What inspired you to focus your research on vector-borne and zoonotic diseases?

While science has always fascinated me, I found early in my career that the aesthetics of ‘science for its own sake’ were rather uninspiring. I am more motivated to find solutions to real-world problems – or at least to make some contribution in that vein rather than relying on serendipity to justify my endeavours. Vector-borne and zoonotic diseases (V-BZD) pose some of the biggest threats to human health across the globe, and that’s why they appeal to me as a subject of research. The study of these diseases requires a multidisciplinary approach; it is necessary to understand the microbiological, entomological and human biological aspects that determine how their natural transmission cycles are maintained, when and why they spill over into human populations, and how they cause disease. Crossing disciplinary boundaries to better understand and find solutions to essential problems is work that I find both challenging and rewarding.

Could you outline the core aims of the University of Massachusetts’ Laboratory of Medical Zoology (LMZ)?

Our goals are to gain better understanding of zoonotic disease transmission and to use that understanding to determine practical courses of action to reduce incidence and/or severity of disease. While clinical research is rightly focused on treating disease in humans, medical zoology aims to combat disease by mitigating exposure risk and thereby preventing disease. These mitigating factors include efforts to reduce the source of infection, such as vectors, but also to provide accurate information to public individuals and agencies to guide their best practices.

LMZ not only conducts basic research but also works to meet public service needs. Why is this dualistic approach important?

Basic research is at the core of every approach we take in the lab. I was educated and trained as a population geneticist and evolutionary biologist by Dr Francisco Ayala. I also had the great fortune to meet and chat several times with Nobel laureate Joshua Lederberg about my work and disease threats in general. Lederberg once opined about the schism between medical science and basic sciences that he observed as a student. He was worried that scientific approaches to the study of disease did not always incorporate the best basic science practices – and, likewise, basic scientists failed to concern themselves directly with applied problems. I understood this sentiment and was lead to coin the term ‘medical zoology’ as the descriptor for my lab.

Medical zoology can be thought of as a multidiscipline aimed at achieving fundamental understanding of V-BZD with the ultimate goal of diminishing their incidence.

What would you say have been LMZ’s greatest successes so far?

We’re proud of all the peer-reviewed publications we’ve produced over the past few years, but we are particularly excited about the success of TickReport™ - our fee-based tick-testing service. When we began this service in 2006, we could never have anticipated that it would be so popular, and that the number of server subscribers would increase to the point where, in 2016, we anticipate testing over 10,000 ticks from all 50 US states, as well as Canada, Europe and South America. We can measure its success by the overwhelmingly positive feedback from those that have utilised the service. We also have a growing number of reports on how tick testing has helped guide patients and providers in diagnosing and treating tick-borne disease.
OF ALL THE threats that loom large around the world, the most significant to human health are vector-borne and zoonotic diseases (V-BZD). Indeed, mosquitoes are a vector for a wide range of diseases, such as malaria, dengue fever and lymphatic filariasis (the main cause of elephantiasis). The recent growing concern over Zika virus – also transmitted through mosquito bites – serves as further evidence for the risk to health V-BZD poses.

Thus, improving understanding of V-BZD is of extreme interest to researchers around the world, including those based at the Laboratory of Medical Zoology (LMZ) – an academic research lab at the University of Massachusetts. The focus of their investigations is on infectious diseases, but the team there pay particular attention to diseases with transmission cycles involving other animal species, or zoonoses.

THE APPROPRIATENESS OF A DUALISTIC APPROACH

Led by Professor Stephen Rich, much of the lab’s focus has been on studying Lyme disease and human malaria. However, more recently, there has been a shift from purely conducting basic research to a more applied bent, where meeting public service needs has become an important consideration. Thus, rather than just studying the pathogens and their transmission, Rich and his team are committed to identifying potential means of intervening.

This shift from interdisciplinary to multidisciplinary research led Rich to coin the term ‘medical zoology’, one which moves away from a rigid disciplinary boundary to acknowledge a consistent study approach. “At the core of this approach is an abiding understanding that evolution is the central paradigm of biology, so it is essential to understand how the complex circumstances of V-BZD have evolved,” explains Rich. “To find answers to questions one has to go past the ‘how’ and dig deeper to answer ‘why’.”

To discern the ultimate causes requires understanding of the phenomena on different time scales – evolutionary, ecological and epidemiological. That these temporal components span the realm of basic and applied science necessitates the multidisciplinary approach LMZ has adopted.

THE TICK-BORNE DISEASES PASSIVE SURVEILLANCE DATABASE

One of the public services LMZ has developed is their Tick-borne Diseases Passive Surveillance (TDPS) database. It provides a not-for-profit alternative to commercial services and increases awareness of the distribution and risk of ticks and tick-borne diseases. “Prior to TDPS, disease risk was determined by counting the numbers of human disease cases in a region or time period, or by collection of ticks from natural habitat,” explains Rich. “Since humans are not the source of infection where zoonoses are concerned, the reports accounted for disease outcomes, not disease risks.”

The database Rich and his team created directly accounts for who is getting bitten by ticks, when and where. Importantly, the data gathered are
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A PIECE OF DATA IS PEACE OF MIND

The Laboratory of Medical Zoology (LMZ) is committed to developing diagnostic tools for detecting infection and genotyping strains of pathogens in vector species. Alongside this commitment runs the public service it offers, where the tools it develops are made available to individuals and health agencies that require information about the infections.

One of the lab’s programmes is called TickReport™ – a crowd-sourced surveillance product that enables people to purchase tick test results; clients send ticks in and the lab tests them to identify disease-causing microbes. The programme was established in 2006 and, having proved successful with a viable funding model, LMZ intends to diversify its services to offer MosquitoReport™ and BeeReport™. “MosquitoReport™ could not be more relevant given the growing concern about mosquito-borne diseases, such as Zika virus,” explains Rich. “LMZ is partnering with municipalities and third party contractors to observe mosquito-borne infections in regions where mosquito surveillance and control were previously unavailable.”

The BeeReport™ service will be the first of its kind, offering a fee-for-service that allows commercial and private beekeepers to test the health and risk of disease to their hives. Importantly, the team’s proven approach in TickReport™ will translate well to its new enterprises and reinforce the mission of the lab. “We’re excited about the future and continuing to grow this logical extension of the academic mission,” explains Rich. “We will continue to provide practical information and reliable data to individuals seeking to make informed decisions about their health and that of their companions.”

With this in mind, the lab’s adoption of the slogan ‘A piece of data is peace of mind!’ is extremely apt.

You can find out more about TickReport™ here: www.tickreport.com

THE BENEFITS OF NON-TRADITIONAL FUNDING MODELS

While research labs are typically funded by a variety of federal private granting agencies, TDPS is funded through crowd sourcing. Thus, the people who use the services offered pay a nominal fee for their own personal laboratory. “We don’t view the people who use our services as customers, but rather important stakeholders,” explains Rich. “The benefits of crowd sourcing are that we can scale the lab operations to meet specific needs.”

As well as providing important funding support, the stakeholders also provide samples of ticks from the environment. As the number of stakeholders increases, LMZ is able to realise favourable economies of scale that enable them to reduce unit costs and make testing more affordable. Truly, this is a brilliant example of how effective bringing everybody together can be – not only does it serve each individual stakeholder’s interests, but it serves the wider population too. The more there are, the cheaper it is for each; furthermore, the data LMZ collect are always made available for public consumption.

The methods, approach and philosophy Rich and his lab have adopted are genuinely honourable, where everyone involved benefits – including science.