

## Colourful Side of Bacteriology: The Pigmented Bacteria

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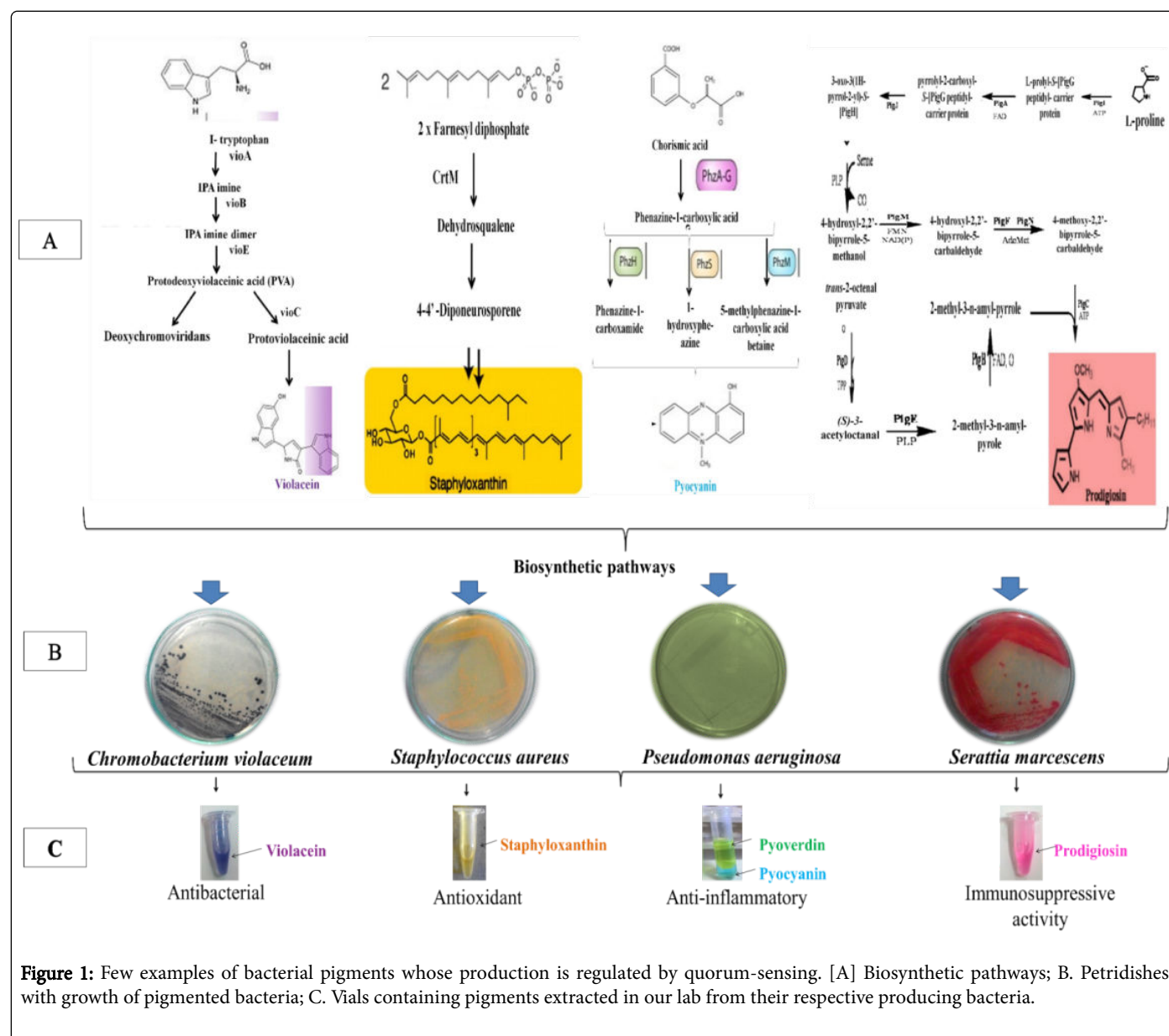
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### Image Article



The characteristic of pigment production is widely distributed among life forms of all domains of taxonomy. Animals, plants, and microorganisms-different members from all these diverse living groups have been reported to produce a variety of pigments. Among microorganisms, pigments displaying a wide diversity of colour,

structure, and function have been reported. Though much has been published regarding microbial pigments, much more remains to be investigated, particularly regarding their biological role in the producing organism(s). Our knowledge regarding the evolution of

pigment production in microorganisms, and the ecological significance of these pigments is still limited.

Many of the pigments produced by pathogenic bacteria have been shown to act as a virulence factor. They have also been reported to possess a variety of biological activities in vitro/in vivo. Few examples of such bacterial pigments are shown in Figure 1. Production of all the pigments shown in this figure is believed to be associated with quorum-sensing (QS) in bacteria. QS refers to a population-density dependent regulation of the behavior of the given microbial population. Since pigment production in many of the pathogenic bacteria (e.g. *Pseudomonas aeruginosa*, *Staphylococcus aureus*, etc.) is under control of QS, the genetics of pigment production assumes high importance in clinical context. Many of the screening assays for identifying novel QS-inhibitors also employ pigment production as the test parameter. Some of these bacterial pigments (e.g. *prodigiosin* from *Serratia marcescens*) have the potential of being developed as a commercial product, and hence the metabolic pathways and the genes involved in biosynthesis of these pigments attract attention from an industrial perspective too.

Figure 1 displays biosynthetic pathways for four of the bacterial pigments; the coloured growth of *Chromobacterium violaceum* (producer of the violet pigment-violacein), *Staphylococcus aureus* (producer of the orange-yellow staphyloxanthin), *Pseudomonas aeruginosa* (producer of the green pyoverdine, and blue pyocyanin), and *Serratia marcescens* (producer of the pink-red prodigiosin); and the respective pigments extracted in different solvents. Genetics underlying the production of these bioactive pigments is being intensively studied, and the gene(s) involved have also been

characterized. For example the *vio* operon regulating the production of *violacein* containing five genes *vio A-E* [1]; the *pig* cluster associated with biosynthesis of *prodigiosin* in *Serratia* [2]; *staphyloxanthin* biosynthesis genes organized in the *crtOPQMN* operon [3], etc. Information regarding the genetics of pigment production in bacteria is important from medical as well as industrial perspective. This information can be used in certain cases to construct overproducing mutants for the pigments which have any commercial application [4], and in other cases to devise novel anti-virulence strategies to reduce QS-regulated pigment production in pathogenic bacteria. In any case, studying this colourful aspect of the microbial world, i.e. microbial pigments (and the genetics of their production) is likely to add considerably to our understanding regarding evolution of pigment production in nature, and ecological role of these pigments. This knowledge can have implications in the fields of medicine, as well as, biotechnology industry.

## References

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