

## BroadcastMed | High Altitude Physiology Research on Mt. Everest

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**DR. CHET RIHAL:** Hi, I'm Chet Rihal. Today we have a very special guest with us. Dr. Bruce Johnson is a PhD exercise physiologist with an independent research program and the division of cardiovascular diseases at Mayo Clinic, Rochester. Dr. Johnson has had his interest in pulmonary and cardiac physiology with a particular emphasis on high altitude physiology.

Bruce, why don't you tell us a little bit about your background, your interest in altitude, and a very interesting expedition that you're going to be part of in a few weeks?

**DR. BRUCE JOHNSON:** Yeah, well thanks Chet. I've been involved in extreme, I'd say extreme physiology, environmental physiology, altitude physiology, for about 20 years. And I've had an ongoing interest in the limits of human performance and really brought that interest back to the Mayo Clinic when I first started here. And it took that interest to, really, patient groups. And some of that same interest evolves around what are the limits to activity levels in certain patient groups, like patients with heart failure or chronic lung disease?

And this particular project, really, has been building for a couple of years now and has several projects really linked together. And basically, we're going to take our lab and put it on the backs of yaks and bring it up to the base camp of Everest.

**DR. RIHAL:** Of Mt. Everest?

**DR. JOHNSON:** Mt. Everest.

**DR. RIHAL:** So what are you going to be doing up there?

**DR. JOHNSON:** Well, the base camp of Everest is almost 18,000 feet. And--

**DR. RIHAL:** So how does that compare to mountains that we may have here in North America?

**DR. JOHNSON:** Yeah, so the highest mountains really on continental US are more in the 14,000-foot range. And you can get up to Alaska and Denali, and it's higher. But this is one of the higher base camps and places to do research of this type.

And our projects are linked. We've got several of them. These are logistically difficult projects to plan. So when we go, we try to do a number of studies that are linked and in somewhat in parallel.

**CHET RIHAL:** Tell us about the team that will be going on this expedition.

**DR. JOHNSON:** Yeah, so it will be myself and really young members of my laboratory. And as I was saying, I've had an ongoing interest in this type of work. And a lot of these younger post-doctoral-type fellows, medical research fellows, have also this kind of interest in environmental physiology, altitude physiology, and field research. And so this is an opportunity to bring them into the field and show them what it's like.

**DR. RIHAL:** I imagine there's no facilities there. Are you taking the facility with you?

**DR. JOHNSON:** So we estimate we have 1,300 pounds of medical equipment we'll be bringing up with us. And so it's all on yaks and porters to get it up there.

**DR. RIHAL:** So what will you be studying there?

**DR. JOHNSON:** So really three types of projects-- one is a collaboration with The North Face Company and National Geographic. And we're interested in how their products affect performance in the field. So we're working with some extreme athletes, people that will be summiting Mt. Everest. And we're looking at ways to help improve product to help performance in the field.

Second, we have some studies running that will parallel our work here at Mayo, in the laboratory. These are studies looking at lung fluid regulation, pulmonary congestion, rapid weight loss, which is a problem at high altitude, but also a problem in certain patient populations. And then a third project, which is, again, somewhat linked, is we're working with a technology group at Mayo that has developed a monitoring device that can run for up to a month with collecting high resolution data. So we're going to bring this device with us. We're going to use it for some of our data capture and then help develop algorithms that can be used here at the clinic for more home and remote patient monitoring.

**DR. RIHAL:** Are there are similarities in the disturbances in lung water regulation at high altitude and patients with heart failure or no?

**DR. JOHNSON:** Yeah, we think there are. In fact, we think hypoxia plays a major role in the pathophysiology of a number of chronic diseases. And heart failure you don't typically think of as one of the disease states where hypoxia plays a major role. But we think low perfusion to the tissue, low shear stress to the carotid bodies, we think that the dips in oxygen at night, when a lot of these people have forms of central sleep apnea, probably drives the sympathetic nervous system. And then that goes on to play a role in the disease process.

**DR. RIHAL:** So how long will you be spending at base camp?

**DR. JOHNSON:** So, it's about a 40-mile trip into base camp. And you can do it relatively rapidly, but you need to allow time for your group to acclimatize. And we don't want to be sick at base camp, so we'll probably take eight to 10 days to make our way up to base camp. And then the study itself will run about 10 days.

**DR. RIHAL:** About 10 days, yeah. And will you be monitoring the climbers who will be going to the top? And are you a climber yourself?

**DR. JOHNSON:** Yeah, well the climbers actually came to the Mayo Clinic. There were nine of them. We put them through a series of tests here to look at body composition, their fitness, their lung physiology, some biochemical markers. And then we gave them devices. And they actually left a month ago and they have been acclimatizing now. And they'll work their way up to the higher camps and do continuous acclimatization runs. And we'll meet them at base camp and then begin collecting additional data.

**DR. RIHAL:** Well, Bruce, that sounds like a fascinating project. And I'm sure the data that you generate is going to be of both of wide interest and potentially of a benefit to our patients with heart failure and other cardiac problems. So good luck with it.

**DR. JOHNSON:** Yeah, well thank you very much. It will be an exciting study.

**DR. RIHAL:** We look forward to hearing the followup after you're back. Thank you.

**DR. JOHNSON:** Yeah, thank you.