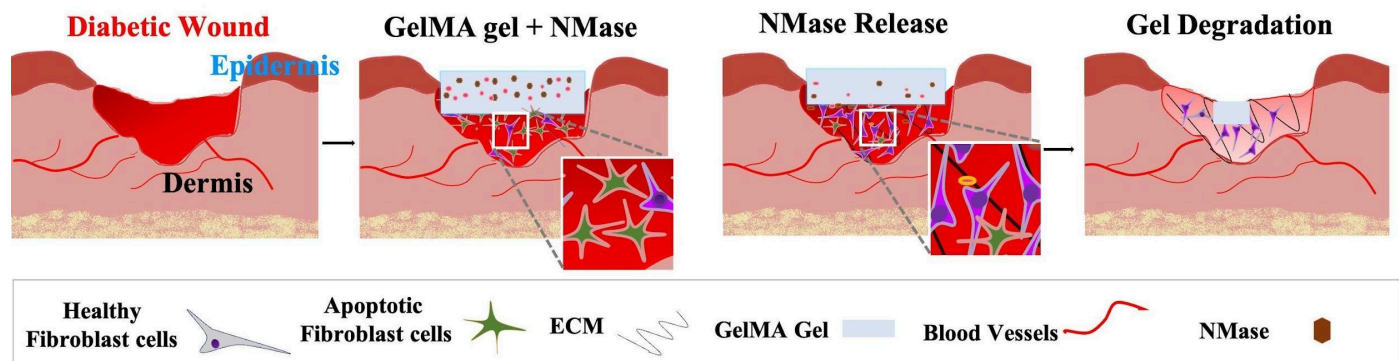


Bioactive gels for healing diabetic foot ulcer

Project Lead: Prof. Shamik Sen

Specific problem being addressed: Diabetes is one of the major health burdens suffered by a significant percentage of the population all over the world. India is one of the countries with the maximum number of diabetes patients. Many factors including ethnicity, lifestyle, environment etc. contribute to this condition. Without timely diagnosis and treatment, diabetes mellitus can lead to several health complications. One of the most common complications among diabetes patients is diabetic foot ulcers (DFU). DFUs are the outcome of multiple factors including decreased local blood supply, impaired angiogenesis, peripheral neuropathy etc., and pose a significant risk for limb loss, morbidity and mortality. Due to a lack of collagen synthesis, wound healing is slow. In this project, we propose to develop neuraminidase-entrapped gelatin-chitosan wound dressings, which will help heal diabetic foot ulcers by inhibiting fibroblast apoptosis, enhancing fibroblast proliferation and motility, and inhibiting bacterial infections by chitosan.

Project summary: Diabetes affects more than 400 million people worldwide. Increased death and impaired motility of fibroblasts (cells that secrete and organize the collagen-rich extracellular matrix) are two underlying factors that disrupt wound healing in diabetes patients. Current treatment options for diabetic wounds include tissue debridement and infection management using anti-microbial creams. However, these interventions are aimed at containing the wounds and not on healing them. We propose the following wound healing technology that would help healing of these diabetic wounds by helping the proliferation of fibroblasts, that otherwise undergo cell death in diabetic wounds.



We have identified an enzyme, *neuraminidase (NMase)*, that enhances proliferation and motility of diabetic fibroblasts and drives collagen deposition. We aim to develop bioactive wound dressings for treating DFUs which actively drive wound healing by inhibiting fibroblast death (caspase inhibitor) and enhancing fibroblast migration, proliferation and collagen deposition (see schematic). We have developed gelatin/chitosan hybrid gels as wound dressings which are adhesive and exhibit antibacterial activity. Successful completion of these studies will enable us to pursue clinical trials on human subjects.

Through this study we aim to achieve:

- (a) Assessment of in vitro efficacy of bioactive gelatin/chitosan gels.**
- (b) Safety and efficacy studies of wound dressings in diabetic rat model.**

Impact of this innovation: Most of the patients suffering from DFUs undergo foot amputation and many of them die within a few years. Current treatment options for diabetic wounds include tissue debridement and infection



management using anti-microbial creams. However, these interventions are aimed at containing the wounds and not on healing them. So, there is an unmet need for a solution for faster healing of diabetic wounds. Our work will lead to faster wound healing of the diabetic wounds. Successful completion of these studies will enable us to pursue clinical trials on human subjects.
