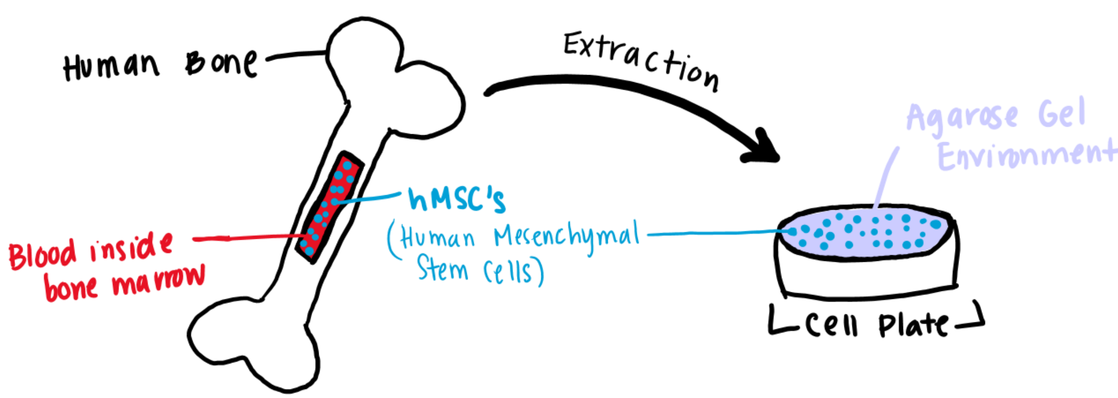
The Electric Slide

By Simran Shergill

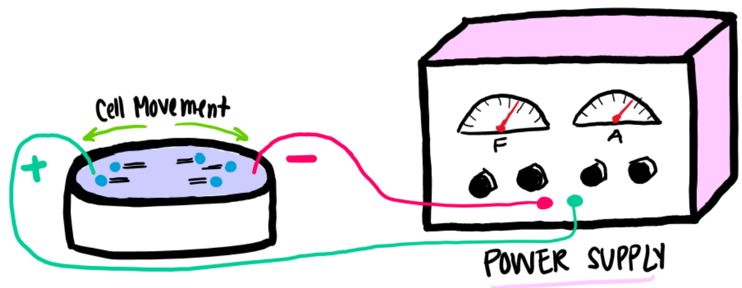
Have you ever heard music so rhythmic, so catchy, and so beautiful that it just makes you want to get up and move? I'm sure you can all revert to a time where this happened to you. Music almost has an "electric" effect on the body, exciting our brain and limbs when we are exposed to such joyous sounds that make our feet feel a beat. We get up, move towards the music source, and bust a move! In this same way, cells in our body react to stimuli outside and inside the body and in turn, start moving!

Now you might need some clarification, what are cells? Well, cells are the tiny building blocks of living organisms that make up the human body, so think of them as the instruments that create a song. Without instruments playing cohesively, we can't create a melody or beat for a song to form a catchy tune. Cells function this same way to constantly upkeep and create "rhythm" within the human body. Without them, we wouldn't have any flow or functionality in our bodies. They are small circular bodies that multiply, move, and function in various ways throughout each organism. They can react to things both inside and outside the body, just as the way humans react to good music or loud police sirens. All these stimuli elicit responses, which is what we want to study.

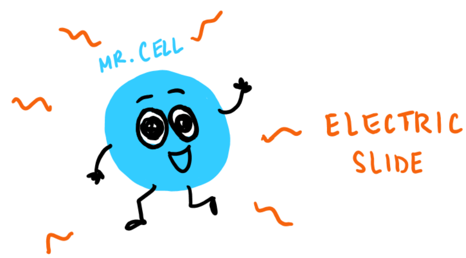
The specific response we are addressing here are the movement of cells in response to electrical stimulation, and yes I mean real electricity! Although this seems harsh, when electrical impulses are delivered to cells, they are in micro doses of amplitude and frequency, meaning they are very small zaps of electricity that do no harm to the living cell. How do we do this? You might ask. Well, first we select cells from the human body and then subject them to electrical stimulation. For our purposes, we want to take human mesenchymal stem cells aka the cells found in bone marrow! Bone marrow is the soft spongey tissue that makes up the middle of your bones, and stem cells help create this spongey tissue. So, once we extract and culture these mesenchymal stem cells from bone marrow, we can move forward with electrically stimulating them.



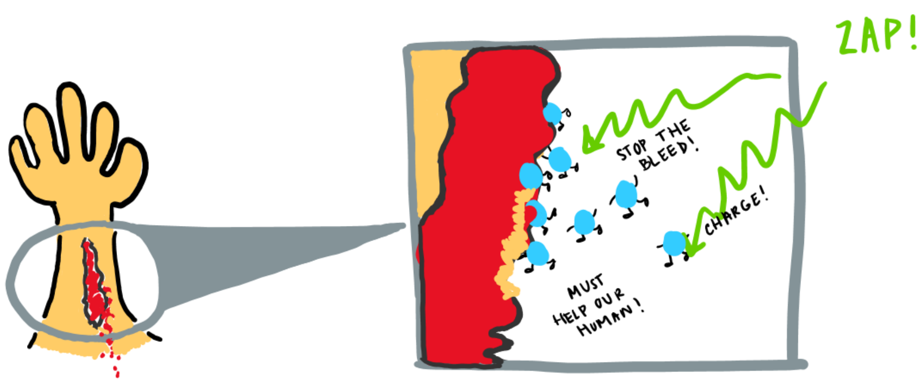
To subject stem cells to electrical impulses, we first place them in a plate filled with agarose gel to create a neutral environment for cells to respond. Then, we place an electrode (wire that sends electricity from one source to another) into the gel to deliver electricity through an attached power supply device. Think of this like jumpstarting a car, you need a cable attached to your car and another cable attached to the car with the power supply you need. The stem cells in the agarose gel represent the dead car battery, the power supply represents the charged car battery that provides power, and the jumper cables represent the electrodes that emit electricity to the cells! To create a schematic, for stem cells it will look something like this:



The agarose gel serves as a jelly electric field where currents can travel through and effect the cells inside. So from here, we can stimulate or "zap" the tiny cells and watch them move through a microscope! As seen in previous scientific research, we can notice that the cells move in response to the electrical stimuli, to either side of the gel. This tells us that the cells can migrate toward a specific area given the appropriate electrical stimulus! This is the "electric slide" dance that the cells do, they move around in response to the electricity! But why does this even matter?



Once we know how cells move in response to electrical stimulation, we can figure out how much stimulation to give them to move them toward specific sites in the body. This would probably happen through a probe or source such as a thin "electrical patch" that could deliver electrical impulses directly through the skin surface. Think about it… a patch that can be placed onto your skin to deliver harmless electrical impulses and move cells toward your wound (a cut, per say) to help heal a wound faster… sounds futuristic right? Now, this approach could work by migrating the body's natural "healing cells" (platelets, neutrophils, macrophages, and fibroblasts) into the wound site. Sounds like a promising fix with notable limitations and considerable challenges for *in vivo* administration, which arguably leads to need for greater research on this topic. However, if achieved, this method could help millions of chronic wound care patients heal in the future! Let's get working on studying the cellular electric slide movement!



For these reasons, the movement of cells in response to electrical stimulation can be a useful and novel tool in helping heal wounds and repair tissues and organs in a fast and less invasive way! Let's hope we can redirect cells to slide to the left… slide to the right… to the wound sites! And save millions of wound care patients from invasive methods of chronic wound treatment.

References

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