GRAMICIDIN

ZUBAY "ORIGINS OF LIFE" (2000) p. 325

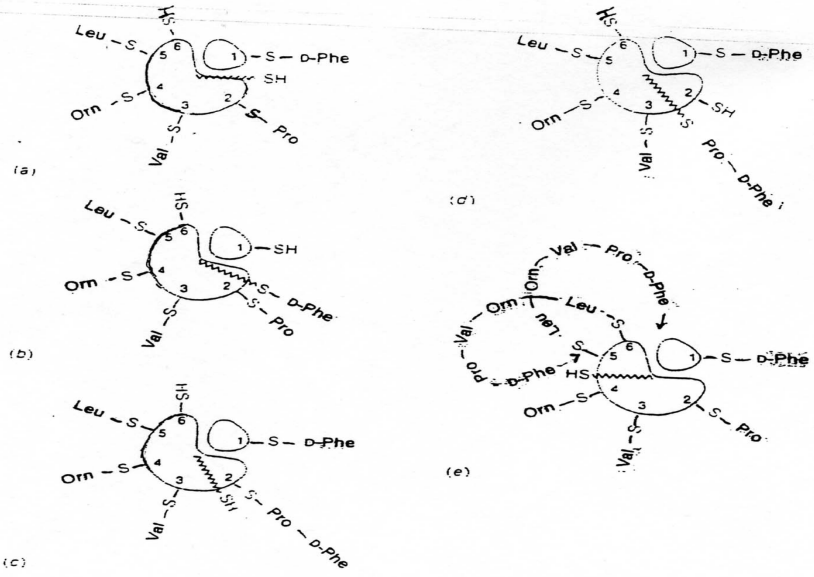

FIGURE 1 The formation of gramicidin S on a protein template. (a) The activated amino acids are held in thioester linkage on the light and heavy enzymes. The phenylalanyl residue has undergone racemization and is being transferred to the pantetheine arm on the heavy enzyme. (b) The first peptide bond is about to be formed by transfer of the phenylalanyl group from the pantetheine group to the prolyl residue. (c) The phenylalanylprolyl residue is about to be transferred to the free thiol group of the pantetheine arm. The light enzyme has accepted another phenylalanyl residue that already has undergone racemization. (d) The phenylalanylprolyl residue is about to be transferred to the valyl residue. (e) The first pentapeptidyl group after being made was transferred to waiting site 6. The second pentapeptidyl group just has been completed and is about to be condensed with the first to yield the decapeptide gramicidin S. The pantetheine arm is now free to repeat the process.

ALL PROTEINS ARE MADE BY RNA-MEDIATED PROCESSES. MESSENGER, TRANSFER, AND RIBOSOMAL RNA'S EXIST TO MAKE PEPTIDE BONDS, AND MOST GENES SPECIFY SEQUENCES OF AMINO ACIDS. THIS HAS CONTRIBUTED TO THE "RNA WORLD" THEORY -- THAT IN AN EARLIER FORM, CELLS ALSO HAD RNA GENES AND ENZYMES WERE "RIBOZYMES."

BUT COULD THE SYNTHESIS OF GRAMICIDIN BE A "FOSSIL" OF AN EVEN OLDER PROCESS, COULD THERE HAVE BEEN SOME KIND OF CELLULAR METABOLISM BEFORE THE RNA WORLD? GRAMICIDIN FORMS PROTON CHANNELS (STRYER IV p 274) AND IS USED AS A TOPICAL ANTIBIOTIC (NEOSPORIN).