Trypanosoma parasites in a blood smear
(Dr. Myron G. Schultz, CDC)
What is an emerging infectious disease? What qualifies a disease as emerging? Before we continue on to the articles, let’s briefly examine this.

According to the CDC’s *Emerging Infectious Diseases* journal, a disease may be considered emerging if it meets one of four criteria:

I. Organism becomes pathogenic;
II. Pathogen spreads to a new area;
III. Pathogen results from recent eco-logic change;
IV. An old pathogen reappears due to antimicrobial-resistance or lack of health care

Those diseases meeting the last requirement are sometimes referred to as re-emerging diseases.

*Nipah Virus* (pages 7 & 8) appears to meet criteria III, as deforestation seems to have caused bat migration. *African Trypanosomiasis* (pages 5 & 6) meets requirement I, following its development of the SRA gene. Until *MERS* (pages 3 & 4) is better understood, we may tentatively say that it meets requirement III as well.

There are many more emerging infectious diseases, representing varying degrees of danger to human populations. Ebola, HIV, SARS, and Tuberculosis, as well as the diseases in this newsletter, are just some examples on a rather long list.

On a separate note, I’d like to take this opportunity to thank Dr. Fisher for taking time out of his busy schedule to answer a few questions. He has had an interesting career and it was an honor to speak with him.

Finally, the last page of this newsletter shows the resources we used for the articles. There are a lot of emerging diseases out there, and I would encourage you to learn about them.

Thanks for reading. Please enjoy and don’t forget to wash your hands!

-The Authors

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**CONTRIBUTING WRITERS**

**JOHN SCHMIDT** is a senior microbiology major. He plans to pursue his Master’s degree following graduation. He is currently re-watching seasons 1-6 of *The Big Bang Theory* for the fifth time, as well as finding a new appreciation for immunology.

**JONATHAN COBB** is a senior majoring in microbiology. After graduating he wants to pursue an MBA and go into hospital administration. He enjoys working out, playing basketball, and watching the Mighty Ducks Trilogy. His heroes include his grandfather Jack Loss and coach Gordon Bombay.

**JOHN EVENOCHECK** is a pre-med microbiology student who intends to go to medical school and specialize in cardiology. He underwent brain surgery as a child due to a medical condition known as craniosynostosis.
INTERVIEW with DR. NATHAN FISHER

Dr. Nathan Fisher was happy to give me some of his time in order to answer a few questions about his experiences in research and his time at NDSU. This abridged transcript includes his responses, as recorded during the interview:

Q: What do you enjoy about research?
A: “Well, I’ve just been a life-long learner and have always enjoyed learning more and more about whatever it is I’m working on. But a really close second is the opportunity to mentor students and younger scientists, and the interaction with colleagues.”

Q: What is the biggest challenge you encounter in research?
A: “The biggest challenge is conveying the importance of basic research to a non-science audience. It’s hard to explain the link between what we do and actually studying the process of how these organisms cause disease. The research we’re doing is 30 years away from being actual drugs.”

Q: What has been the defining moment of your career?
A: “The defining moment of my career? Hopefully I haven’t had it yet! I started a postdoc association at USAMRIID (United States Army Medical Research Institute of Infectious Diseases), and it did pretty well for a few years. I was quite proud of that.”

Q: What caused you to decide on a position at NDSU?
A: “I was really impressed with the sense of community in the department and the breadth of different interests.”

Q: What qualities do you look for in research staff?
A: “That’s a good question. A lot of it has to do with internal drive, so I want people that are interested in science, and that want to be in a research lab. There’s a lot of work to be done and interesting science, and you’re welcome to be here. I don’t get too hung up on academic progress or experience. You have to start somewhere, right?”

Q: If your current research ended successfully tomorrow, what would you do next?
A: “I’d probably want to start working on the next one [pathogen]. Personally, I like early-stage research. I want to understand the biology of the pathogens. I’m not, per se, interested in optimizing the pharmaceutical properties of the drug, or developing the particulars of a vaccine.”

Q: Any advice for micro students?
A: “Definitely take advantage of the opportunities that NDSU has for participating in research. NDSU and the VMS Department are the perfect size for students to make meaningful contributions to research.”

Q: What sort of hobbies do you enjoy?
A: “Fishing! I need to get into hunting, too. But fishing is my biggest hobby.”

Dr. Fisher is currently studying bacterial pathogens that infect patients suffering from cystic fibrosis and other immune deficiencies.

Contact Dr. Fisher

Interested in working with Dr. Fisher? Want to learn more about his research? Use the information below to contact him!

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In the early 2000’s the world was introduced to SARS, which killed nearly 800 people between 2002 and 2003. Now a very similar disease has emerged known as Middle East Respiratory Syndrome (MERS). This disease is similar to the SARS virus in that the early stages of both diseases present with cold-like symptoms. But like SARS, this is not your common cold. It gets much worse.

The virus was first isolated on September 24th, 2012, by Dr. Ali Mohamed Zaki. It came from the lung of a 60-year-old man from the city of Bisha in Saudi Arabia. The man had presented with acute pneumonia as well as kidney trouble. The virus was identified as a novel Coronavirus, and was eventually named MERS CoV.

The disease presents with several indications of sickness, including fever, cough, uncontrol- lable spitting, and shortness of breath. These early symptoms do not seem very serious at all, but within a week the patient takes a turn for the worse. Kidney failure and pneumonia develop if the infection is left untreated. Death occurs shortly after.

Since it first showed itself in 2012, MERS has killed about half of the people infected with it. This high mortality rate is something that has many people worried, and for good reason.

So how does an individual get infected with MERS? A recent study indicates that bats of the species Taphozous perforatus are the natural reservoir of the virus. Their guano (bat feces) ends up in the water supply and is then ingested by humans. Some people have reported contracting the virus from camels or cattle, but research has not yet confirmed this.

On February 13th of this year, the World Health Organization (WHO) announced that person-to-person transmission of the virus is quite low or non-existent. This followed a confirmed case of MERS in the United Kingdom where human transmission appeared to be involved.

That being said, there is always a chance that it will mutate into a form that more easily moves between humans. If this does occur, it could become a serious threat on a global scale. Considering the ease with which viruses evolve, this is certainly cause for concern.

For the time being, no cases of MERS have yet been confirmed in the
United States. The disease is currently only found overseas in the Middle East, as well as in some parts of Europe. This is likely due to its short incubation time and apparent lack of horizontal transmission.

Vaccination and antiviral research continues, but for the time being treatment is mostly supportive. The discovery of bats as the natural reservoir is an important piece of information from an epidemiological standpoint. This allows scientists the chance to study the virus where it normally lives. More importantly they can study the mechanisms that allow a bat to carry it without suffering disease.

MERS has a long way to go before it can be considered a global threat. With any luck we’ll find the other pieces of the puzzle before it gets that far.

QUICK & DIRTY

- Limited transmission from **person-to-person**
- Bats confirmed as the **natural reservoir**
- Presents with **cold-like symptoms**
- First isolated in **September 2012**

FURTHER READING

Would you like to learn more about MERS? See references 6, 7 & 9 on the last page of this newsletter!
Trypanosomes of the species *Trypanosoma brucei* are parasites that are widespread in Africa and cause a disease known as Trypanosomiasis. There are several known subspecies, two of which cause disease in humans. These subspecies are *gambiense* and *rhodesiense* (causing West and East African Trypanosomiasis, respectively). The parasite is spread by the tsetse fly, an insect common in Africa.

*T. b. rhodesiense* (Eastern Africa) and *T. b. gambiense* (Western and Central Africa) affect a large part of sub-Saharan Africa. The disease caused by these parasites is more commonly known as “African Sleeping Sickness”. Wild and domesticated animals, especially cattle, are reservoirs for the parasite.

Both subspecies have evolved resistance to human serum, which normally prevents infection via Trypanosome Lytic Factor (TLF). In the case of these subspecies the Serum Resistance Associated (SRA) gene is expressed, which stops TLF. Because *T. b. brucei* (another subspecies) lacks SRA it is lysed by TLF, so it only affects animals.

The *rhodesiense* subspecies causes an acute infection, mostly in Tanzania, Uganda, Malawi and Zambia. Symptoms for this acute infection begin within a few weeks. These include swelling at the site of infection and a fever, as well as joint pain and fatigue. As the disease worsens the victim becomes tired and confused, with death occurring within only a few months.

The other subspecies, *gambiense*, causes a chronic infection. Most of the confirmed cases, around 95%, are in the Democratic Republic of Congo, Angola, Sudan, and Other.
the Central African Republic, Chad and northern Uganda. There are 7,000 – 10,000 new cases annually, and many more that are probably not reported.

Early in this chronic form the only symptom may be swelling at the site of infection. Within a few months, the neurological problems begin, specifically the drowsiness from which the disease gets its name. If not treated, these symptoms will last for several years before death occurs.

Both the acute and chronic forms of Trypanosomiasis are quite treatable in a healthcare setting. Treatment options are based on determining the stage of the lifecycle the parasite is currently in (called staging). This makes knowledge of the lifecycle a key diagnostic tool. This is especially important in the case of the acute infection, which can cause death in a much shorter period of time.

People are encouraged to avoid bushes where tsetse flies rest during the warmer periods of the day. Wearing clothing lacking bright colors also helps, since the flies are attracted to brighter colors. Additionally, bed netting and bug repellent may help to avoid bites from these insects.

**QUICK & DIRTY**

- Transmitted by the bite of a tsetse fly
- Nearly 100% mortality if not treated
- Both acute and chronic forms of the disease
- The lifecycle is an important diagnostic tool

**FURTHER READING**

Would you like to learn more about African Trypanosomiasis? See references 2, 10 & 11 on the last page of this newsletter!
When we think of emerging infectious diseases, perhaps horrible little critters like Ebola and Avian Influenza come to mind. Those are the ones that inspire movies like Outbreak and Contagion, or books like The Andromeda Strain. They cause a variety of highly visible and nasty symptoms that clearly state, “This individual is very, very sick, and you should stay very, very far away from them!”

But what about a virus that causes a seemingly harmless headache for two or three weeks? A headache that turns into fatigue, disorientation, encephalitis? An infection that eventually leads to a coma that ends in death in half of the victims? A viral infection that causes ongoing neurological complications in many of the survivors? Admittedly, it doesn’t have quite the dramatic punch of a hemorrhagic fever. That being said, this subtle nastiness is what makes Nipah Virus so deadly.

Nipah Virus (named for Sungai Nipah, the village in Malaysia where the first human case was identified) was first isolated in 1999. Belonging to the family Paramyxoviridae and the genus Henipavirus, it is an enveloped, negative-sense, single-stranded RNA virus. It is commonly carried in bats of the genus Pteropus, though they are not necessarily the natural reservoir. In the first recorded outbreak in 1998 to 1999, 257 people in Malaysia and Singapore were confirmed to be infected with what was then considered a novel paramyxovirus. About half of these cases ended in death, resulting mainly from a laundry list of neurological complications.

In an effort to quiet those warning sirens going off in your head, allow me to clarify something. The vast majority of these initial cases involved pig farmers, with the few exceptions involving direct contact with the bats. Fruit trees near the pig farms attracted flying foxes (the bats noted above), whose bodily fluids were ingested by the pigs. The pigs became sick and finally transmitted it to the human laborers. During this outbreak, there appeared to be no evidence of human-to-human transmission, not even in a healthcare
As if all of this wasn’t bad enough, treatment options for Nipah Virus are slim. The antiviral drug ribavirin showed some promise initially, but subsequent research has cast doubt on its efficacy. Treatment, then, is essentially a matter of supportive care, which isn’t much help where the neurological symptoms are involved. The initial outbreak in 1998 was eventually controlled by culling large numbers of swine. However, if this virus has successfully rooted itself in humans, this may no longer be a useful strategy.

For the time being, research continues on this emerging pathogen. Investigation into effective treatment methods and preventive measures, and the search for a natural reservoir are ongoing. The virus is classified as a Biosafety Level 4 virus in the United States and Australia. This is the highest BSL level, where Ebola and Small Pox hang out. It is not currently considered a global threat.

So, if you happen to be traveling to Southeast Asia anytime soon, don’t pet the bats.

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**QUICK & DIRTY**

- Bats may be the natural reservoir
- 50% mortality rate
- Early symptoms are non-specific
- Numerous outbreaks as recently as 2008

**FURTHER READING**

Would you like to learn more about Nipah Virus? See references 3, 5 & 8 on the last page of this newsletter!


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