

Ottawa Science Innovation Challenge

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Acknowledgements

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The Case: Multiple Sclerosis



“I’m open - pass the ball over here!”

Kate pushed the soccer ball forward, skipped past her defender, and struck the ball on goal. The goalkeeper, Angie, dove valiantly but came up short as the ball soared over her and into the top corner of the net. Angie lay on her back and shook her head, “Why can’t you do that more often during our games?” she jeered.

Kate laughed. It was a beautiful Thursday morning and there wasn’t a place in the world she’d rather be than on the Gee Gees soccer pitch practicing her favourite sport with her teammates. She walked over to Angie and offered a hand to help her up. “Well the goalies on other teams tend to be a little better than you,” she jabbed back.

Angie rolled her eyes, then took Kate’s hand and began to stand. Suddenly, Kate realized that her arms and legs had gone completely numb, as if a switch inside her body had been abruptly shut off. Kate’s vision also blurred as she lost her grip on Angie. Both girls tumbled back to the ground.

“What was that about?” Angie asked irritably, brushing away the black, turf-infill pellets that were clinging to her skin. Then she glanced over at Kate, who was still lying face-first on the ground... motionless. “Uh... you good, Kate?”



Kate’s heart was thumping rapidly in her chest. She was well aware that she had fallen, but she had absolutely no feeling in any of her limbs. She tried desperately to move, to stand up, but to no avail. Just as she was beginning to panic, a rush of sensation coursed through her body. While still lying down, she clenched and unclenched her hands a couple of times, wiggled her toes, and straightened out her legs. Everything seemed to be back to normal, almost like nothing had happened at all.



“Kate? Hello?”

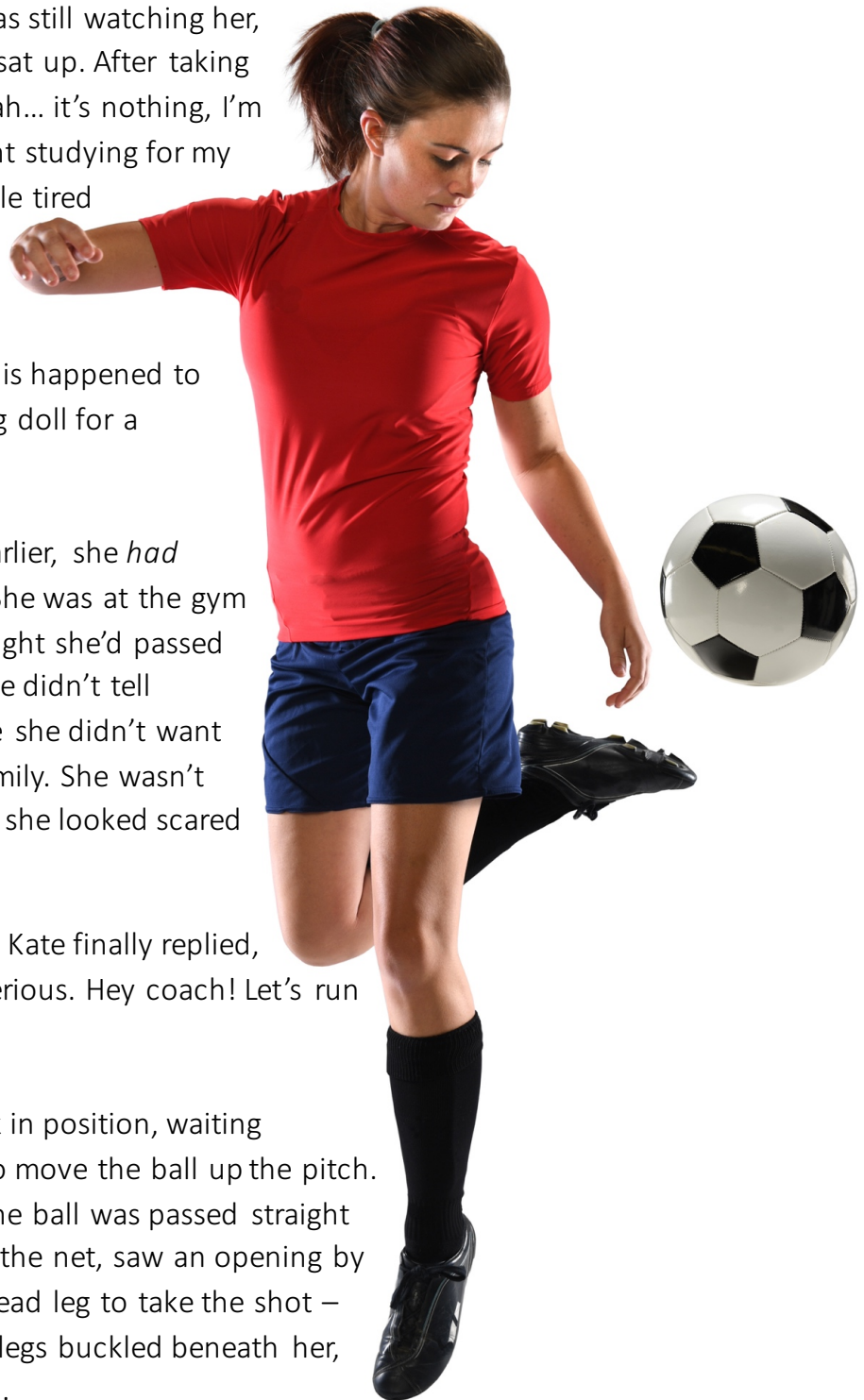
It dawned on Kate that Angie was still watching her, so she carefully rolled over and sat up. After taking a deep breath, she said, “Uh yeah... it’s nothing, I’m fine. I was just... up late last night studying for my exam today and I guess I’m a little tired and clumsy from lack of sleep. Sorry Angie.”

Angie wasn’t convinced. “Has this happened to you before? You looked like a rag doll for a second...”

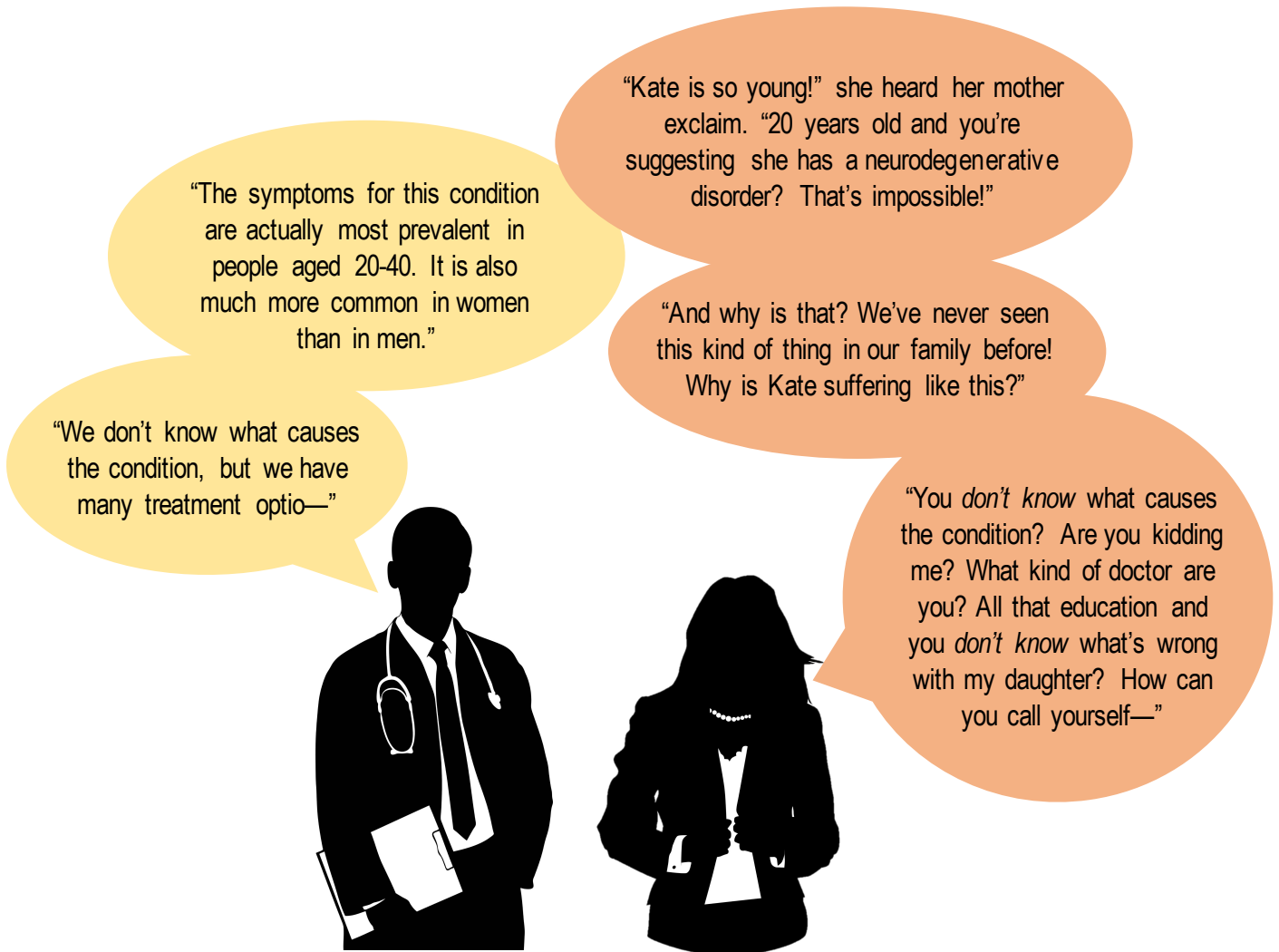
Kate hesitated. A few months earlier, she *had* experienced a similar episode. She was at the gym when it happened, but she thought she’d passed out because of dehydration. Kate didn’t tell anyone about it, mainly because she didn’t want to scare any of her friends or family. She wasn’t about to tell Angie now either... she looked scared enough already.

“No it hasn’t happened before,” Kate finally replied, “And I’m sure it isn’t anything serious. Hey coach! Let’s run that play one more time!”

Within moments, Kate was back in position, waiting attentively for her teammates to move the ball up the pitch. She made the perfect run and the ball was passed straight into her feet. She glanced up at the net, saw an opening by the near post, and planted her lead leg to take the shot – then her vision went black. Her legs buckled beneath her, and she collapsed to the ground.



Kate woke up in the hospital. She realized she could move her limbs again, and apart from some minor scrapes and soreness from the fall, she felt perfectly normal. Kate heard two voices nearby, one she recognized as her mother's, and the other from a man, presumably her doctor.



"Mom!" Kate called out. Hearing her mother yell was starting to give her a headache. Both her mother and her doctor walked over to her bedside.

"Kate! You're awake! How do you feel?" her mother asked.

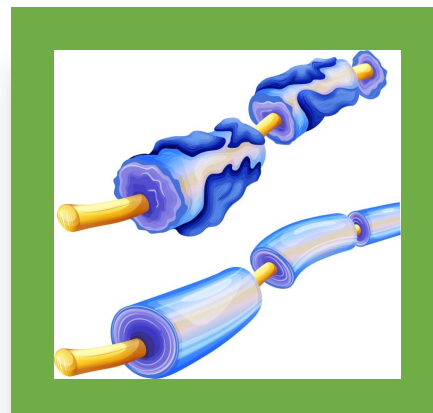
Kate shrugged, "Been better but I feel alright, I guess." Then she turned her attention to the doctor. "So... what's wrong with me?"

The doctor cleared his throat. "I think I have a good idea, but there's something I need to know. Your mother tells me this is the first time this has happened to you... is that true?"



Kate bit her lip, but decided to tell the doctor about her earlier episode. Her mother gasped and was about to say something, but the doctor cut her off.

“That’s what I expected, thank you for sharing this. I’ve taken a look at your MRI scans as well and I am diagnosing you with Relapsing-Remitting Multiple Sclerosis. As I was explaining to your mother, MS is an autoimmune condition where your body attacks the myelin sheath surrounding your nerve fibres.” He paused, seeing Kate’s blank stare. “Think of it like an electric cable,” he continued, “Your neurons are like the metal wires on the inside and the myelin sheath is like the rubber casing that surrounds it. When there are damages along the cable’s coating, the signals sent between your brain and the rest of your body fade much more easily and have a higher risk of being lost at the weak points along the cable. That’s what causes the impaired senses, as well as the loss of sensation in your limbs.”



Kate nodded. “So what about the Relapsing-Remitting part? What does that mean?”

“It just means your symptoms come in brief attacks, or *relapses*, that can be separated by months, maybe even years, of *remission* periods where you experience no symptoms at all. RRMS is also the most common type of MS. We’ll run some more tests to confirm, but I believe we have the correct diagnosis.”



At this point, Kate was feeling slightly overwhelmed. “Am I going to... die?” she asked.

The doctor shook his head. “That’s something you shouldn’t have to worry about anytime soon. Most patients with MS have a very similar life expectancy to that of the average person.”

Kate’s eyes lit up. “Does that mean I can be cured?”



“I’m afraid that’s where I have to give you the bad news. We don’t understand enough about what actually causes the disease yet, and for that reason, we don’t know how to cure it. That being said, we have a variety of treatment methods that can delay future episodes and reduce future disability, but that’s the best we can do.”

Kate nodded. It was a lot of information to take in, but she still had one burning question to ask. “Will I still be able to play soccer?”

The doctor thought for a moment, choosing his words carefully. “I would highly encourage you to continue some light activity for personal fitness, but I wouldn’t recommend competing in varsity sports. It has been observed in many patients with MS that rises in body temperature have been associated with intensified symptoms, so vigorous exercise is something you may want to avoid.”

Kate felt her eyes begin to water. “But I feel fine! I’ll play until I collapse if I have to, I just want to compete!”

Her mother put her hand on her shoulder. “Kate, I know that’s not what you want to hear, but we can’t afford to risk it. We have to pull you out of soccer.”

Kate was devastated. She knew deep down that it was probably the best decision to make, but she didn’t want to accept it. If sports had taught her anything, it was to never back down from an obstacle. There was always a solution to every problem; one just needed enough passion and effort to find it.

That night, Kate stared out the window as her mother drove her home from the hospital. Whenever they passed a soccer pitch, Kate’s gaze would stay fixed upon it until the field had faded away in the dark of night. After passing the third field, she’d made up her mind.

She was going to find a way back to soccer. She was going to overcome her MS. Whether it be a cure for her condition, or a way to control the timing of her symptoms, she didn’t really care. Kate was overcome with a sudden rush of excitement. All she needed now was a place to start her research...



The Challenge

The case is used to identify possible aspects and directions to explore related to this year's topic: Multiple Sclerosis. In fact, your proposal should not focus on any of the characters or the story illustrated in the case. You should use the case as an eye opener to the different problems related to Multiple Sclerosis, and from there conduct a literature search to better understand this problem. Only then will you be able to connect ideas together and form a new research proposal.

Below are examples of problems and possibilities for the proposals. However, you are not limited to these problems or solutions, these are simply for inspiration:

Problems highlighted	Possibilities to explore
Cause of MS remains a mystery	Find potential lifestyle, environmental, genetic and biological factors. What are the triggering mechanisms?
Sometimes difficult to recognize the early symptoms of MS, leading to delayed diagnosis and extensive damage of the central nervous system	Easier and less expensive diagnostic tests (compared to MRIs) that can be conducted, genetic or biological indications that someone is more susceptible to MS
Cannot currently reverse the damage of myelin sheath	Therapies to reintroduce/rebuild the myelin sheath, the possibility of using stem cells, better understanding the mechanisms of building the myelin sheath
Most MS medications have either severe side effects or must be inject, further causing inconvenience to patients	Find ways to introduce drugs orally/topically, find ways to reduce certain side effects
MS patients struggle with certain daily activities and sports	Potential new technologies that can aid MS patients to form more coordinated movements, medications that can aid the body to coordinate movements better
A large amount of MS patients suffer from emotional instability and even psychiatric disorders	Find better solutions for lifestyles being affected; explore psychiatric component



Additional Information

Discovering Multiple Sclerosis

In 1868, Dr. Jean-Martin Charcot examined a young woman who suffered an unusual combination of symptoms. She had a tremor that he had never seen before, slurred speech, and abnormal eye movements. He tried several typical treatments for other neurological disorders, including electrical stimulations, injections of silver (which was a standard treatment for syphilis--another nerve disorder), and strychnine (which was a deadly poison that can stimulate nerves in small doses). Unfortunately, none of his treatments worked and his patient died. Frustrated and puzzled by the cause and resistance, he dissected and examined her brain after she died and discovered scars (or plaques). He called this disease “sclerose en plaques.” (“The History of MS: The Basic Facts| National MS Society”, 2016)

Multiple Sclerosis Facts

Canada has the highest rate of multiple sclerosis (MS) in the world with an estimated 1 in 340 Canadians living with this disease. MS is usually diagnosed between the ages 15 to 40 and it is more prevalent in women than men and in people of northern European background. (“What is MS?|Multiple Sclerosis Society of Canada”, n.d.)

Beginner’s Guide to Multiple Sclerosis

Multiple Sclerosis is currently classified as an autoimmune disease of the central nervous system that attacks and damages the myelin sheath. The myelin sheath covers and protects nerves like an insulation coating around electrical wires, and plays a crucial role in the transmission of action potentials and electrical signals through nerve fibres. When the myelin sheath is damaged significantly, nerve impulses can be completely disrupted, nerve fibres are damaged, and healthy tissue is replaced with scar tissue. Current research suggest that a key culprit in MS is the white blood cell called the T cell. Activated T cells leave the bloodstream and enter tissues of the nervous system to damage the myelin sheath. Currently there is no cure. (“What is MS?|Multiple Sclerosis Society of Canada”, n.d.)



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