



Viral Star Wars

Ebola virus researchers, among others, will soon get an information download from satellites to aid them in determining Ebola's natural host. Pinpointing where a virus lurks in the jungles of Africa can be a daunting task for even the most intrepid researcher. The magnitude of life teeming within the rainforests, as well as the changes in climate, life cycles, and temperatures that can occur in a small geographic area over a matter of weeks, days, or even hours, creates an exceptional challenge for data collection and analysis.

The European Space Agency (ESA), in conjunction with Jena-Optronik, several subcontractors, and eight test end-users, has designed and developed a project called Epidemio, which will collect and disseminate a variety of earth observation (EO) data for studying, monitoring, and predicting a variety of diseases in which environmental factors play a potentially large but currently unknown role in the rise of epidemics.

Kathrin Weise, of Jena-Optronik and project manager of Epidemio, told the *JCI* that "we are just now in the beginning phase of the project," which started January 1, 2004, and "are defining baselines for the different data and determining variation." Weise expects that satellite data will begin to be sent to Epidemio's current set of eight user groups in four months or so. She adds that each user group "has provided the requirements [for the data type needed]; different users have different test sites and they are interested in different information."

Types of data provided include such diverse information as urban mapping, weekly minimum and maximum temperatures across Africa, water body mapping, wind-blown-dust maps, and in-depth vegetation information, including details like flowering times of different plants. It is this last type of data that will be used to try to identify the elusive viral reservoir for Ebola.

Pierre Rollin, of the Centers for Disease Control, provided the *JCI* some insight into the difficulty researchers have had in finding the

reservoir. It is known, he says, that "human and non-human primates can transmit and die from Ebola virus"; however, "they die quickly, and very quickly," meaning that they cannot be long-term hosts of the virus, as the outbreaks recur long after all the infected primate species have died.

Rollin notes that efforts to find the reservoir of the virus have involved taking blood samples from a variety of animals in the vicinity of the first outbreak and testing them for Ebola or for antibodies to the virus, but that in all cases, however, "so far everything has been negative."

"Another attempt [to identify the natural host] has been to infect some [local] animals in the laboratory to see which one could allow replication of virus and spread the virus," Rollin told the *JCI*. Rollin and colleagues have been able to find only one animal, a bat, that can both support viral replication and carry quite a high titer of the virus without becoming ill.

Success? Not really, says Rollin. "This could be a red herring; [with infection instigated in the laboratory,] the bats could carry it by chance. And we haven't tested every animal" that could live in the areas where Ebola outbreaks occur.

As Rollin explains, the greatest difficulty in finding the natural host is twofold. First, "the number of possible types of animals that are in [an area under investigation] is huge — including species that we do not even know yet. It is really a fishing expedition."

Kathrin Weise:
Epidemio project manager



The other factor is time. Referring to the first Ebola outbreak in Gabon, Rollin notes that "the alarm sounded very late" and stresses the difficulty of "trying to do an epidemiological investigation of this type, when the first case had happened 3 [to] 6 months ago, and he is dead and no one can tell how he could have been infected. The longer you go [in time], the more the season has changed; things have changed in the ecology, so you cannot collect species you may want."

Rollin does say that more recent outbreaks have been localized in a much shorter period of time, making it much easier to get more accurate ecological information. This then also reduces the potential range required to search for the host.

While Rollin thinks that data such as those to be provided by Epidemio may be useful, he feels that it is fieldwork that is essential. In the end, he states, "someone has to go into the field."

The aims of the Epidemio project, as defined by Weise, are in fact designed to facilitate the fieldwork. The project description indicates that these large datasets are meant to provide a low-cost means to aid researchers in selecting sites and focusing their efforts in the field.

With different tests under way, given eight groups using various EO datasets to aid research in different diseases — including, in addition to Ebola, malaria and meningococcal meningitis — the usefulness of these data should shortly become clear.

Laurie Goodman, New York

Pierre Rollin feels hands-on work is essential.

