



COMMAND CENTRAL

Peppi and Bollo move upward from Joanne's shoulder toward her head.

"We're about to arrive in the brain. Time to stop and observe some important activities," says Peppi. "As far as the muscles are concerned, the brain is command central. Most muscles act only when the brain gives an order. When the brain says 'Sit,' certain muscles contract and pull. The bones and joints cooperate, and a human sits. More obedient than a trained dog!"

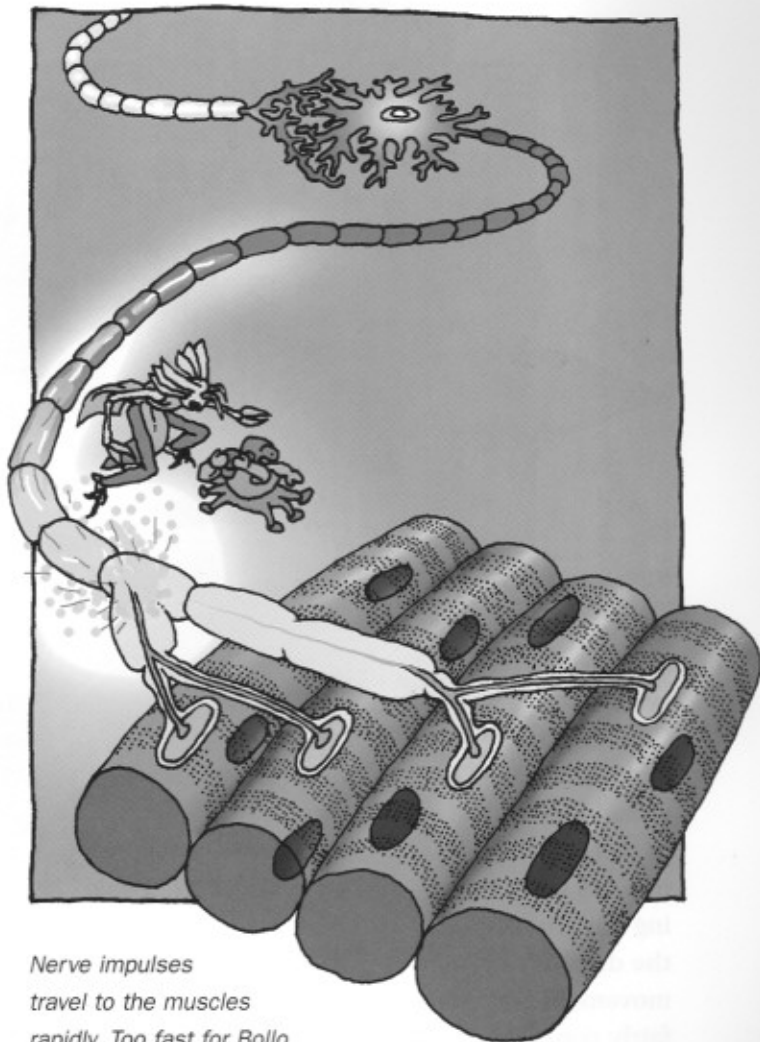
"How does that order reach the muscles?" asks Bollo.

"Think of the nerves as the messengers. They carry signals deep into the muscle cells. Inside the muscle cells are

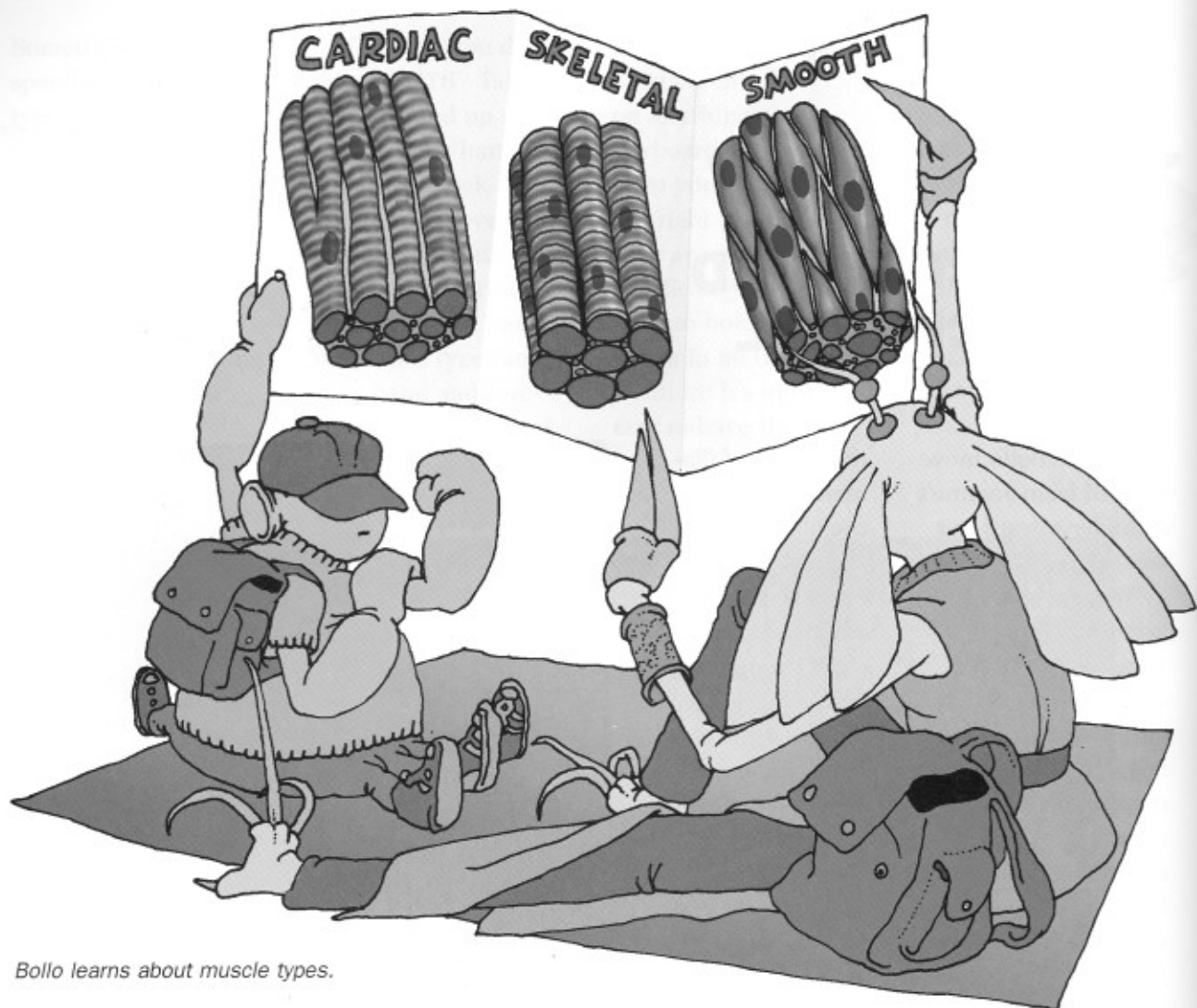
thousands of filaments. Normally, the filaments are slightly interlocked—like two combs with their teeth overlapping a little bit. When a nerve impulse reaches the muscle cells, the fibrils slide in between each other; this movement is called a 'muscle contraction.' The muscles go into action within a few thousandths of a second after getting their instructions."

"You said most muscles work this way. What about the others?"

"The muscles I've been describing are the skeletal muscles. They work when the nervous



Nerve impulses travel to the muscles rapidly. Too fast for Bollo to clock!



Bollo learns about muscle types.

system tells them to. But a few muscles are 'on automatic.' These include the muscles in the digestive system. As we saw during our trip through the digestive system, movement there is fairly constant."

"I bet the heart falls into that category,

too," says Bollo.

"You're right. The heart beats on its own . . ."

". . . because it gets a reminder from the heart's natural pacemaker, I know," says Bollo.

"Good for you!" says Peppi.

"There's still one

thing I don't understand," says Bollo.

"Heart muscles work 24 hours a day. But when humans work or play hard, their skeletal muscles get really tired. Sometimes, they even cramp. What's the difference?"

"Different muscle types have different

designs. Heart muscles are designed especially for endurance," says Peppi. "Skeletal muscles, on the other hand, can tire. Some of them tire more easily than others."

"But why do they get tired?" asks Bollo.

"They run out of gas," says Peppi.

“Gas! There’s no gasoline in muscles,” says Bollo.

“You’re right about that. But just like a car needs gasoline to keep it running, muscles need fuel, too. The fuel is the nutrients and oxygen that combine during cellular respiration. If the fuel supply

gets low, the muscles begin to slow down.”

“Can humans do anything to increase muscle endurance?” asks Bollo.

“Yes. Use them! When humans get plenty of exercise and use the same muscles again and again, their muscles become more

resistant to fatigue,” says Peppi. “Of course, they need to eat properly so that the muscles have the fuel they need to do their work. They also need to relax once in a while to give those muscles a break. Cardiac muscle, on the other hand, never takes a break.”

“B-r-e-a-k! You said the magic word,” says Bollo. “My muscles are ready for a rest.”

“And so is Joanne,” says Peppi. “Let’s let her sleep in peace. It’s time for us to pack up and head back home.” □



Peppi and Bollo say good-bye.