

Interview with Stephan Guenther, Hamburg

“Extremely unlikely”

Highly hazardous FMD viruses recently escaped from a “high-security” lab in the United Kingdom. Could such a thing happen elsewhere?



Stephan Guenther

On August 3rd this year there was an outbreak of foot and mouth disease (FMD) at a cattle farm in the South of England. This highly infectious disease probably originated from a private high-security lab in the vicinity. Meanwhile, the authorities responsibly assume that it could erroneously or even deliberately have been carried out of the lab by an employee. *Lab Times* asked Stephan Guenther, Head of the Department for Virology at Hamburg's Bernhard Nocht Institute (BNI), whether it is possible that similar dangerous viral diseases could escape from German laboratories.

Lab Times: Dr. Guenther, what are the most dangerous pathogens worked on at the BNI?

Guenther: We are working with the Filo virus family such as the Ebola virus and the Marburg virus but also with the Lassa virus, which belongs to the Arena virus family. The virus responsible for the break out of the Crimean-Congo haemorrhagic fever is also amongst our collection.

What are the most important security regulations to which you must adhere when working with these virus strains?

Guenther: There is constantly reduced air pressure in the lab. The air is filtered several times before being exhausted. Waste is destroyed by autoclaving. Effluent water is also decontaminated by boiling. No inflammatory materials may be kept in the laboratory. Personnel work in protective suits, which are connected to an external air supply. Before personnel are allowed to take the suit off, it must be disinfected in a special type of sluice by spraying with peracetic acid.

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When reading about high security labs, the abbreviations L4 and S4 always seem to pop-up. What do these mean?

Guenther: L4 is the highest protection level and is defined in the “Biosstoffverordnung” [a German decree about safety and health protection when handling biological agents]; in L4 labs it is forbidden to work with genetically engineered viruses. S4 is the highest security level and is defined in the “Gentechnikgesetz” [a German law that regulates genetic engineering]; in S4 labs it is permitted to work with genetically engineered viruses.

What differentiates new S4 labs from the old L4 labs?

Guenther: The same security regulations apply for personnel but the technical standard is much higher in the new labs. Many things, which used to have to be done by hand, are now automated, e.g. mixing the disinfectant. In addition, there is a new fire extinguisher system and enormous tanks directly under the lab. They serve to catch the shower water and in case of a fire, the fire water, which is then decontaminated by boiling. However, the danger of a fire is very slim as the new lab is made entirely of steel.

What would happen if a technical defect suddenly occurred?

Guenther: All technical installations are redundant. Measuring equipment constantly monitor their functional status. If one system fails or shuts down, the other one takes over. In this moment the failure is reported to the control room, which undertakes the necessary steps to remove the defect. Should there be a power cut, the high security labs have got their own emergency generator.

Have there ever been any accidents in the BNI high security lab?

Guenther: To date there have been no accidents, although there have been so-called operational malfunctions, where something unforeseen happened but which didn't endanger any personnel. For example, on one occasion there were inconsistencies in the air pressure, so the colleagues had to leave the lab and technical support was alerted, who immediately came and checked everything. Another instance was when one of the employees lost a glove. However, with the air in the lab being practically pure and the fact that viruses cannot fly, it meant he wasn't exposed to any real danger. Even if the protective suit has a hole in it, nothing can really happen because the air spilling outwards prevents any virus from finding its way right into the suit.

Stephan Guenther, virus researcher



Stephan Guenther, 40, is Head of the Department for Virology at Hamburg's Bernhard Nocht Institute (BNI), the most important tropical medicine research institution in Germany. The department focusses on molecular aspects of the life cycle, virus-host cell interaction, and the pathogenesis of tropical viruses (such as the Lassa, Ebola, and Marburg virus families). In 2003, along with researchers in several other laboratories, Guenther and a colleague from the BNI, Christian Drosten, identified the SARS coronavirus for the first time in SARS patients (*N Engl J Med.* 2003 May 15;348(20):1967-76). Guenther coordinates European networks for the diagnosis of highly infectious fever viruses and is collaborating with the WHO.

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Would it be possible for someone to deliberately carry virus out of the lab?

Guenther: The amount of individual virus samples are registered and regularly monitored. The Authorities also know exactly what and how much is stored in our facility. If anything does disappear it would be immediately noticed. The employees never work alone in the lab and there is always a further person who monitors what's going on in the lab via monitor. Furthermore, access to the samples is limited to very few specific employees. Hence it is completely out of the question that someone, who has nothing to do with the lab, can get at the virus'.

Would it be possible if an employee did not adhere to security measures for a virus to be unwittingly carried out of the building?

Guenther: That is extremely unlikely due to the numerous security measures in place. An employee would have to act extremely negligently, for example, if he accidentally tipped a culture bottle containing a virus over his suit and didn't thoroughly disinfect the suit afterwards. But even if something like that were to happen, you couldn't compare it to the incident that happened in South England on 3rd August. Our tropical virus types are much more sensitive to the environment than that which caused the foot and mouth outbreak. They dry out quite rapidly and are then no longer infectious. Even if small amounts got into the environment, an epidemic in Germany would be almost impossible due to the physical and chemical make-up. Lassa and Ebola virus types cannot be so easily transferred from human to human. Poor hygiene in hospitals or burial rituals that involve family members touching the deceased are important factors, which contribute to the fact that a virus can actually be spread in the Tropics.

Does that also apply to genetically engineered varieties of these viruses?

Guenther: Experiments with genetically modified viruses are subject to approval. In order for us to be able to work with recombinant Lassa virus types, we have to describe accurately every step of our experiments, as well as calculate the risk what could happen if the virus changed. Even the current experiment and all results have to be documented accurately. Despite any amount of precautionary measures, it is impossible to 100 per cent anticipate every hazard.

A further S4 high security lab will apparently be built at the Robert-Koch-Institute (RKI) in Berlin. Wouldn't you agree that the

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more security labs that are built, the greater the possibility of dangerous viruses getting into the environment due to human error or construction failures?

Guenther: The RKI belongs to the German Ministry of Health. There are plenty of experts who have calculated and compared these risks with one another and have obviously reached the conclusion that more high-security labs mean more security.

What would happen if someone who had been in the Tropics, was admitted to a German hospital displaying symptoms of Lassa Fever?

Guenther: In Europe, Germany is by comparison, one of the countries with many imported cases of Lassa Fever. However, we have a very good infrastructure, to not only diagnose the virus

quickly but also to treat Lassa patients effectively. The procedures are as follows:

First substantiate the suspicion; the patient should have been in West Africa, have a high fever and have twice tested negatively for malaria. The suspect case is then officially registered, the transport arranged for a sample to go to the BNI or Marburg and for the patient to be brought to one of the five German treatment centres. In the treatment centres doctors deal with the patients under strict security measures, similar to those in place in our labs. This means that the doctors wear masks, the room are kept at low pressure and the air is filtered. As soon as we have the first sample here in Hamburg, we perform several tests until we are 100 per cent sure, whether we have a case of Lassa, or not. Should our suspicions be confirmed, then the appropriate Authorities are immediately informed. These can, in turn, inform for example airlines, with whom the patient has flown and they in turn can identify and inform fellow travellers, who could have also possibly been infected. Last year we had one case of Lassa, where, only 2 days after diagnosis, we received several samples from different European countries for testing.

INTERVIEW: THORSTEN BRAUN

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