CONCLUSIVE SUMMARY

(i) Teichoic acids (TA) occur on the cell walls of most Gram-positive bacteria as well as on the outer surfaces of cytoplasmic membranes and were first discovered in 1958 by James Baddiley. They consist of polymerised polyolphosphates. TA's are classified into two types depending on the site of occurrence, namely membrane teichoic acid and wall teichoic acid which differ also chemically. Membrane teichoic acids are polyolphosphates of exclusively glycerol, while wall teichoic acids may be glycerol or ribitol polyolphosphates. Even in the ribitol TAs there are wide variations from organism to organism regarding the substituents. The wall TA of *Staphylococcus aureus* is a ribitol polyolphosphate containing ester linked D-alanine and N-acetylglucosamine residues attached to ribitol moiety.

(ii) Being cationic in nature TA's are expected to act as chromotropes to induce metachromasia of suitable cationic dyes; but surprisingly no such report existed in the literature. We have shown that TA induces distinct metachromasia in the strongly aggregating dyes pinacyanol and 1,9-dimethylmethylene blue, and also red shifted J-band is induced in the cyanine dye carbocyanine. However TA's have weak chromotropic character and failed to induce distinct metachromatic band in common cationic dyes like acridine orange, methylene blue etc.

(iii) There have been no report on the conformation of TA's when we undertook the present investigation. We have shown that TA of *S. aureus* induces strong circular dichroism in the dye pinacyanol, and the CD spectrum is almost like the mirror image of dichroism induced in the dye by poly-(L-glutamate) at neutral pH, leading to the inference from analogy that TA has a right handed extended helical conformation, and not a random coil. TA itself shows dichroism in the short UV region, the ellipticity of which decreases with ionic strength as well as with increasing

concentration of the polymer. TA also induces dichroism in the thiazine dye 1,9-dimethylmethylene blue, and also in carbocyanine thus supporting the conclusion derived from the dichroism of TA-PCYN system.

(iv) The biological importance of TA is yet to be revealed, and upto till now it has been the belief that TA has strong affinity for bivalent metal ions, particularly for Mg^{2+}. We developed a method of semi-quantitatively assessing the relative affinities of TA for Ca^{2+} and Mg^{2+}. The genesis of the method is dependent on the destruction of metachromasia of dye-polymer systems by metal ions. The results show that TA does not exhibit any special affinity for Mg^{2+}, and the affinity for Mg^{2+} is only marginally higher than that of Ca^{2+}.

(v) The relatively weak chromotropic character of TA has been revealed from the spectroscopic and dichroic probe of the competitive binding of a dye by TA-DNA, and TA-poly(styrene sulfonate) (PSS). The results indicate that TA is a much weaker chromotorpe than PSS, and the chromotropic character is comparable to that of DNA, which has been branded as a weak chromotrope earlier.

(vi) The results of conductometric titrations show that TA binds the drugs neomycin, gramicidin-D and daunomycin with 1:1 stoichiometry, similar to the binding of dyes acridine orange, 1,9-dimethylmethylene blue by TA. TA, and also DNA, does not bring any appreciable change in the absorption and CD spectra of actinomycin D.

(vii) It is known that while Gram-negative bacteria are sensitive to the antibiotic neomycin (NMC), unlike the Gram-positive bacteria containing the teichoic acids. NMC does not have any chromophore to absorb in the normal uv-vis range. So our spectroscopic probe of the affinity for NMC of TA has been an indirect one. Spectrophotometry shows that NMC has a very strong affinity for TA as reflected by a complete destruction of the metachromasia of

TA-DMMB and TA-PCYN systems by addition of NMC. This finding may have biological implication in the sense that TA's present in the wall and membrane of the Gram-positive bacteria may act as trap for NMC, thus inhibiting the permeability of the drug to the cytoplasm. Results of the competetive binding of NMC by TA and DNA show that the binding constant of NMC by TA is slightly higher than that by DNA.