and 42 days respectively with continued daily intraperitoneal inoculations. We have observed the course of the disease in more than 50 leukemic animals of this strain and none has survived for this period of time.

Summary. Injections of adrenal cortical extract into 13 mice of the inbred C58 and RIL strains in the terminal stages of spontaneous lymphoid leukemia resulted in the following responses: (a) An acute response (maximum at 6 hours following initial injection) resulting in a decrease of circulating leukocytes of the blood, a lymphopenia with a corresponding absolute polymorphonuclear leukocytosis and a decrease in the number of circulating immature lymphocytes. (b) These blood alterations become more pronounced following continuous daily injections and tend not to return to the leukemic blood picture within 24 hours after injection of the extract. (c) Regression of infiltrated thymuses and subcutaneous lymph nodes was observed. Regression of the spleen, although definite, was not so pronounced as that observed in other lymphoid tissues. (d) Extensive degenerative changes in immature lymphocytes in thymuses and lymph nodes resulting in pyknosis, dissolution and depletion of these cells. In the spleen similar changes occurred but were not so generalized. Pronounced degenerative changes in immature lymphocytes was observed in thymuses and lymph nodes of mice receiving daily injections over a relatively long period of time. Recovery and repair in these lymphoid organs was slight.

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Intertransformability of *Salmonella simsbury* and *Salmonella senftenberg.**

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It is recognized[1-7] that profound changes may be induced in H antigens of *Salmonella* by cultivating the organisms in serums containing appropriate H agglutinins. Such changes seem to occur particularly in monophasic cultures. Thus, in the stools of a person infected with *S. cholerae-suis* var. *kunzendorf* (VI,VII:1,5) Kristensen and Bojlen[8] found an organism with the biochemical properties of Kunzendorf whose antigens were VI,VII:c. Such variants are easily produced *in vitro* by cultivating Kunzendorf cultures in 1,5 serum. The writers have encountered 12 of these variants occurring naturally among cultures from man and swine. Likewise, Edwards and Moran[7] found that monophasic strains of *S. minnesota* (XXI,XXVI:b) were easily changed to a form with new H antigens (XXI,XXVI:z_{33}) by cultivation in b serum. Cultures with the latter formula occurred naturally among strains isolated from sewage by A. A. Hajna and it seems very

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1 Kauffmann, F., *Z. Hyg.*, 1936, **119**, 104.

2 Gnosspelius, A., *Z. Hyg.*, 1939, **121**, 528.

3 Kauffmann, F., and Tesdal, M., *Z. Hyg.*, 1937, **120**, 168.

4 Edwards, P. R., and Bruner, D. W., *J. Bact.*, 1939, **38**, 63.

5 Bruner, D. W., and Edwards, P. R., *J. Bact.*, 1941, **42**, 467.

6 Edwards, P. R., and Bruner, D. W., *J. Bact.*, 1942, **44**, 289.

7 Edwards, P. R., and Moran, A. B., PROC. SOC. EXP. BIOL. AND MED., 1946, **61**, 242.

8 Kristensen, M., and Bojlen, K., *Zbt. f. Bakt.*, I, Orig., 1936, **136**, 295.

likely that they arose from XXI,XXVI:b cultures by induced variation which occurred in nature.

Observations like the above cast suspicion on *Salmonella* types with unusual H antigens.

A type with hitherto unrecognized H antigens may be a derivative of some known type whose antigens have been changed. Bruner and Edwards[9] described *S. simsbury* (I,III,XIX:z_{27}) as a new type with distinct H antigens. Subsequently 10 additional representatives of *S. simsbury* were recognized among cultures received for typing. While the organism seemed to constitute a valid *Salmonella* type and was so accepted, the observations on *S. minnesota* indicated the need for further study of the relationship of *S. simsbury* to *S. senftenberg* (I,III,XIX:g,s,t).

Nine cultures of *S. simsbury* were plated and single colonies selected. The single colony isolations were examined and found to have O and H antigens characteristic of the type. They were inoculated into semisolid agar to which had been added z_{27} serum freed of O agglutinins by absorption with boiled cultures of *S. senftenberg*. One culture gave evidence of change in the H antigens by spreading slightly in the first transfer in serum-semisolid medium. From this spreading growth a form indistinguishable from *S. senftenberg* was isolated. Similar changes were observed in the remaining 8 strains of *S. simsbury* after 6 to 11 transfers in the medium.

The cultures of *S. simsbury* which had been changed to I,III,XIX:g,s,t and 10 typical cultures of *S. senftenberg* were then planted in semisolid medium containing g,s,t serum. These cultures proved more resistant to change than did the original *S. simsbury* strains. After 10 to 12 serial transfers over a period of 2 months they began to spread very slowly through the medium. After several additional transfers a form which had H antigens unlike any known *Salmonella* type was isolated from all the cultures. To this form the symbol z_{34} was applied.

The z_{34} forms were then transferred serially in semisolid medium which contained both g,s,t and z_{34} serums. After numerous transfers over a period of 3 months one of the *S. senftenberg* cultures spread rapidly through the medium. From this culture a form having the antigens I,III,XIX:z_{27} was isolated. The remaining z_{34} cultures gave no evidence of change.

The agglutinative characteristics of the various forms are given in Table I. Absorption tests confirmed the results obtained by agglutination. The g,s,t form of *S. simsbury* removed all agglutinins from *S. senftenberg* serum. Likewise, the z_{27} form of *S. senftenberg* exhausted *S. simsbury* serum. The changes brought about may be summarized as follows:

I,III,XIX:z_{27} ⟶ I,III,XIX:g,s,t
I,III,XIX:g,s,t ⟶ I,III,XIXz_{34} ⟶
I,III,XIX:z_{27}

S. simsbury and *S. senftenberg* must have descended from the same ancestral stock. Possibly this ancestor was a typical diphasic *Salmonella* which shifted normally between g,s,t and z_{27} phases. A stock culture of *S. simsbury* that had been transferred regularly on agar slants for 5 years was found to possess H antigens like those of *S. senftenberg*. The conditions under which the culture was kept made it highly improbable that it was mislabelled. This apparent spontaneous change of a stock culture from z_{27} to g,s,t supports the hypothesis that the ancestor of the two types was diphasic. A second possibility is that the parent culture was a more complex monophasic strain which spontaneously divided into two simpler components. Loss variation of this sort occurs in *S. hormaechei* (XXIX,Vi:z_{30},z_{31}) which produces XXIX,Vi:z_{30} and XXIX,Vi:z_{31} variants which are quite stable but which can be changed each into the other by growth in appropriate serums (Edwards[10]). A third possibility is that the very rare *S. simsbury* is an induced variant of the commonly occurring *S. senftenberg* just as XXI,XXVI:z_{33} seems to be an induced variant of XXI,XXVI:b. The difficulty of the g,s,t⟶z_{27} variation does not support this view.

It is not possible to state exactly how

9 Bruner, D. W., and Edwards, P. R., PROC. SOC. EXP. BIOL. AND MED., 1942, **50**, 174.

10 Edwards, P. R., *J. Bact.*, 1946, **51**, 523.

TABLE I.
Agglutination and Absorption Tests.

Serums	Antigens					
	Senftenberg (g,s,t)	Senftenberg (z_{34})	Senftenberg (z_{27})	Simsbury (z_{27})	Simsbury (g,s,t)	Simsbury (z_{34})
Senftenberg (g,s,t)						
Unabsorbed	20000	0	500	500	20000	0
Absorbed by						
Simsbury (g,s,t)	0	0	0	0	0	0
Senftenberg (z_{34})	10000	0	500	500	10000	0
Senftenberg (z_{27})	10000	0	0	0	10000	0
Simsbury (z_{27})						
Unabsorbed	0	0	10000	10000	0	0
Absorbed by						
Senftenberg (z_{27})	0	0	0	0	0	0
Simsbury (z_{34})	0	0	10000	10000	0	0
Simsbury (g,s,t)	0	0	10000	10000	0	0
Senftenberg (z_{34})						
Unabsorbed	0	5000	500	500	0	2000
Absorbed by						
Senftenberg (g,s,t)	0	2000	500	500	0	2000
Simsbury (z_{34})	0	200	0	0	0	0
Simsbury (z_{34})						
Unabsorbed	0	5000	500	500	0	5000
Absorbed by						
Simsbury (z_{27})	0	5000	0	0	0	5000
Senftenberg (z_{34})	0	0	0	0	0	200

Figures indicate highest dilutions at which agglutination occurred.
0 indicates no agglutination at 1 to 200.

S. simsbury arose but since it obviously came from the same ancestor as *S. senftenberg*, it seems logical to omit *S. simsbury* from the Kauffmann-White classification and to assign *S. senftenberg* the formula I,III,XIX:-g,s,t—z_{27}.

Summary. By growth in serums it was possible to change *S. simsbury* (I,III,XIX:z_{27}) into *S. senftenberg* (I,III,XIX:g,s,t) and vice-versa. The z_{27} ⟶ g,s,t change was accomplished without difficulty but the reverse was done only by first transforming the H antigens to a hitherto unrecognized form (z_{34}) and then changing them to z_{27}. It is recommended that *S. simsbury* be dropped from the classification and that the formula of *S. senftenberg* be written I,III,XIX:g,s,t—z_{27}.