

Name: _____ Class: _____

Why Paralympic sprinters have trouble with curves

An artificial leg slows a runner when it's on the inside of a curve

By Helen Thompson

In this informational text from Science News for Students, Helen Thompson discusses a study of how runners with prosthetic limbs performed on the curved portion of a track. As you read, take notes on what happens when runners with prosthetic limbs go around the curve in a track.

- [1] Curves tend to put the brakes on human runners. They're even harder for amputees¹ using an artificial limb. Research now shows that even which leg the prosthesis is on can affect how fast someone can take a curve.

Two important forces are in play when a sprinter rounds a bend. First, working against gravity slows a runner. But centripetal (Sen-TRIP-eh-tul) force also is at work. It pulls something on a circular path toward the center of the curve. And it, too, will slow a runner down.

Studies have suggested that when an experienced sprinter goes around a turn, the inside leg creates less force than the outside one. So researchers at the University of Colorado at Boulder wanted to see how this might affect runners with artificial limbs. To find out, a team from its Applied Biomechanics Lab filmed such U.S. and German runners.

The Paralympic Games is an international sporting competition for athletes with physical disabilities. Like the Olympics, this group hosts summer and winter games every four years.



["Below-the-knee amputee Fields runs for berth in 2012 Paralympics 090721"](#) by U.S. Army is licensed under CC BY 2.0

- [5] The scientists compared Paralympic sprinters who had amputations above the ankle to non-amputee runners. They also looked at each as they ran clockwise and counterclockwise around a track. Someone with a prosthetic limb on the inside of a curve ran 3.9 percent slower than runners with one on the outside of the curve.

1. a person who has lost all or part of a limb

Most amputee runners wear J-shaped prosthetic limbs. That absorbs then releases energy, much as a human ankle does. But these devices can't create as much force as a real ankle does. So amputee runners make up for this by swinging their legs faster.

Sprinters whose prostheses were on the inside of a curve also decreased the speed of their steps, the researchers found. So they couldn't compensate as well for their artificial limb generating less force against the ground compared to a regular ankle.

Paralympic races always run counterclockwise. Left-leg amputees therefore may be at a disadvantage, the data indicate.

The team published its results in the March 16 issue of the *Journal of Experimental Biology*.

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Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. PART A: Which statement describes the central idea of the text?
 - A. Further advances need to be made in prostheses to provide them with the same power that non-prosthetic limbs have.
 - B. Sprinters run with their prosthetic limb facing the outside of the curve to use the full power of their non-prosthetic ankle.
 - C. The curve in a race track forces all runners to take it at a slower pace due to gravity and centripetal force.
 - D. Having a prosthetic limb on the inside of a track impacts how quickly a sprinter can run around a curve.

2. PART B: Which detail from the text best supports the answer to Part A?
 - A. "But centripetal (Sen-TRIP-eh-tul) force also is at work. It pulls something on a circular path toward the center of the curve. And it, too, will slow a runner down." (Paragraph 2)
 - B. "Studies have suggested that when an experienced sprinter goes around a turn, the inside leg creates less force than the outside one." (Paragraph 3)
 - C. "Someone with a prosthetic limb on the inside of a curve ran 3.9 percent slower than runners with one on the outside of the curve." (Paragraph 5)
 - D. "Most amputee runners wear J-shaped prosthetic limbs. That absorbs then releases energy, much as a human ankle does." (Paragraph 6)

3. Which statement describes the author's main purpose in the text?
 - A. to suggest that left-leg amputees be allowed to run clockwise around the track
 - B. to present a study about how Paralympic sprinters are affected by running curves
 - C. to emphasize how much more work needs to be done on prostheses for runners
 - D. to explain how prosthetic limbs provides sprinters with the power they need

4. How do paragraphs 6-7 contribute to the development of ideas in the text?
 - A. They emphasize how sprinters with prostheses are advocating for running races without curves.
 - B. They show how it takes more training for left-leg amputees to run curves than for right-leg amputees.
 - C. They highlight the functional similarities between an ankle and prosthetic limbs used for sprinting.
 - D. They explain why it matters if a sprinter's prosthetic limb is on the inside of a track.

5. What is the connection between the direction that sprinters with a prosthesis run and the speed at which they can run?
