

## Podcast # 1 Can a fungus really cause pneumonia?

### Dialogue:

GG: Hello and welcome to inaugural podcast of Think Blasto! I am Dr. Greg Gauthier, an infectious diseases specialist at the University of Wisconsin.

JM: Yes, welcome to Think Blasto! I am Dr. Joseph McBride, an infectious diseases specialist at the University of Wisconsin. As Greg said this is the inaugural podcast of Think Blasto!: a podcast series designed to describe and outline a disease that is more common in Wisconsin than in most parts of the world: an infection called Blastomycosis.

GG: As infectious disease physicians who see patients with blastomycosis, we realize that there is a wide spectrum of knowledge about blastomycosis.

JM: Therefore, we hope this series of short podcasts will introduce and enrich blastomycosis to any interested parties. We hope to provide background information about the disease, discuss the infection with other experts in medicine, veterinary medicine, public health, and maybe even patients themselves regarding their experiences and insight into blastomycosis. And for Wisconsin listeners – throughout the story of blastomycosis we want to give you more cocktail party anecdotes in describing yet another example of why our state is special and unique.

GG: So, why us? Why now? Collectively, Joe and I have nearly 2-decades of clinical and research experience on blastomycosis. As infectious disease physicians, we are the doctors battling the germs, microbes, also known as pathogens. And one germ that Joe and I are both especially interested in targeting and treating is *Blastomyces* – the germ responsible for blastomycosis. Joe and I actively participate in outreach and are using this podcast as a way to reach you regarding a disease for which there is not a lot of easy to find information out there.

JM: So - what better way to start the inaugural podcast than to provide some basic information of the infection? Therefore, today's topic of Think Blasto! podcast is "Can a fungus really cause pneumonia?"

GG: In this episode we will focus on what blastomycosis is, what looks like, where it lives, how it is acquired, and who is at risk for infection. So Joe, tell me what exactly is this blastomycosis?

JM: Blastomycosis is caused by a fungus that can infect humans and animals. In humans, blastomycosis causes an infection of the lung known as pneumonia. In addition, *Blastomyces* germ can spread from the lungs to other organs such as the skin, bone, brain, or even prostate. In fact, almost any organ can be infected.

When we think of infection such as pneumonia, mostly bacteria and viruses often come to mind; however, blastomycosis is different because it is *not* from a bacteria, it is *not* from a virus, it is caused by a fungus. Fungi are *not* the same as bacteria or viruses, they are their own unique type of organism. In fact, fungi are so unique that biologists have given them their own biologic kingdom. This is similar to what has been done for animals, plants, and bacteria – each of these have their own kingdom too.

GG: So you are telling me that blastomycosis is caused by a fungus. Are there a lot of fungi that cause infections in humans or animals?

JM: Well scientists estimate there are up to 5 million different types of fungi in the world. Thankfully only a small number of them are able to cause infection in humans and animals.

GG: Wow Joe, That's a lot of different types of fungi, but why do so few fungi cause infections in humans and animals?

JM: Well one explanation might boil down to temperature. To cause infection in humans and animals, a fungus must have the ability to grow at human or animal bodies. Body temperature for humans is 98.6°F, whereas for animals such as dogs, it is a bit higher. For the vast majority of fungi, the body temperature of humans and

animals is just too high to allow fungus to grow. Thus, if fungus can't grow because body temperature is too high, the fungus can't cause infection.

GG: So this must mean that the fungus that causes blastomycosis can grow at human or animal body temperature?

JM: Yes, that is right. So far we know that *Blastomyces* a fungus that can survive and grow in humans and animals because it can grow at body temperature. Greg, could you tell me a bit about how blastomycosis was first discovered?

GG: Yes, blastomycosis was first described in the medical literature in 1894 by Dr. Thomas Gilchrist, a physician at Johns Hopkins University in Baltimore, Maryland. Four years later in 1898, Dr. Gilchrist and his colleague, Dr. Stokes named organism *Blastomyces dermatitidis*. For over 100 years it was thought that just 1 species of *Blastomyces*, which is *Blastomyces dermatitidis*. However, with wide-spread use of DNA sequencing, we now know that there are 6 different species of *Blastomyces*. Wisconsin is home to 2 of the 6 species, *Blastomyces dermatitidis* and *Blastomyces gilchristii*. The later species, *B. gilchristii* was named in honor of Dr. Gilchrist in 2013.

JM: Now that we know Wisconsin is home to 2 of 6 different species of *Blastomyces*, what does this fungus look like? When most people think of fungus they think of mushrooms or athlete's foot? Is this something we can see?

GG: *Blastomyces* is very small and cannot be seen with the naked eye, it requires a microscope to see it. Under the microscope the shape of *Blastomyces* is influenced by temperature. At room temperature, *Blastomyces* grows as a thin, threadlike mold that produces infectious spores. These spores are very very tiny balls, that are directly attached to the mold. At human body temperature, *Blastomyces* has a very different shape and grows as a round-shaped yeast. Although spores and yeast are round, the yeast is much much larger.

When we look at the yeast under the microscope they have a distinct appearance and scientists refer this as broad-based budding. When *Blastomyces* yeast grow, they divide from 1 cell into 2 cells so it looks like two overlapping balls. On the Think Blasto! website, we have a picture of what the mold and yeast look like.

JM: What you are describing is that the one germ *Blastomyces* can take two different forms. At room temperature *Blastomyces* is a mold and at body temperature, which is higher, it is yeast. Is the germ kind of like a Dr. Jekyll and Mr. Hyde? Is it typical for fungi that cause infection to change shape like this in response to temperature and what do these changes mean?

GG: So Joe, yes, *Blastomyces* is like Dr. Jekyll & Mr. Hyde. No, it is not common for fungi to be able to change shape like this in response to temperature. The ability to switch between mold and yeast forms in scientific terms is known as thermal dimorphism – thermal means temperature and dimorphism meaning two morphologies or two forms. In addition to *Blastomyces*, there are only a few other fungi in North America that are capable of thermal dimorphism, and they just also happen to cause infection in humans and animals. The diseases caused by these close relatives are called histoplasmosis which is found in the Midwest, the other is Valley fever also known coccidioidomycosis which is found in the Southwest United States, and finally, a disease known as rose handler's disease, also known as sporotrichosis occurs sporadically throughout the United States.

JM: So Greg could you describe how a person typically becomes infected?

GG: A person becomes infected when they breathe in *Blastomyces* spores.

In the soil or dirt, we learned that *Blastomyces* grows as a mold that produces spores. When the dirt is disrupted, the spores are released from the mold and go into the air. When in the air, the spores can be breathed into the lungs. Once in the lungs, the spores germinate and grow as yeast to cause pneumonia. Each inhaled spore is capable of germinating into a single yeast. Each yeast then replicates to produce more yeast.

JM: So, blastomycosis occurs after inhaling spores that are released into the air following disruption of soil. Who is at risk for blastomycosis?

GG: Great question. Anyone who breaths in spores is at risk for developing blastomycosis. What sets *Blastomyces* apart from a lot of other fungi is that it can cause infection in persons with a healthy immune systems as well as persons with impaired immune defenses. An example of an impaired immune defense would be someone who has received an organ transplant, or are undergoing chemotherapy, or on medications that suppress the immune system.

JM: Therefore, anybody in the right environment and in with the right exposure might get blastomycosis. Are there certain people with lung diseases such as asthma or COPD at higher risk for blastomycosis?

GG: Another great question Joe, as far as we know, they are not.

JM: Does everyone who inhales *Blastomyces* spores develop a symptomatic infection?

GG: Not everyone who inhales *Blastomyces* spores develops an infection. Researchers estimate that about 50% of people exposed will develop symptomatic blastomycosis. This information was obtained right here in Wisconsin and is based on analyzing people who have been naturally exposed to *Blastomyces* during outbreaks in Wisconsin. In subsequent podcasts, we will be discussing blastomycosis outbreaks as well as symptoms that people and animals experience.

JM: You described that blastomycosis is acquired from inhaling spores from the dirt, but what if I had contact with someone with the infection, whether it was a family member or a pet with blastomycosis, could I catch the disease from them?

GG: Blastomycosis is not transmitted person-to-person, so you cannot get it from a family member. It is not transmitted from animals to humans, so you cannot get it from your pet. Blastomycosis is only acquired from the environment. Joe, could you tell me where one would find blastomycosis?

JM: So, blastomycosis is a disease that primarily occurs in the United States and Canada; however, it has also been rarely reported from Africa and India. There was even 1 reported case from Israel.

But within the United States, blastomycosis is primarily occurs in the Midwest, Central, and Southern regions, particularly in states that border the great lakes, the Ohio River, and the Mississippi River. Blastomycosis is also occurs in a few states in the Northeast that border the Saint Lawrence River such as New York. This adds up to about 21 states. If we include states such as Texas, Nebraska, Utah, Idaho, and California where a new species of *Blastomyces* known as *Blastomyces helicus* was recently described, it adds up to about 26 states in total. On the Think Blasto! website, we have a map of North America showing the distribution of blastomycosis to check out.

GG: So Joe, which state has the largest number of cases of human blastomycosis?

JM: That well that is yet another reason why Wisconsin is special. The state of Wisconsin seems to have the largest number of cases in the United States. There are 2 reasons for this:

First, Wisconsin is in the minority, it is only 1 of 5 states in which state law requires mandatory reporting of blastomycosis (This is only for people, not animals).

Second, Wisconsin soils offer a very favorable habitat for growth of *Blastomyces*.

GG: What soil environments does *Blastomyces* likes to grow in?

JM: *Blastomyces* is not found everywhere in the dirt, it is selective about where it likes to grow. Figuring out the natural habitat of *Blastomyces* was challenging. For a long time, researchers were unable to determine where

exactly *Blastomyces* liked to grow because it is very difficult to grow from soil samples. Ultimately, during the investigation of 3 separate blastomycosis outbreaks in Wisconsin in the 1980's, the discovery of its habitat was found. Ultimately, it prefers sandy soils with decaying plants that are nearby fresh water such as lakes, rivers, and streams.

GG: So for patients, families, nature lovers, and pet owners, lets summarize what we have learned today.

- 1) First, Blastomycosis occurs humans & animals (GG)
- 2) Blastomycosis is caused by a fungus named *Blastomyces* (JM)
- 3) Two of the 6 known *Blastomyces* species live in Wisconsin, these are *B. dermatitidis* & *B. gilchristii* (GG)
- 4) Wisconsin has the highest number of blastomycosis cases in the United States (JM)
- 5) The preferred habitat of *Blastomyces* is sandy soils with decaying plants that are nearby fresh water (GG)
- 6) In its soil habit, *Blastomyces* grows as mold that produces infectious spores (JM)
- 7) When the spores are inhaled into the lungs they convert into round budding yeast to cause pneumonia (GG)
- 8) Finally, we learned that anyone is at risk for blastomycosis but only about half the people who breath in *Blastomyces* spores will develop symptomatic infection (JM)

We would like to thank you for listening today. We hoped that you learned a lot of helpful information about blastomycosis. Please stay tuned for subsequent podcasts and remember to Think Blasto!

Thank you – and until next edition – goodbye.