OBJECTIVES
Chapter 3.0 - OBJECTIVES & RATIONALE
3.1. CURRENT RESEARCH TRENDS AND NEEDS WITH REFERENCE TO \textit{L.\textsc{monocytogenes}}.

For decades, \textit{Listeria \textsc{monocytogenes}} and Listeriosis has been a broad field of research. The ‘International Symposium on Problems of Listeriosis’, shortly referred to, as ‘ISOPOL’ has been a major platform for global researchers in the area to consolidate research progress, every third year. ISOPOL has been a platform for discussions on \textit{Listeria} since the year 1957. From the agenda of the ISOPOL, \textit{Listeria} / Listeriosis, research can be classified into five main areas, namely,

- Biology of \textit{L.monocytogenes}.
- Pathogenicity of \textit{L.monocytogenes}.
- Epidemiology and clinical aspects of \textit{L.monocytogenes}.
- Prophylaxis and control of \textit{L.monocytogenes}.
- Social sciences in \textit{Listeria} control.

This bacterium being a pathogen that is food-borne, major research focus is applied, and understandably towards its control and/or elimination at the source or at the sites of incidence be it food or the food-processing environments. As mentioned earlier, due to its pathogenic behaviour much of the research discussions on \textit{Listeria} are on the pathogenicity, epidemiology and prophylaxis of the bacterium and the disease caused. It will be un-callous to state that, even the biology of the bacterium is discussed with emphasis on its pathogenic nature. Though there have been voluminous and commendable contributions on the cell biology, physiology and genetics of the bacterium, they have been with reference to the pathogenic state of the bacterium.

Marth \textit{et al}, on summarising the research needs with reference to \textit{L.monocytogenes} categorise the needs into,

- Regulatory Perspective
- Industrial Perspective
- Academic perspective

Research on \textit{L.monocytogenes} in terms of regulatory perspectives would address
issues pertaining to Consumer exposure to the pathogen, easy and rapid
detection and enumeration of the pathogen in food and the control measures on
the incidence of the pathogen in food.
Research with Industrial perspective would focus on the development of
pathogen control strategies, which would include Good Manufacturing Practices
(GMP’s), Standard Operating Procedures (SOP’s), Standard Sanitary Operating
Procedures (SSOP’s), Food safety measures (Hazard Analysis & Critical Control
Points (HACCP) etc.
As for academic perspective, research needs will have to address issues beyond
and far from the scope of the industrial and the regulatory research
communities. Academic research will have to deal with understanding the
proteomic and genomic expression of the pathogen under different conditions.
Also it is essential to understand if, how, where and when, the pathogen would
express special genomic components. Further more it is a need to understand
with a holistic approach on the existence of the pathogen in its true niche, its
ecological interactions and response under normal and stressful conditions.
Understandably, the research pursuit, as is being described in this thesis note,
very much addresses the issues pertaining to the ecology, interaction and
existence of the pathogen in its true niche at the molecular level by analysing the
gene expression pattern of the bacterium in different conditions.
3.2 RATIONALE AND SIGNIFICANCE OF THE RESEARCH CARRIED OUT.

Fundamentally, much has been reported and reviewed from phylogeny to taxonomy to genomics of *L.monocytogenes*. However, the genomic and proteomic endowment of what, how, where and when the organism expresses, still has a gargantuan area to be explored.

*L.monocytogenes* is an emerging model for prokaryotic transcriptomics (Cossart and Archambaud, 2009), however, as could be expected, due to the pathogenicity and obviously for the high mortality rate and the epidemiological history that Listeriosis has been tagged with, expression studies of the organism within a host, has been the maximum. Expression studies of special genome components of *L.monocytogenes* in its non-pathogenic mode in the terrestrial ecosystem, in interaction with other bacteria, protozoa, nematodes and insects had commenced early this decade and now has taken to the sapling stage. Also, the gene expression studies of the bacterium under specific stress conditions are underway. All the gene expression studies on the bacterium but for the one under stress conditions have immediate implications towards understanding the bacterium better, as a pathogen.

Having to appreciate the existence of *L.monocytogenes* in their terrestrial niche and to understand the gene and protein expression profiles existing as a component of biofilms, either in the pure or mixed population state will provide invaluable data. This data will give insight into the expression profile of the organism in actual surface association that will be of relevance both to its ecology and its pathogenesis. Till date the understanding along these lines has been primitive. Of special interest are the associations of *L.monocytogenes* with other microbes. Characterisation of the microbial communities with which *Listeria* is associated in nature, and in the processing plants and foods will yield intriguing results. The biological and ecological relevance of the findings would be greatly complemented by investigations on how the organism responds and copes with the stress encountered in the actual microbial communities of which it is a denizen. This necessarily includes further understanding of not only how *Listeria* may interact with other bacterial species, but also how different strains
of *L. monocytogenes* may interact with each other. The objectives of the research pursuit as narrated in this thesis note is towards understanding the expression pattern, both in terms of cellular and genetic expression of the pathogen at different forms of growth in the presence of another bacterium, as may be the case in its true niche, adds value and novelty and make this study intriguing.
3.3 BULLETED OBJECTIVES.

i) To study and profile the gene expression by sessile cells (biofilms) of *L. monocytogenes*.

ii) To compare the gene expression by sessile cells to planktonic cells of *L. monocytogenes*.

iii) To study the gene expression and community behavior of *L. monocytogenes* as biofilms in the presence of *Bacillus Sps*. 