# RESYNTHESIS OF TISSUE PROTEINS AFTER THERMAL BURNS

T. L. Zaets and T. A. Borisova

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The dynamics of incorporation of lysine-$C^{14}$ into total proteins of the organs was studied in animals after thermal burns. Three weeks after burning,the rate of incorporation of lysine into liver, serum, and myocardial proteins was higher than in the control animals.

Against the background of the intensified breakdown of tissue proteins characteristic of burns, the problem of their resynthesis is particularly important.

The work of Blocker et al. [4] showed that protein resynthesis in the burned animal not only is not depressed, but is in fact stimulated. However, the protein deficiency may not be made good under these circumstances because of predominance of catabolism. The work of other investigators [2-5] and the writers' previous investigations [1] suggest that the change in the rate of protein synthesis after burns is specific for each organ and that there is no uniform pattern of change in the intact organism on the 2nd and 6th days after burns. The subsequent course of the condition is characterized by an increase in disturbances of protein metabolism: an intensification of protein breakdown, leading to hypo- and dysproteinemia.

The characteristics of the changes in protein synthesis at this period (the 3rd week after burning) were the subject of study in the present investigation.

## EXPERIMENTAL METHOD

Experiments were carried out on albino rats weighing 150-200 g on which a 3rd degree flame burn covering 20% of the body surface was inflicted. The rate of synthesis of tissue proteins was investigated by determining the dynamics of incorporation of lysine-$C^{14}$, given to the rats in a dose of 150 $\mu$Ci per animal, into the total tissue proteins. The animals were killed 2, 4, 6, and 24 h after administration of the isotope. The proteins were isolated preparatively and the radioactivity present in 5 mg of dry protein was determined with a Geiger-Müller counter.

## EXPERIMENTAL RESULTS AND DISCUSSION

The results given in Table 1 show that incorporation of lysine-$C^{14}$ into total proteins of most organs of the burned animals (blood serum, liver, kidneys, adrenals, spleen, pancreas, cardiac and skeletal muscle) was significantly increased above normal. The increased level of incorporation of the isotope, with a shift of the maximum, indicates a higher rate of incorporation of lysine into the serum and liver proteins of the burned rats. Since a similar pattern was discovered when the incorporation of glycine-$C^{14}$ and methionine-$S^{35}$ into these same proteins was investigated [1], it can be concluded that the synthesis of serum and liver proteins is increased in burned animals both on the 6th day and in the 3rd week after burning.

No significant shift of the maximum of lysine-$C^{14}$ incorporation into protein could be found in the skeletal muscle of the burned rats, but in the myocardium after burning, together with an increase in the level

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TABLE 1. Incorporation of Lysine-$C^{14}$ into Proteins (Pulses/min/5 mg Protein) of Organs of Control and Burned Rats 3 Weeks after Burning (M ± m)

| Organ studied | Time after injection of lysine-$C^{14}$ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 h | | | 4 h | | | 6 h | | | 24 h | | |
| | control | burns | P | control | burns | P | control | burns | P | control | burns | P |
| Blood serum | 2935±116 | 3179±293 | >0,2 | 3712±316 | 7296±281 | <0,001 | 3951±152 | 5390±362 | <0,02 | 3017±198 | 3584±214 | >0,05 |
| Liver | 793±52 | 1223±87 | <0,001 | 1568±82 | 2294±93 | <0,001 | 1612±56 | 1679±44 | >0,2 | 1638±72 | 1876±72 | <0,05 |
| Kidneys | 1289±68 | 1307±74 | >0,2 | 1684±85 | 2410±87 | <0,001 | 1987±94 | 1710±58 | <0,05 | 1938±88 | 2038±107 | >0,05 |
| Adrenals | 938±42 | 1300±44 | <0,001 | 1010±36 | 1363±68 | <0,001 | 2462±72 | 4419±70 | <0,001 | 1574±35 | 2363±40 | <0,001 |
| Spleen | 864±24 | 1532±38 | <0,001 | 1942±44 | 4464±78 | <0,001 | 2022±46 | 3904±45 | <0,001 | 2745±30 | 3427±31 | <0,001 |
| Pancreas | 640±12 | 1162±26 | <0,001 | 3592±31 | 6185±41 | <0,001 | 2922±18 | 3461±24 | <0,001 | 1741±15 | 1778±19 | >0,02 |
| Heart | 325±23 | 408±16 | <0,01 | 893±22 | 1205±34 | <0,001 | 946±15 | 1131±17 | <0,001 | 1184±19 | 1161±13 | >0,02 |
| Skeletal muscle | 154±20 | 77±24 | <0,05 | 285±31 | 606±46 | <0,001 | 291±30 | 555±34 | <0,001 | 520±34 | 655±41 | <0,05 |
| Intestine | 2080±159 | 1899±133 | >0,2 | 3652±214 | 4309±225 | >0,05 | 4672±204 | 5184±211 | >0,05 | 4736±114 | 4096±162 | <0,05 |
| Cerebral cortex | 277±14 | 262±14 | >0,2 | 600±22 | 636±19 | >0,1 | 619±18 | 625±15 | >0,1 | 709±25 | 604±22 | <0,05 |
| White matter of brain | 197±11 | 199±12 | >0,2 | 333±14 | 511±17 | <0,001 | 623±24 | 534±26 | <0,05 | 693±26 | 508±17 | <0,02 |
| Cerebellum | 267±19 | 234±10 | >0,1 | 401±27 | 696±34 | <0,001 | 707±28 | 605±15 | <0,05 | 714±29 | 581±24 | <0,02 |
| *n* | 5 | 5 | | 5 | 5 | | 5 | 5 | | 5 | 5 | |

of radioactivity in the proteins there was also a shift in the maximum of incorporation, which occurred sooner. It can be concluded from these results that protein synthesis in the myocardium is intensified 3 weeks after burning. The incorporation of lysine-$C^{14}$ into the proteins of the central nervous system was also altered in the burned animals. Normally the highest rate of synthesis was found in proteins of the cerebral cortex, since the maximum of incorporation of lysine-$C^{14}$ into cortical proteins was reached 4 h after injury, compared with 6 h after injury into proteins of the white matter of the brain and cerebellum. After burn trauma, however, the rate of incorporation of lysine into proteins was changed in the white matter and cerebellum. It was concluded from the shift of 4 h in the maximum of lysine-$C^{14}$ incorporation that lysine incorporation was accelerated during the synthesis of proteins in the cerebellum and white matter of the brain.

No shift in the maximum of lysine-$C^{14}$ incorporation into proteins was observed in the early period in the pancreas, spleen, or adrenals; the curves of lysine-$C^{14}$ incorporation, although at different levels in normal animals and after burning, followed a parallel course. Increased incorporation of lysine-$C^{14}$ into the proteins of these organs may reflect not accelerated protein synthesis in this situation, but the influence of the changed pool of free amino acids on incorporation of the radioactive amino acid.

The results indicate a heterogeneous pattern of changes in intensity of protein synthesis in the different organs 3 weeks after burning. Proteins of the liver, blood serum, and heart muscle are evidently synthesized more intensively in burned rats than in normal rats. Protein synthesis is not accelerated in the other organs (adrenals, spleen, pancreas), but the change in intensity of lysine-$C^{14}$ incorporation into proteins may be the result of a change in the concentration of amino acids in the amino acid pool. In this way, profound disturbances of protein metabolism after burns and the increased protein catabolism do not rule out the possibility of an increased rate of their resynthesis and activation of reparative processes in a number of organs.

## LITERATURE CITED


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