NIMBioS: Examples of Research Efforts at the Interface of Mathematics and the Life Sciences involving Multiple Scales

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NIMBioS arose four years ago from a unique collaboration of federal agencies with an objective of fostering new research that applies mathematics and computational science to diverse problems in the life sciences. The National Science Foundation, US Department of Homeland Security and US Department of Agriculture are formal sponsoring agencies, with additional support from the National Center for Medical Intelligence. This poster describes the variety of methods used at NIMBioS to foster interdisciplinary research to address fundamental as well as applied questions in biology, with a particular focus on efforts related to human health. Research activities at NIMBioS are chosen through a community-driven process whereby requests for NIMBioS support are submitted by the broad scientific research community and vetted through an external advisory board. Project requests are assessed based upon their potential for developing transformative science, responding to national needs, and incorporation of an interdisciplinary perspective requiring expertise across the mathematical and life sciences. This poster notes the connections between activities to date and medically-related research, and suggests challenges for future medical-related research that could benefit from more direct interactions with mathematicians and computational scientists.

Many of the research activities sponsored to date at NIMBioS have emphasized animal infectious disease with particular attention to zoonotic infections of human concern. This includes spatial optimization approaches for vaccine delivery to control rabies; harvesting strategies to limit feral populations, including cats and swine; modeling for mosquito-driven diseases such as dengue; and efforts to link data to models for bovine tuberculosis, anthrax, *Mycobacterium avium* subsp. *paratuberculosis* (MAP) infections, and *Toxoplasma gondii*. These efforts inherently involve processes operating on multiple temporal and spatial scales. This poster will provide a summary of some of these modeling efforts for infectious disease and will point out how NIMBioS has fostered collaborations on other problems such as modeling human metabolism and body weight regulation, intra-cellular movements, and renal hemodynamics. These are illustrative of the opportunities available to the research community to utilize the NIMBioS infrastructure to foster interdisciplinary activities across the life sciences that benefit from mathematical modeling.