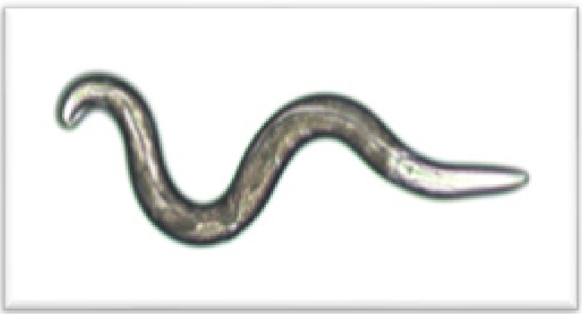
Wound Research: Insights from a Mighty Miniature Model, *Caenorhabditis Elegans*

Pooranachithra M*
Department of Biotechnology Science Campus-Alagappa University Tamil Nadu.
Email: pooranachithra@gmail.com

Delving into the world of miniature wide opens a new vision to the existing research. Identifying potential of the minuscule encourages the development of current research. It becomes a massive power when such a miniature mimics the entire system of mammals. One such wonderful wicked weapon among the model systems is a nematode which is the title hero of the current story, *Caenorhabditis elegans*.



It is a microscopic model with the adult having 3 mm in length. One can manifestly witness its elegance by the transparency of the worm through the microscopic eyes. The miniature model is being used by the researchers all over the world for more than decades in various fields of Science. Our group, led by Prof. K Balamurugan, Department of Biotechnology, Alagappa University, Karaikudi, Tamil Nadu primarily focuses on the research based on host-pathogen interactions and have published quality of research findings on a number of human pathogens. The former

* Ms. Pooranachithra M, Ph.D. Scholar from Alagappa University, Chennai, is pursuing her research on "Identification and Characterization of Targets Involved and Ability of Natural Compounds in Wound Healing Process using Model Nematode *Caenorhabditis Elegans*." Her popular science story entitled "Wound Research: Insights from a Mighty Miniature Model, *Caenorhabditis Elegans*" has been selected for AWSAR Award.

research scholars of the group have given a special attention to understand how a eukaryotic host system elucidates the innate immune responses against bacterial pathogens by targeting the effector systems involved. Each research finding attests the role of physiological/biochemical/neuronal cells in innate immune response of the host system during infection with various human pathogens.

In common, all of the tested pathogens were found to reduce the survival of the host, however, the interaction with the host varied for each of the pathogen tested. As a notable concern, the host system was found to exhibit biphasic and triphasic expressionpattern of regulatory players during infection. Recently, the key proteins involved in regulatory events during bacterial infection were uncovered through 2D-based proteomic approach. Excluding the host pathogen interactions, our research group fascinated their research towards ageing, obesity, reproductive defects and post-translational modifications. The writer of the present story is a member of this research group who is engaged in exploring the potential of the model nematode for utilised in wound research.

Wound is a common threat worldwide. The term 'wound' comprises all kinds of injuries from scratch to laceration. Briefly, it is a damage or disruption of the normal anatomy of the biological system. The damageinstigates a process of restoration named healing, which is customary for all biological systems. Due to the environmental factors and deterioration of the individual's immune, the biological system is unable to accomplish the processes of healing. Hence, external inducer(s) in the form of therapeutic agents are required to endorse the system to promote healing. In the era of wound research, lot of therapeutics are being investigated to address the wound-healing process through antibacterial therapy. However, there is not much attention given for wound closure-related therapeutics. Hence, a simple model system is needed to take the research forward to delineate healing and closure-related therapeutics.

The process of healing may vary from one organism to another, depending on the skin architecture, although the basic ideology behind the healing is common over eukaryotes. Hence, an outcome, from the wound research in a simple model will pave way for a new window of knowledge to demote the wound complexities over the horizon. One of the major complexities of injury, which is contemplated over here, is infection at the site of injury. The process of healing is interrupted and delayed by the incidence of infection and it deliberatelyescort to a chronic state of the wound. Hence,fortifying the immune system against wound infection becomes obligatory. In this context, the research work of the writer endeavours to provide new insights from the wound infection studies using the model nematode, *C. elegans*.

The incidence of injury in *C. elegans* was first reported in 2008 by Pujol and subsequently the simple nematode was being employed for understanding thewound-healing process. Based on functionality, the simple epithelial epidermis and overlaying collagen cuticleofthe nematode is comparable with mammalian hypodermis and the outer dermis, which becomes a massive advantage of using this modelin wound research. Earlier, wounding of *C. elegans* was done individually using femtosecond laser and microinjection needle. In my study, a novel wounding protocol wasdiscussed to provide voluminous wound population in a single venture. The protocol requires truncated glass wool pieces to wound *C. elegans*. The occurrence of injury was confirmed by morphological changes as well as other parameters of wounding such as reactive oxygen species, calcium signalling, F-actin dynamics and collagen content. By evaluating the different parameters of healing, the active principles from plant sources accountable for healing and closure were assessed. Briefly, the wounded *C. elegans* were subjected to preliminary screening with phytocompound(s) for their wound-healing abilities. Furthermore, the mode of action of selective active principles was investigated through analysing the global transcriptomics and proteomics alterations during the course of healing/closure and this part of research is communicated to an International Journal.

To extend the research on wound-healing process, a wound-infection model was developed using *C. elegans*. Briefly, the wound-infection model was established by exposing the wounded *C. elegans* with a pathogen, *Staphylococcus aureus*, which is commonly noted in most of the wound infections. The impact of the pathogen on wounded worm was assessed through their lifespan. It is known that the survival of the host was invariably reduced upon exposure to any virulent pathogen(s), and hence, it was anticipated that the exposure with *S. aureus* could diminish the survival of the wounded worms. As anticipated, the survival of wounded worms was found to be decreased than the unwounded worms. To our surprise, the study observed that the wound-infection model showed better survival ability than the wound model. The rationale behind the improved survival of wound-infection model is being investigated through molecular and proteomic approaches.

This new study outlined the potential of the model nematode, *C. elegans* for wound research, including wound healing as well as wound infection. Our findings will attest the contribution of the tiny model in screening of phytocompounds specific for healing and closure. However, further research is required on wound-infection studies using *C. elegans* to uncover the key regulatory player(s) involved in longevity of wounded worms during the course of infection.

The research group of Prof. K Balamurugan includes Sivamaruthi B, Kesika P, Durai S, Vigneshkumar B, Jeba Mercy G, Kamaladevi A, Prasanth M Iyer, Marudhu Pandiyan S, Prithika U,Vigneshwari L, Dilawar Ahmad Mir, Sharika R, Balasubramaniam B, Pooranachithra M, Mohana M, Vinitha T and Venkatakrishna L M.