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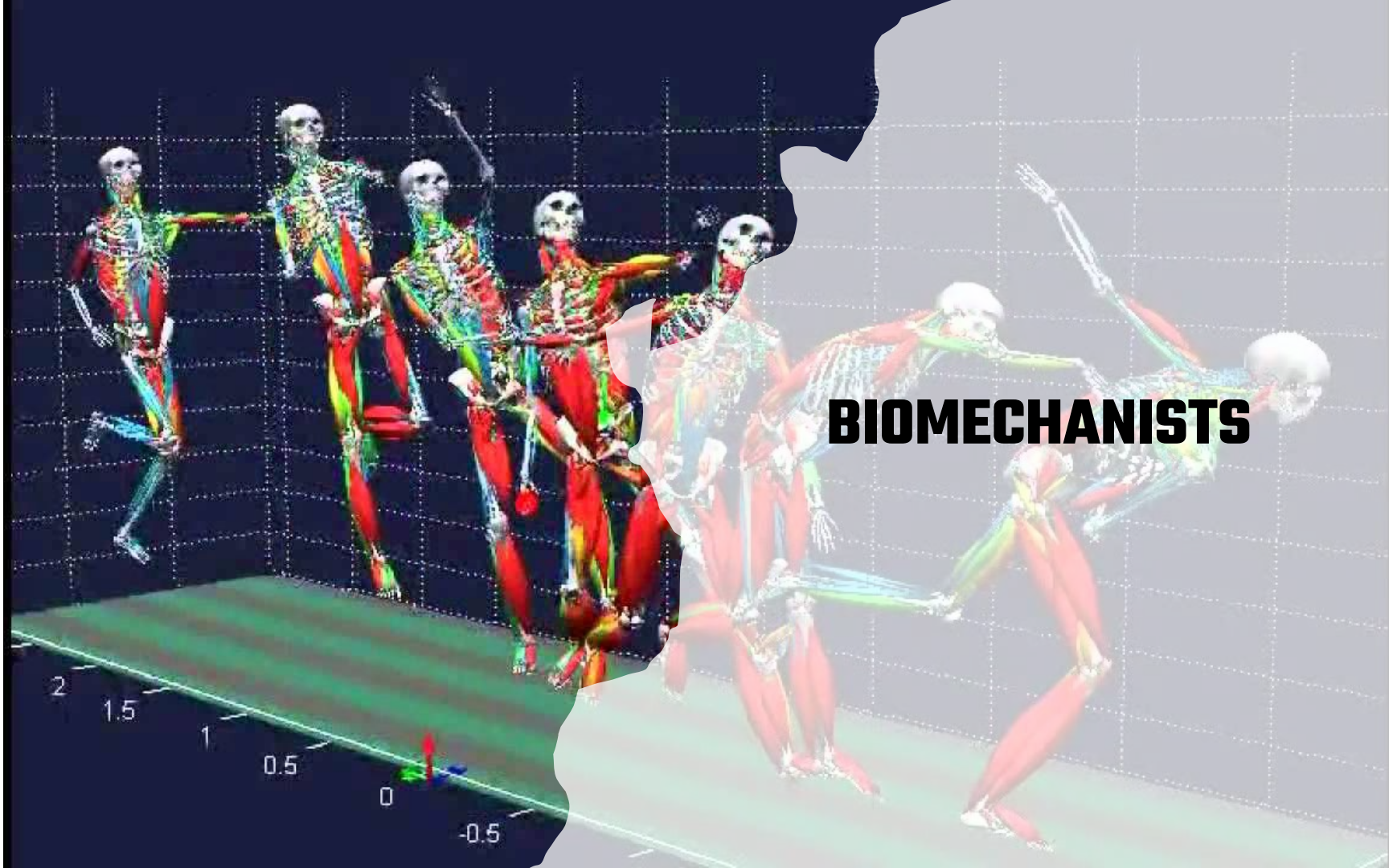


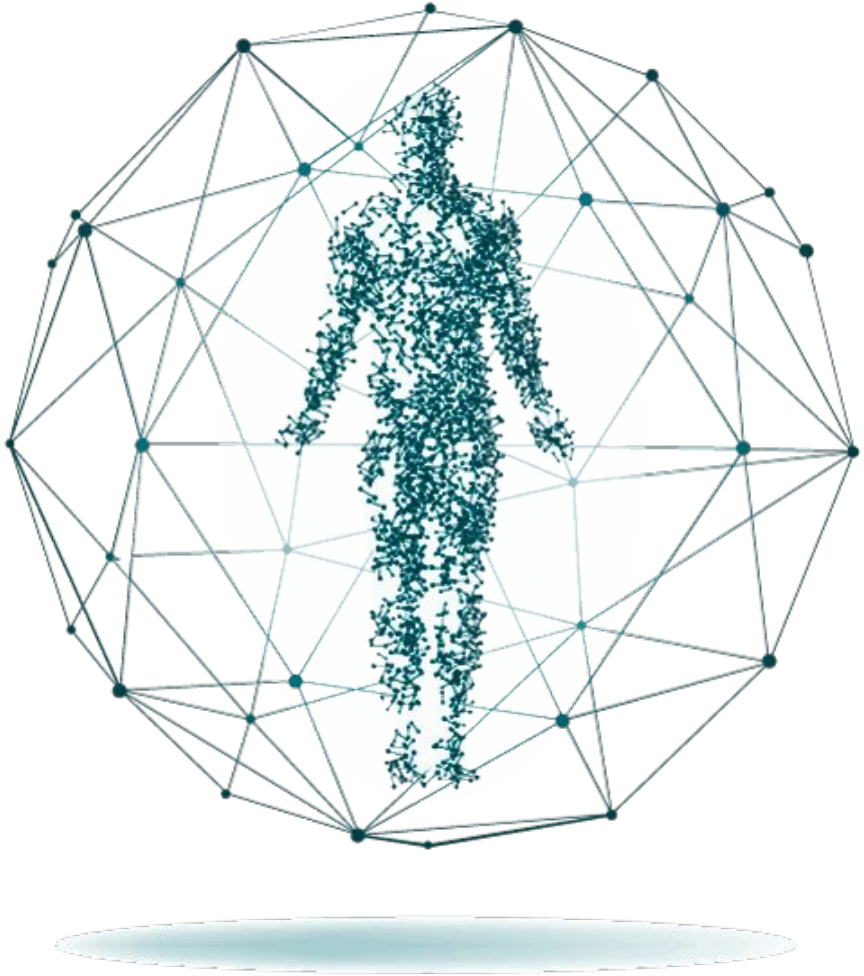
BIOMECHANISTS

3383B

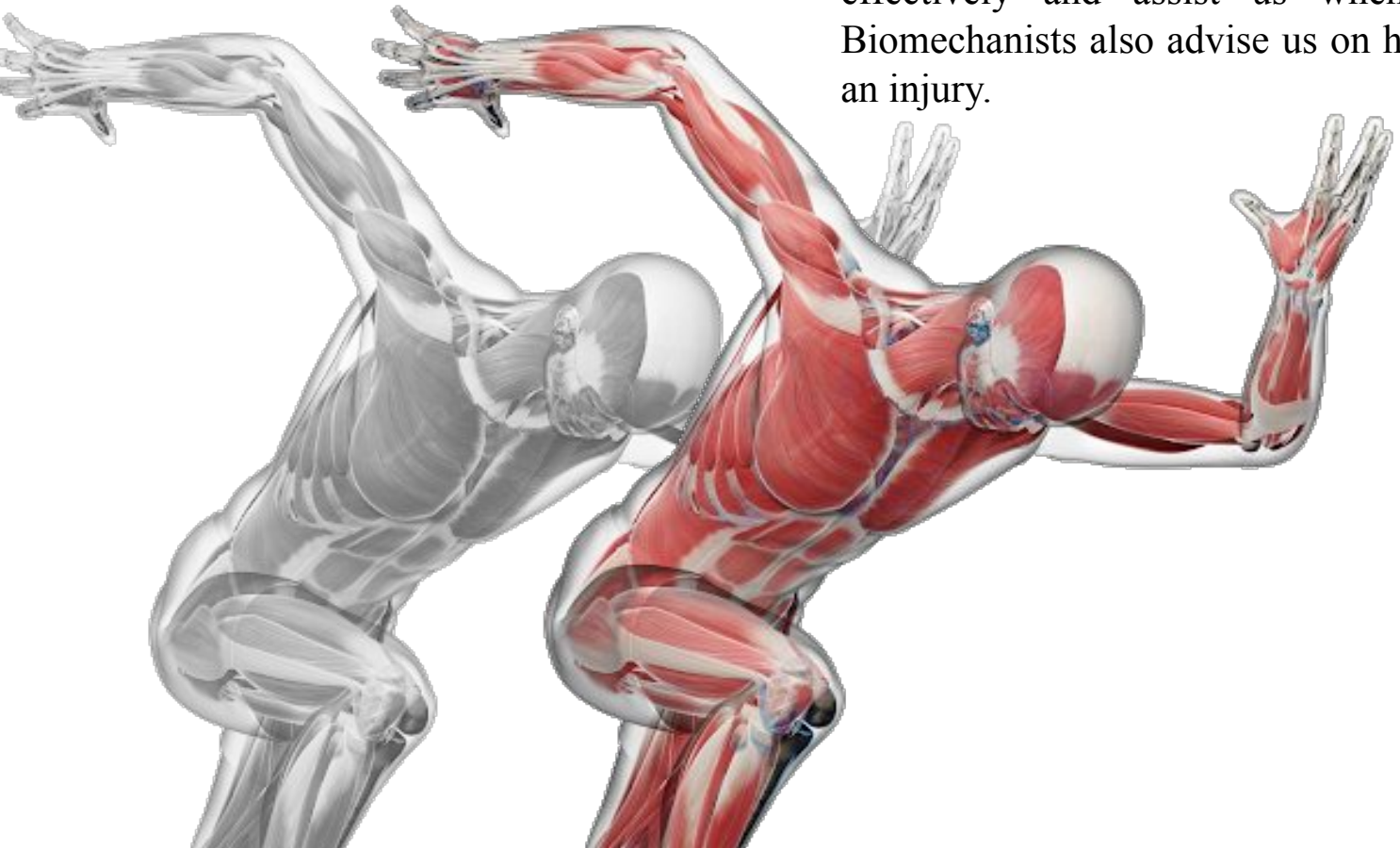
We Are Team: 3383B Pi of ORCHARD HILLS MIDDLE SCHOOL

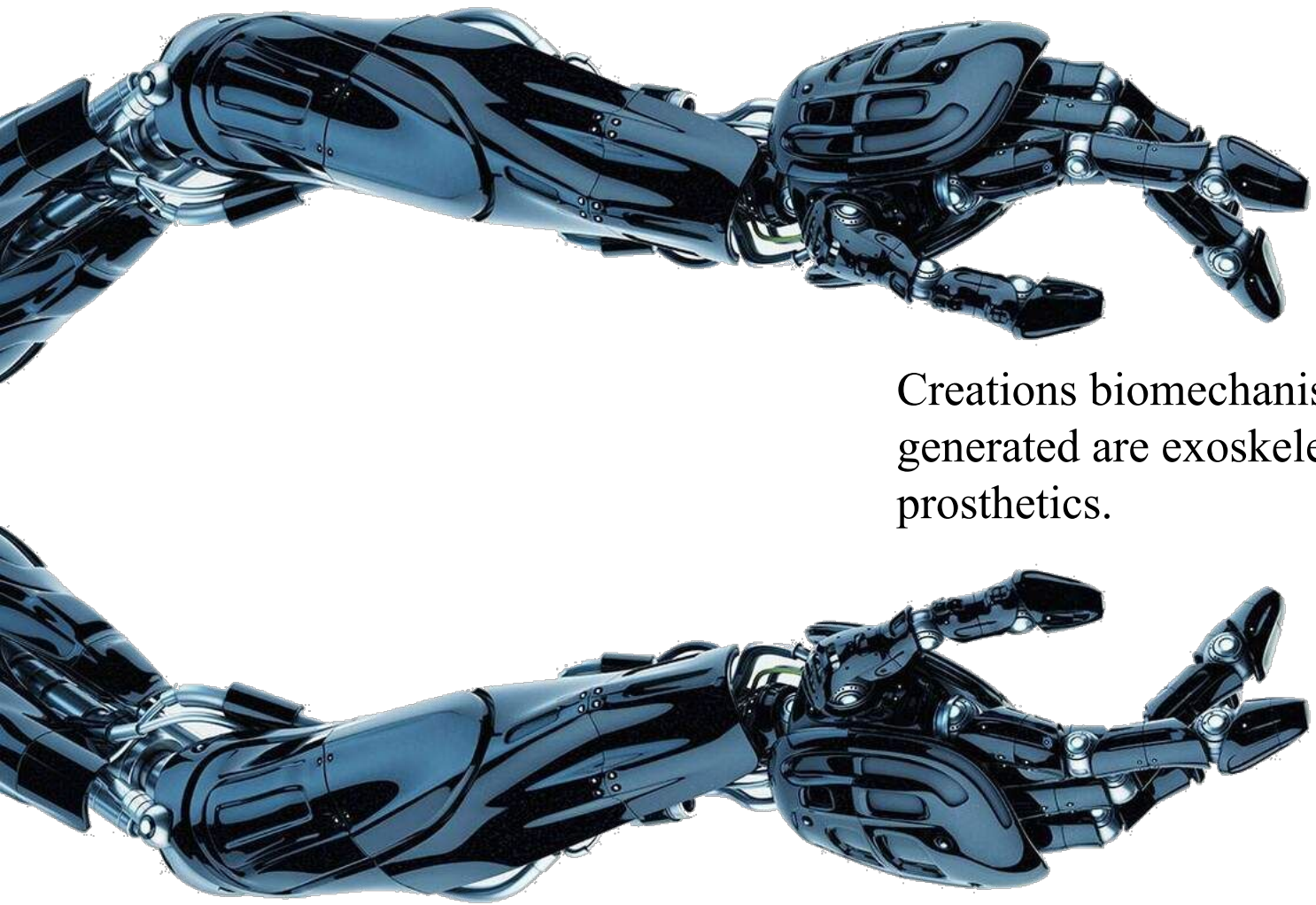
We are passionate middle schoolers who are fascinated by engineering and technology. These tough times are another reason to push our motivation and passion to do robotics! We chose biomechanists for our STEM career project. **Biomechanists change human lives, environments, and our world.** This profession **matters** to us because **we can expand the universe with just our hands.**

Who Are Biomechanists?



Biomechanists are people who study movement of biologic subjects. They find how we can move effectively and assist us when we get injured. Biomechanists also advise us on how to avoid getting an injury.



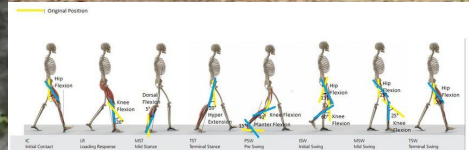


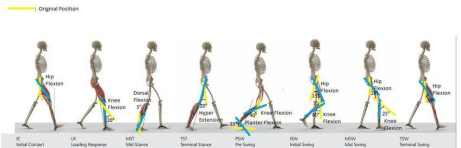
Creations biomechanists have generated are exoskeletons and prosthetics.

Prosthetics are artificial limbs that work in place of the patient's original limb.

Exoskeletons help humans from preventing injuries and they aid others who have a disability.

What Impact Do Biomechanists Make?



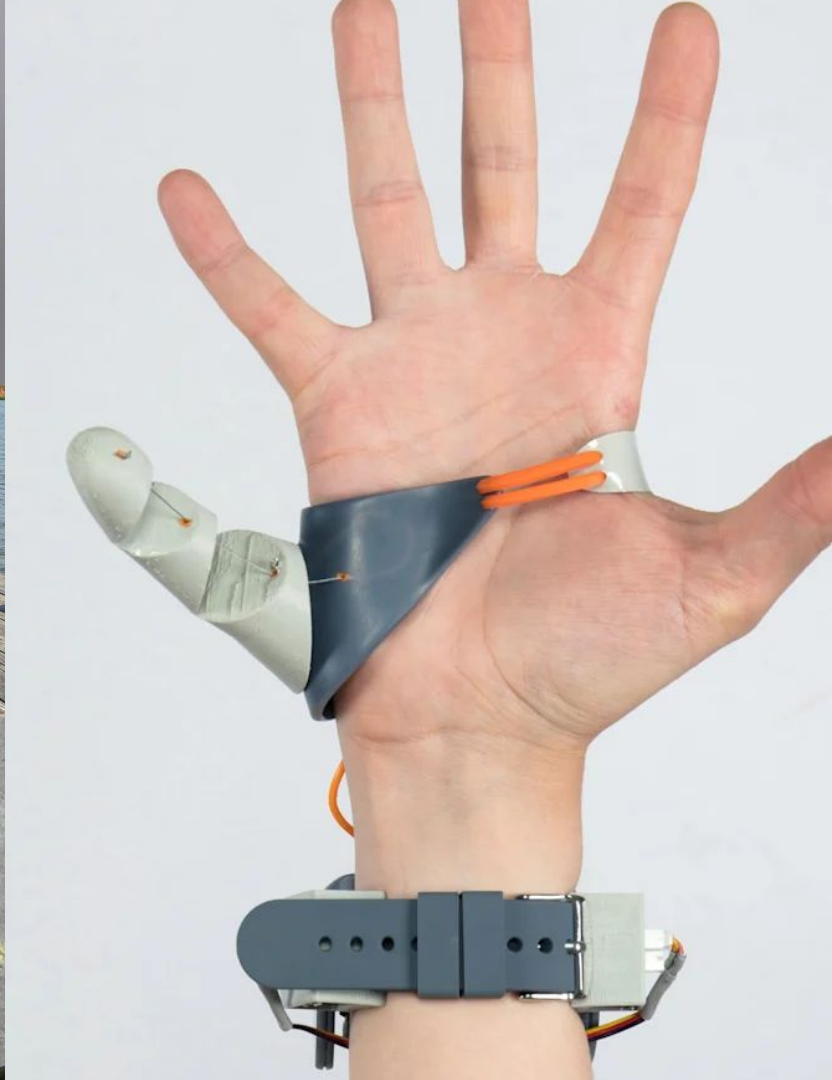


Biomechanists have a “hidden jem” impact on the world. They innovate new technologies. Robotics is impacted because exoskeletons and prosthetics are all part of the goal. Our team thinks the point of robotics is to create an environment where robots assist humans, Biomechanists works towards our hope.

With biomechanists the world gets enhanced. Biomechanists understand movement.

Prosthetic and orthotic devices are in high demand. The employment percentage of the professions are expected to grow 17% from 2019 to 2029.

Biomechanists are trying to make new inventions making lives much easier and enjoyable.



Depth On Prosthetics

◀️ **“Valerie Levine, a junior in chemical engineering, began a project to make prosthetics through 3-D printing for children without hands, delivering them to four children.”**

Prosthetics known as prostheses are customly made to your lifestyle. If you do not have a limb, biomechanists can design a prosthetic that matches your needs.

How Are Prosthetics Made?

Materials:

- custom fitted socket
- pylon (an internal structure)
- knee cuffs
- belts that attach to the body
- prosthetic socks
- realistic looking skin

Steps

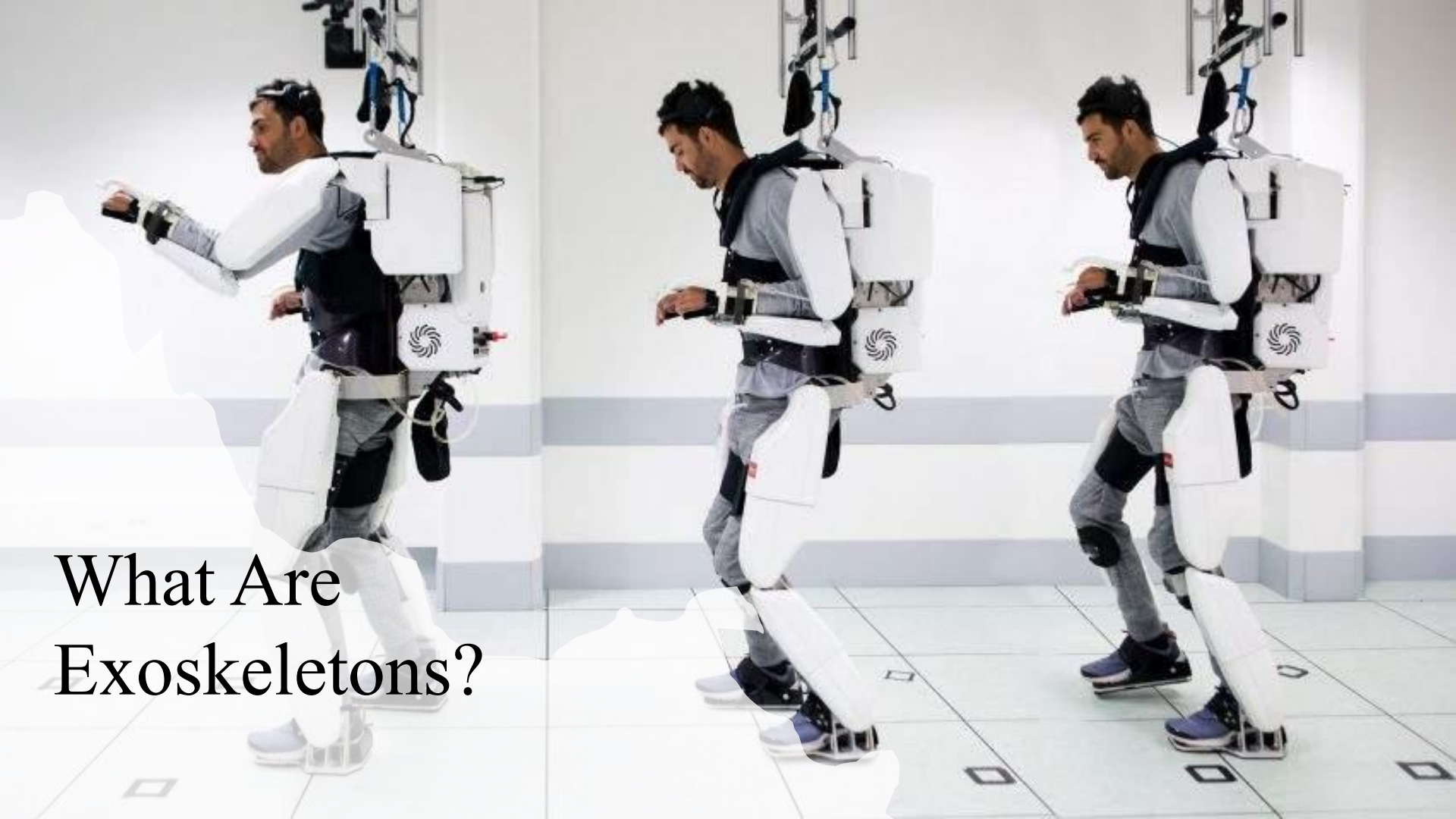
1. Prosthetist talks to amputee and makes a digital model of the limb.

2. Prosthetist measure the limb and the muscles around it so, the fabrication can get started.

3. The amputee goes into amputation surgery.

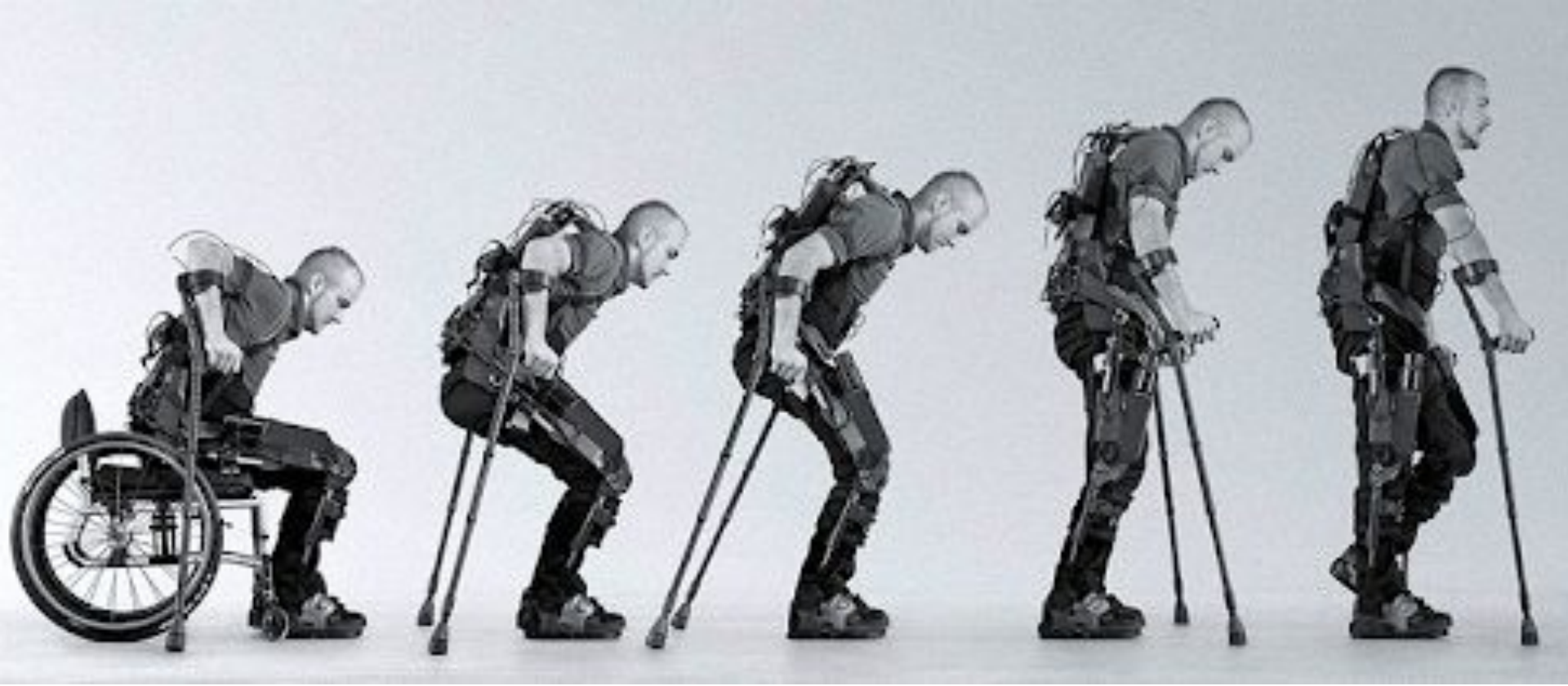
4. After the swelling has gone down, a plaster mold is taken of the residual limb (mold serves as a template for the duplicate of the residual limb).

5. The duplicate is used to test the fit of the prosthetic leg.



What Are Exoskeletons?

Exoskeletons help amplify the ability of the person. Some are used for people who are paralyzed, people who work in factories, construction sites, and the military.



Exoskeletons help people in wheelchairs connect with the motorized suit and walk like a normal person.

Types of Exoskeletons

The ReWalk Personal 6.0 System

A brand of exoskeletons, the rewalk 6.0 is made specially for use everywhere, it is the most customizable exoskeleton. The fit optimizes safety, function, and joint alignment.

ReWalk™ Robotics
More Than Walking.

MAK Active Knee

MAK Active Knee is indicated for use in gait rehabilitation in patients affected by hemiplegia or knee weakness.

An Interview with Mr. David Ortiz

David Ortiz, MScPO
Biokinesiology PhD Student
Jacquelin Perry Musculoskeletal Biomechanics Research Laboratory (MBRL)
Division of Biokinesiology and Physical Therapy, University of Southern California

"I fell in love with it – I really liked the possibility of making something with my own hands that would change someone's life!"

The poster is from the International Society of Biomechanics and American Society of Biomechanics joint conference in Calgary, Canada last year (August 2019) with Mr. David Ortiz.

Q1.

A1.

Q2.

A2.

1. What does Biomechanics mean to you?

Biomechanics provides an opportunity to study human movement from the perspectives of joint motion, the forces acting on the body, and the interaction between the joint motion and forces. This helps us understand how diseases and health conditions affect movement, including the risk for injury or development/maintenance of pain.

2. How does your usual schedule as a Ph.D. student go? Could you please tell our team about special events?

I get a monthly stipend from my division and I "work" for the stipend by being a Teaching Assistant (I'll call this TA-ing) for two classes per year (one per semester). I have to balance my own classes, TA-ing, and doing research – while still trying to find some time to sleep and exercise. One of the most fun special events is the annual National Biomechanics Day (NBD).

Q3:

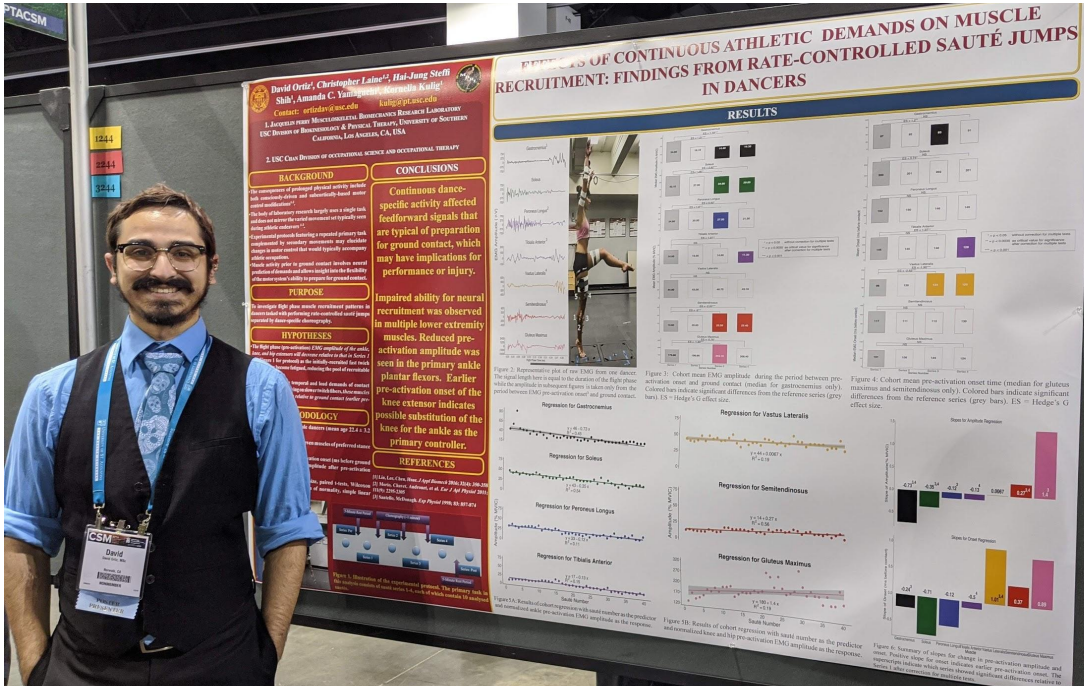
3. Why did you choose to be involved with prosthetics under the major of biomechanics?

A3:

I chose to be involved in prosthetics before I knew about biomechanics! One of the classes in my Master of Science program (in Prosthetics and Orthotics, also called “O&P”) was Biomechanics – the class was mainly focused on the math aspect of biomechanics, but it was fascinating.

I first learned about prosthetics during the last two years of my undergrad degree. I was in the Rehabilitation Science program at the University of Pittsburgh – the program was meant to help prepare students to apply to rehabilitation-type careers (physical therapy, occupational therapy, O&P, etc), sort of like a pre-med program.

This poster below is from the Combined Sections Meeting of the American Physical Therapy Association Conference in Denver, CO (February 2020) with Mr. David Ortiz.



I spent two months at a clinic to see what it was about. **I fell in love with it – I really liked the possibility of making something with my own hands that would change someone’s life!** O&P relies on biomechanics – we need to make sure we know how the orthosis or prosthesis could affect someone’s movement, in order to design it as well as we can!

When I decided I wanted to apply for a PhD program, I chose biomechanics because I wanted to do research that would help improve the field of P&O!

4. Why do you think biomechanists impact our world so much?

Q4.

This is a great (but hard) question!

I think biomechanics is a “hidden” field in understanding human movement. I feel like neuroscience and exercise physiology are known by the general population whereas not a lot of people know about biomechanics.

A4.

Advances in technology are helping us live longer than we could in the past and help us participate in new activities, but that means we’re likely to get injured (including diseases, like cancer or stroke in “injury”) or experience the effects of aging. When the body is injured or ages, everything is affected – the signals from our brain and nervous system (neuroscience), how quickly we can heal, digest food, or stay fit (physiology), and how well our bones and muscles work together to produce movement (biomechanics).

If someone’s movement pattern changes, they see a physical therapist to retrain their movement or an orthotist if they need a brace (orthosis). If someone loses part of a limb, they see a prosthetist and then a physical therapist to help them learn how to move better using the prosthesis. But if we don’t understand how a healthy person moves, the physical therapy, prosthesis, or orthosis will not work very well! We can provide the best interventions by understanding biomechanics, how the body should move, and how it currently moves.

Biomechanics is important for robotics too! If the goal is to design a robot that helps people move, we need to make sure the robot doesn’t try to make them move in unnatural ways. You can imagine this leads to injuries – the opposite of the goal!

Mr. David Ortiz's Weekly Schedule-The Spring 2019 Semester

Monday: 5 hours of class (two classes)

Tuesday: 4 hours
i. 1 hour of meeting with my mentor
ii. 3 hours of TA-ing for Clinical Biomechanics (also called Movement Analysis)

Wednesday: 3 hours
i. 2 hours of class (one class)
ii. 1 hour of a weekly seminar

Thursday: 6 hours
i. 2 hours of a weekly lab meeting
ii. 4 hours of class (one class!)

Friday: 2 hours of class

Then finding time to study and do research!

Q5. **5. What do we need to prepare and have to become a biomechanist?**

A5. (1) You need to become a biomechanist if you have an interest in how people and animals move.

(2) The major types of classes you'll take are physics and anatomy. Some colleges have an undergrad degree in kinesiology and is a great preparation for biomechanics.

(3) I recommend taking exercise physiology and a basic neuroscience class – you'll be able to understand how movement is controlled and its effects even better.

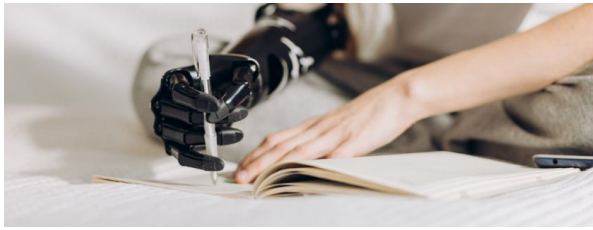
(4) Finally – reach out to a research lab, ask if you can come visit! Researchers might show you their equipment and projects. Getting personal experience is the best way.

Testimonies: People who got aid from biomechanists.

Brad's Genium Story

“Five acres, four dogs, three kids and a life big enough to hold them all. As one of the first people fit with a C-Leg, and a prosthetist himself, Brad has unique perspectives when it comes to wearing Microprocessor controlled knees—and on living a full life.”

Ali Lifts Limits with the Genium Prosthetic Leg



“Ali hasn't slowed down since she lost her leg in a boating accident in 2009. She coaches, teaches and competes in powerlifting. She feeds her creative side through her art, and relaxes outdoors with her fiancé and dog.”

Credits

N.V.Y.I.S

Nathan Kim, Vikranth Rao,
Yunji Lee, Iain Kim,
and Sophie Shah

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