Ebola: small, but real progress

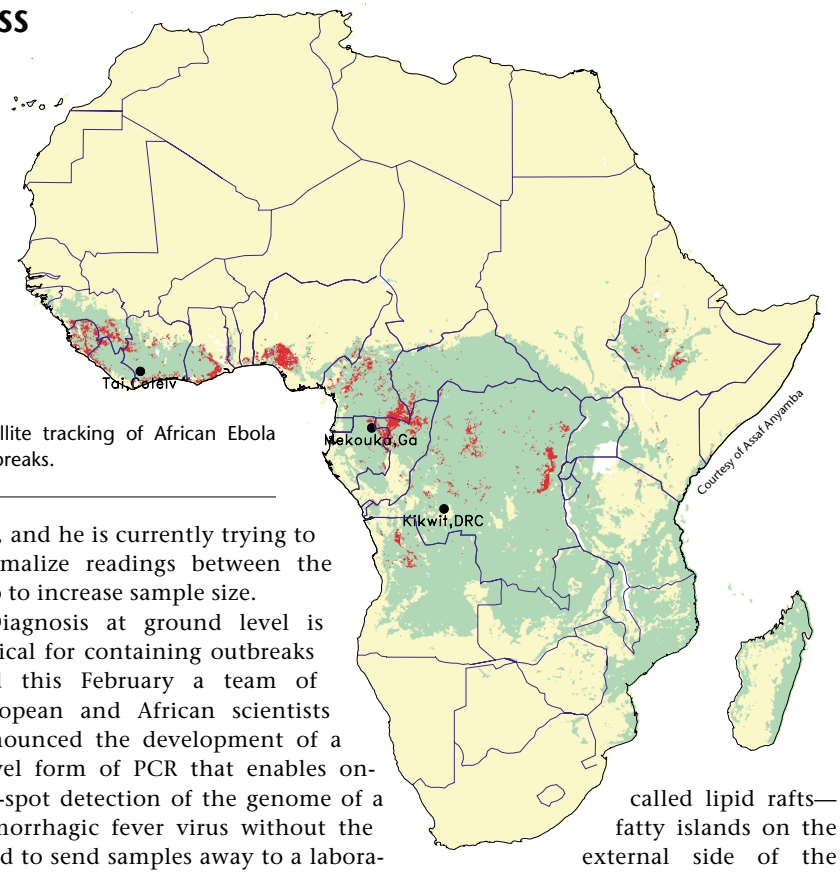
As *Nature Medicine* went to press, 49 people had died in the most recent outbreak of Ebola in Gabon, and 11 more are infected. Although scientific attention is currently focused largely on the major infectious disease killers—AIDS, malaria and tuberculosis—there has nevertheless been some progress in combating Ebola. Satellite tracking systems are helping to determine the trigger for outbreaks, new understanding of the biology of the Ebola virus could lead to a treatment for the often fatal disease, and human trials of an Ebola vaccine are anticipated by the year's end.

Thus far, Ebola has been contained within central and northeastern Africa, with the worst outbreak in 1976 killing 280 people in the Congo. The virus is named for a river in the Congo. Afflicted patients present with flu-like symptoms, which rapidly progress to extensive bleeding, and death frequently occurs within 10 days of initial infection.

The virus is spread by physical contact, and as with all infectious diseases, the present day ease of international travel raises the possibility that Ebola may spread to other countries. Gabon is an Ebola 'hotspot'—this is the third outbreak in the province since 1996—and experts describe the current situation in Gabon as 'smouldering' because there is a low level of persistent transmission and new cases are still being reported. The epidemic will not be over until there is a 42-day period in which no new cases are reported.

But what triggers the outbreaks? New research suggests the role of a climatic factor. Compton Tucker of the Goddard Space Flight Center in Maryland leads a team that analyzes meteorological data from satellite images to evaluate climate patterns that might predict infectious disease outbreaks. They have noticed a pattern to Gabon's Ebola outbreaks in that the climate undergoes a sharp change from persistent, extremely dry conditions to a wet recovery season over the couple of months before the outbreaks occur (*Photogram. Eng. Rem. Sensing* **68**, 147; 2002).

Tucker points out that current predictions are based on a small sample size of data over 1981 to 2000, which came from a satellite saturated with water vapor. Additional data is available for 2000-2001 from a newer satellite, and he is currently trying to normalize readings between the two to increase sample size.



Satellite tracking of African Ebola outbreaks.

Diagnosis at ground level is critical for containing outbreaks and this February a team of European and African scientists announced the development of a novel form of PCR that enables on-the-spot detection of the genome of a hemorrhagic fever virus without the need to send samples away to a laboratory equipped with level 4 biosafety. Magnetic beads are added to blood samples to trap virus particles. The beads are removed and heated to 95 °C, which kills the virus and exposes its nucleic acid. If the sample contains Ebola, reverse transcriptase-PCR amplifies a region of the virus' glycoprotein and the PCR product is visualized on a small gel. Because the test is based on PCR, varying the primers allows testing for any pathogen, including yellow fever and Lassa virus.

Christian Mathiot, director of the Pasteur Institute in Darkar, Senegal, was involved in field-testing the method during an outbreak of yellow fever, and praises its high-quality sensitivity, specificity and simplicity. The work was funded by a Euro 500,000 (US $437,000) European Union INCO grant, and according to Amadou Sall, scientific manager of the Senegal team, the team has applied for more funding to further optimize the test. He is concerned, however, that changes to the INCO program might thwart funding for hemorrhagic fever studies in favor of work on HIV.

Meanwhile, scientists have pinpointed how filoviruses such as Ebola, and the related Marburg virus, enter human cells; they hitch a ride on so-called lipid rafts—fatty islands on the external side of the plasma membrane. The virus also hijacks the lipid rafts when it is ready to assemble new viral particles (*J. Exp. Med.* **195**, 593; 2002). Other viruses, including HIV, are also thought to use the lipid rafts of host cells during infection.

Finally, the National Institute for Allergy and Infectious Diseases has revealed that it is hoping to move a potential vaccine against Ebola to clinical trials before the end of the year. Gary Nabel's team demonstrated that macaque monkeys exposed to three monthly injections of naked DNA encoding an Ebola glycoprotein, followed months later by a boost of an adenoviral vector, were protected against infection for six months (*Nature* **408**, 605; 2000).

Nabel is awaiting regulatory approval for a Phase I trial of the vaccine in humans in which the naked DNA and adenoviral components of the vaccine will be tested separately. Should the vaccine proceed through development, Phase III trials will be problematic to organize at the practical level because Ebola outbreaks are rare and thankfully have not affected the large numbers of people typically tested in Phase III trials.

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