0	0	±	3	3
Li_3Cit	±	±	±	±	0	1
Li_2Ox	0	0	1	2	4	4
LiLact	0	0	0	1	4	4
LiAcet	0	0	0	1	3	3
NaCl	0	0	0	1	4	4
NaI	1	0	0	0	3	4
NaBr	0	0	0	0	3	4
NaF	4	4	4	—	—	—
$NaNO_3$	0	0	0	0	3	4
Na_2SO_4	0	0	0	3	3	4
NaCNS	4	0	0	1	2	4
Na_2HPO_4	4	4	4	—	—	—
Na_3Cit	±	±	±	4	4	4
Na_2Ox	i	i	±	i	i	4
NaLact	0	1	0	4	3	4
NaAcet	0	0	0	3	3	3
KCl	0	0	0	3	4	4
KI	3	0	0	0	2	4
KBr	0	0	0	0	4	4
KF	1	±	0	3	4	4
KNO_3	0	0	0	0	3	4
K_2SO_4	i	0	0	i	3	4
KCNS	4	3	1	4	4	4
K_2HPO_4	0	0	0	3	3	4
K_3Cit	±	±	0	4	4	3
K_2Ox	0	0	0	3	3	4
KLact	0	0	0	3	3	4
KAcet	4	1	1	—	4	4
$MgCl_2$	0	0	0	0	1	4
$MgBr_2$	4	4	3	4	4	3
$Mg(NO_3)_2$	3	±	0	4	0	±
$MgSO_4$	±	0	0	±	1	2
$MgAcet_2$	1	1	1	1	2	3
$CaCl_2$	2	2	1	2	2	2
$Ca(NO_3)_2$	2	1	±	P	P	P
$SrCl_2$	3	±	0	2	1	2
$Sr(NO_3)_2$	P	2	±	P	P	P
$BaCl_2$	±	0	0	±	±	1
$Ba(NO_3)_2$	i	i	0	i	i	1

*1, 2, 3, and 4, degree of lysis.
P, heavy precipitate.
i, insoluble.
—, not done.

various salts on the hemolytic and skin necrotizing factors in staphylococcus toxin. The salts studied are given in Table I. The toxin preparation is the same as previously used.[2, 3] Washed rabbits' red cells were added to M/1, M/2, and M/4 solutions of the different salts to make a 1% suspension in a 2 cc. volume. The least amount of toxin which would completely hemolyse this concentration of cells suspended in 2.0 cc. of physiological saline was the amount of toxin used in all the tests. The toxin was added not less than 10 minutes after the cells were placed in the salt solutions. The titrations were read after standing at room temperature over night. The control titrations were run without toxin. The pH of all the salt solutions was determined.

Table I shows the effect on the blood cells of the various salts alone and in the presence of the hemolyzing unit of staphylococcus toxin.

From this table it can be seen that certain salts are hemolytic, while other salts are either slightly hemolytic or entirely non-hemolytic. Furthermore NH_4F, LiBr, $LiNO_3$, Li_2SO_4, Li_3 citrate, Li lactate, Li acetate, NaCl, NaI, NaBr, $NaNO_3$, NaCNS, Na acetate, KI, KBr, KNO_3, inhibit the hemolytic action of staphylococcus toxin. Of these salts the halogens and the nitrates show the strongest inhibiting effect.

The methods used to study skin necrosis are the same as given previously.[3] All the salts used in the hemolytic study were injected into rabbits intradermally in 0.5 to 2.0 cc. amounts.

A majority of these salts produced some skin necrosis in either M/1, M/2 or M/4 concentration. Solutions of NH_4Cl, LiCl, NaCl, K_2SO_4, Na lactate, Na acetate, and $MgSO_4$ failed to produce necrosis in the skin in the concentrations used. When either LiCl or $MgSO_4$ in 2 cc. quantities was injected intradermally immediately to 15 minutes before the injection of toxin no skin necrosis occurred at the immediate site of toxin injection. An equal volume of K_2Ox similarly injected into rabbits increased the extent of the skin necrosis.

Several of the results of the above experiments are particularly interesting. First, the effect of certain salts on the hemolysin and the skin necrotizing factors in staphylococcus toxin should be noted. This is strikingly illustrated by LiCl and $MgSO_4$. The former salt inhibits necrosis at the site of injection but has little or no effect on inhibiting hemolysis. The latter, $MgSO_4$, shows a marked suppression of both the hemolytic and skin necrotizing factors. Secondly, the effect of certain salts alone on rabbits' red blood cells and skin

are interesting, for example, the oxalates of Li, Na, K, have little or no hemolyzing power but cause extensive necrosis of the skin. Thirdly, the precipitation of staphylococcus toxin by certain of these salts, such as $(NH_4)_2 SO_4$, the salts of Ba and of Sr, and more particularly the precipitation by calcium chloride and the recovery of the toxin with K_2Ox, which will be subsequently reported, are worthy of note.

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Attempts to Demonstrate Virus-Neutralizing Substances in Saliva and Serum from Mumps Immunes.*

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Active immunity to experimental mumps parotitis in *Macacus rhesus* has been studied by Johnson and Goodpasture,[1] with the following conclusions: "The only reliable experimental method at present of inducing active immunity to mumps in monkeys is by causing a unilateral or bilateral clinical or subclinical specific parotitis by intraparotid inoculation." They failed, except rarely, to demonstate any passive immunity to mumps in monkeys previously injected with the serum of persons immune to this disease, or any marked virus-neutralizing action of human convalescent serum.

As a further step toward understanding the mechanism of active immunity to experimental mumps, the present study has been made concerning the virus-neutralizing properties of human and monkey saliva and of monkey serum.

For this purpose it was decided to inject a number of normal *Macacus rhesus* monkeys by the usual transductal route with variously treated mixtures of mumps virus (saline suspensions of infected glands) and saliva (or serum) from immune or normal animals and human beings. One parotid would receive the immune substance, the other the normal, and the presence or absence of virus-neutralizing substances would be shown by the presence or absence of or difference in the mumps "takes" on the 2 sides, with respect to time of onset and size of gland.

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† National Research Council Fellow in Pathology.

1 Johnson, C. D., and Goodpasture, E. W., *Am. J. Hygiene*, 1936, **23**, 329.