Biofilms: Systems Understanding of Construction and Deconstruction

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Research.

Microbes, both bacteria and fungi, form biofilms on surfaces. Microbial biofilms typically increase the antibiotic resistance of their resident microbes, thus contributing to persistent infections and disease. Abiotic surfaces that are part of medical devices, food processing equipment, oil field equipment, or the interior of NASA space vehicles are frequently fouled by biofilms from which microbes can disseminate. Some biofilms provide an organized tissue for specialized metabolism that can produce desired chemicals. Whether beneficial or harmful, biofilms are structurally complex and dynamic systems with different cell types and extracellular matrix, systems that resemble multicellular organisms. A group of faculty at Rice has recently developed powerful experimental and modeling tools to investigate the processes of microbial cell-cell cooperation, cell-cell antagonism, and extracellular matrix remodeling in the structure and dynamics of biofilms.

Collaborative plan

Faculty listed above have begun meeting regularly, are recruiting a (CTBP) postdoctoral fellow to bridge biofilm research between labs, and will invite leading biofilm researchers to come to Houston and speak at Rice. Through these activities, additional Rice faculty with biofilm-related research (e.g., Oleg Igoshin (BIOE), Yousef Shamoo (BIOS), Natasha Kirienko (BIOS), Jeff Hartgerink (CHEM), Matt Bennett (BIOS)) will be recruited to this group. A course in current biofilm research will be started. After this phase, Rice faculty with overlapping research related to biofilms will write collaborative proposals to NSF or NIH. In the longer term, center or program project grant proposals will be submitted by larger groups of Rice faculty. Funded collaborations will also be pursued with biofilm scientists at NASA in Houston and, importantly, at nearby industrial labs (e.g., Exxon Mobil).

Investment

This effort to build a leading program in biofilm research will be aided by support in grant preparation and administration, education activities that enhance visibility, establishment of matching funds for postdoctoral hiring, connecting faculty to industrial collaborators, IP development and technology transfer, hiring new faculty in biofilm research areas synergistic with existing faculty, providing competitive funding to catalyze interdepartmental collaborations and seed funding to support high-risk/high-payoff research directions by biofilm faculty, and endowing graduate and post-doctoral scholarships in biofilm research.

Impact of Investment

Collaboration between these Rice faculty and others from the Natural Sciences and Engineering divisions provides an exceptional opportunity for building a internationally prominent research program on biofilms, an area of research that addresses significant problems in medicine, space travel, and industry.