



## IF YOU CAN'T STAND THE HEAT, YOU MAY BE A POLIO SURVIVOR.

[Dr. Richard L. Bruno, HD, PhD](#)

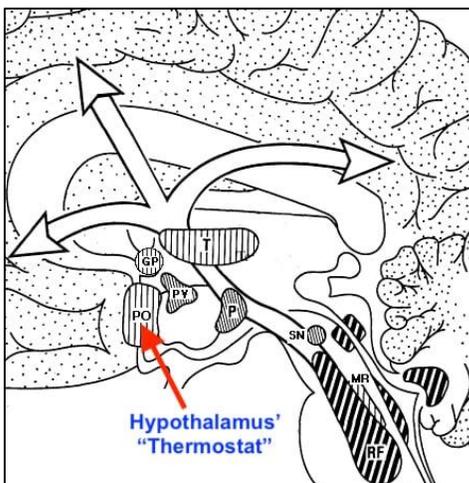
Director, International Centre for Polio Education

**Question:** When the temperature goes up I feel so hot, even indoors in the winter, that I sweat and soak my clothes. But sweating doesn't cool me down and, in spite of my frozen "polio feet" staying ice cold, I feel like I'm cooking inside. Is my problem with temperature a post-polio thing?

**Answer:** The poliovirus damaged the neurons in the brain and spinal cord that control body temperature that control the sympathetic nervous system. Your brain's thermostat (in the hypothalamus) should turn on sympathetic nerves to cause skin veins and arteries to constrict when it's cold, preventing loss of body heat. The reason polio survivors have cold and purple "polio feet" is that there isn't a signal from the brain thermostat that reaches blood vessels to tell them to constrict. So hot blood flows to the vessels near the surface of the skin, heat in the blood radiates away from your body and your skin gets cold, which passively makes the veins clamp down, trapping cold, purple blood in the little veins and, voilà, "polio feet."

But if the poliovirus damaged neurons that control body temperature, shouldn't polio survivors have trouble with heat as well as cold? Over the course of decades I had not heard one polio survivor report being overcome by heat, only that they were being frozen stiff by the cold. So while I studied blood flow and the effects of cold on polio survivors, I never studied the effects of heat. But I should have. Back in 1985, in our own first Post-Polio Survey, about 1/3 of polio survivors said that they were adversely affected by the heat.

Why didn't I study heat intolerance? Truth be told, I think I was frightened off by the first polio survivor I studied. She said that her polio-affected foot was always much colder than the other foot, even when she was in a room where others were comfortably cool. I was shocked and worried when she removed her sock to reveal a reddish-purple calf and a deep purple foot. I was afraid she had a blood clot, maybe even a clogged artery. But her veins were clear and she had bounding pulses in both feet. The real shock came when I placed an electronic thermometer on her skin. The room temperature was 75°F (24°C). I watched as the numbers on the thermometer dropped and dropped, until they stopped at 72°F (22°C). Her foot was actually colder than the room temperature! I had to put her foot up on a stool and cover it with a hot pack for half an hour before it began to warm just slightly. And when it finally did heat up, the skin became as red as a lobster. It didn't take a rocket scientist to see that there was something radically wrong with blood flow in this polio survivor's leg. So that's where our research focused, on the effects of cold.



Too Darn Hot. It's not that I wasn't interested in the effects of heat. The mechanism for sweating was one that I had studied fairly extensively when I was the autonomic nervous system fellow at Columbia-Presbyterian, before even seeing a polio survivor. The first paper I ever presented was on the mechanism of decreased sweating in Parkinson's patients. We knew that the brain's thermostat and sympathetic nerves not only control blood vessels but also control sweating, which cools your body by evaporation of sweat on your skin when opening blood vessels doesn't "dump" enough body heat via radiation. Given our finding of polio survivors' arteries not getting a signal to constrict, I would have expected poliovirus damage to the brain's thermostat and sympathetic nerves would cause polio survivors always to sweat too little. And I would have been wrong.

In a recent Internet survey, six-dozen polio survivors reported difficulties with temperature, specifically on heat intolerance. When asked about sweating, a minority reported "little to no sweating" associated with heat intolerance, while three times as many reported "hot flash-like" sweating, especially about the neck and face. "Comfortable" temperatures were reported to range from 61°F (16°C) to 72°F (22°C), while heat intolerance symptoms began from 72°F (22°C) to 85°F (29°C). The most common symptoms of heat intolerance were "nausea," "feeling faint or dizzy," being "itchy," fatigued and even anxious. Surprisingly, only three polio

survivors reported that their skin became red when they felt overheated, suggesting an inability of blood vessels to open and dump enough body heat so that sweating wasn't necessary. Also surprising were polio survivors who reported having "hot flash-like" sweating from the neck up at the same time as they were experiencing painfully cold legs and feet.

With these findings, we may have come full circle. We know that polio survivors have cold legs and feet ultimately because arteries clamp down and prevent hot blood from the body's core from heating the skin's surface. Perhaps the inability to get rid of excess body heat results from the same problem - surface arteries not opening - that leads to symptoms of heat intolerance and triggers sweating above the waist to try to cool the body.

So, at least for some polio survivors, cold feet cause hot heads.