BME Design-Fall 2025 - Violet Urdahl Complete Notebook

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Violet Urdahl - Sep 05, 2025, 3:22 PM CDT

Last Name	First Name	Role	E-mail	Phone	Office Room/Building
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Koelemay	Evan	BWIG	ekoelemay@wisc.edu	7153409782	
Younker	Aubrianna	BPAG	ayounker@wisc.edu	7154906823	

Tess FITZGERALD - Sep 07, 2025, 12:08 PM CDT

Course Number: BME 200/300 Advisor Section 303	
Project Name: Knee Crutch (Stair Chair)	
Short Name: Knee Crutch	
Project description/problem statement:	
About the client:	

Tess FITZGERALD - Sep 11, 2025, 5:57 PM CDT

Title: Client Meeting 1

Date: 9/11/2025

Content by: Tess Fitzgerald

Present: BME 200/300 Knee Crutch Team; Client: Daniel Kutschera

Goals: Introduce the team to the client, get more detailed information on the client's goals for the product, limitations on previous product, and budget.

Content:

- 1. What is your target demographic for this device?
 - a. Non weight bearing patients, below the knee (ankle fracture for example). Average age around 60-70.
- 2. Does it need to be adjustable?
 - a. 5'2" 5'9" doesn't need to be adjustable as long as it is short enough to work with many different heights
 - b. Ideally adjustable
- 3. What is our budget?
 - a. 500 dollars (somewhat flexible)
- 4. Are you hoping to modify the previous project or start from scratch?
 - a. Start from scratch use ideas from the past project? (handle and manual movement)
- 5. What went right/wrong with the previous project?
 - a. Too tall, too heavy, needs more stability such as rubber on the bottom
 - b. Needs a stress test
 - c. Adjust to have a cup like platform to support the knee on its sides
- 6. Can you tell us more about the prototype that you mentioned in the project description?
- 7. Why do you want to have us design a knee crutch instead of purchasing one on the market?
 - a. existing model isn't as functionally efficient as his garden box prototype
 - b. Hard to bend knee, and creates a larger gap that needs to be ascended
- 8. Is it moved by their legs, by their arms, or both?
 - a. Arms
- 9. Is this product suitable for elderly patients?
 - a. Yes, it will be used on patients will limited strength and mobility
- 10. Are there any weight or material constraints that we should be aware of? Does it need to be portable? Just at home or at work too?
 - a. Ideally around the weight of an iwalk (4.8 lbs). Only used very briefly going up/down a small set of stairs
- 11. What is the intended use of this crutch?/Are there specific activities or movements that this device is intended for, outside of walking? Is it just for the stairs?
 - a. specifically just for stairs
- 12. What type of lower leg injuries would require the use of the crutch? Can the injury be anywhere below the knee or does it need to be lower?
 - a. Ankle fractures mostly
- 13. Can the patient bend their knees?
 - a. Yes, they need the device to be something they can kneel on, not strap in.
- 14. Is the user ascending or descending stairs? Both?
 - a. both up and down stairs (turned backwards on the way down the stairs)

Improvements necessary from previous design: Lighter, not wood, has stress testing, rubber bottom for more stability on the bottom.

The insecurity is coming from the length of the lever arm. The arm socket in the previous design had too much "wiggle room"

The concavity would provide more stability - using a material with more bend for the knee platform part.

Device being used by client: simplay 3 yard garden seat (15in x 12 in x 9in)

Conclusions/action items: After meeting with our client, we plan to receive more specs on his current device, as well as video of it in use. This will give a better idea of the limitations of user and what we need to provide to overcome them. The team will meet in the next week to begin outlining a product design specification and brainstorming possible prototypes ideas.

Team Meeting With Client 09/25/25

Violet Urdahl - Sep 25, 2025, 12:19 PM CDT

Title: Team Meeting With Client

Date: 09/25/25

Content by: Violet Urdahl

Present: Violet, Tess, Aubrey, and Daniel Kutschera

Goals: Pick up and evaluate prototype

Content:

- · Met with Daniel to get prototype from last semester
 - He demonstrated and showed issues with the design
- Team brainstorming
 - Want the design to be adjustable but not unstable
 - Instability comes from leg component adjustability
 - Decided to make leg support component adjustable instead

Conclusions/action items:

AUBRIANNA YOUNKER - Sep 25, 2025, 12:17 PM CDT



Download

IMG_2089.jpg (2.79 MB) Existing Prototype Photo

AUBRIANNA YOUNKER - Sep 25, 2025, 12:21 PM CDT





Download

IMG_2087.jpg (3.12 MB) Existing Prototype Photo

AUBRIANNA YOUNKER - Sep 25, 2025, 12:22 PM CDT



Download

IMG_2088.jpg (3.31 MB) Existing Prototype picture

Violet Urdahl - Oct 06, 2025, 5:50 PM CDT

Title: Client Meeting 10/6

Date: 10/6/25

Content by: Violet Urdahl

Present: Violet, Lauren, Evan, Tess, and Aubrey

Goals: Meet with client to discuss presentation and further dimensions

Content:

- Fun fact: Dan is fluent in sign language
- Patient currently using one: 5'7" using 12" side of garden box
 - Has a rigid removable dressing (RRD) that goes up to just below the knee
 - Protects and shapes limb
 - Some sensitivity at knee, moved foam to be higher for lip on RRD creating sensitivity
- Using Simplay3 garden bench
 - o 9", 12", 15"
 - o 10"-14" is sweet spot
- · Ordering materials: we order, Dan venmos after the fact
 - Send receipt
 - Can reach out after the fact
 - Trusts our judgement
- Give ballpark range for force that can be applied
 - Seems ok with using mfg metrics for strength
- · Stabilogram is cool with him
- Deliverable verbage for Dan: Daniel Kutschera, PT
- Let him know further ahead of time for future presentations so he can ask for time off
- Testing with patients: maybe with a lighter patient, need to sign a waiver
 - o Maybe load with some weights before to verify it can support
- Wants product to be distinguishable from iWalk
 - Unique design
- Final presentation: patients using garden box
 - Highlight that iWalk is targeted to mobility for walking, ours is stability for stairs

Conclusions/action items:

Dan provided some metrics that will be very useful for the dimensions of our design. Additionally, it was great to learn that we can just order materials and request reimbursement after. The team will being ordering materials ASAP.

Violet Urdahl - Nov 12, 2025, 1:20 PM CST

Title: Client Meeting

Date: 11/10/25

Content by: Violet Urdahl

Present: Dan Kutschera and Knee Crutch team

Goals: Update our client on current project progress

Content:

- · Briefed Dan on current project progress
 - Happy with current height
 - Maybe print out a half inch block
- · Check weight soon
- He will send email to us and other teams about coming to hospital
 - Testing: could do it with some of Dan's colleagues
 - Going to ask CEO about plausibility of testing on patients
- Write out fabrication of prototype for replication
 - Maybe patent??

Conclusions/action items:

The team presented our current design progress to the client today. We were happy to hear that he is pleased with our progress, and he urged us to consider a patent. The team hopes to visit his hospital soon.

AUBRIANNA YOUNKER - Dec 10, 2025, 4:46 PM CST

Title: Client Meeting Poster Session

Date: 12/5/2025

Content by: Aubrianna Younker

Present: Whole team, client, and advisor

Goals: The goal of this entry is to document one of our last meetings with our client

Content:

Our client was able to attend the poster session. Here we were able to present our prototype and poster to him, explaining the work we've done this semester and the testing we performed. Our client, Mr. Daniel Kutshera, was very pleased with our prototype and the testing we performed. He will be in contact with us in the next couple of days regarding picking up the prototype and giving us our refund.

Conclusions/action items: Overall, Daniel Kutshera was a great client to work with; he was very excited about this project, and he has lots of good project ideas. We hope he can use this project to help his clients get to their homes independently with comfort.

Tess FITZGERALD - Sep 15, 2025, 5:55 PM CDT

Title: Advisor Meeting 1

Date: 9/15/2025

Content by: BME 200/300 Knee Crutch Team

Present: BME 200/300 Knee Crutch Team

Goals: Introduce the team to the advisor and vice versa.

Content:

Introductions were made and the team shared why we chose this project.

The team discussed with Dr. P getting in contact with our official advisor, Professor Bartels to organize a more official meeting time for future.

Get more information on weight requirements. Mentioned factor of safety 2.

Mentioned getting more individual research entries on competing designs, the biology/physiology of how a user may end up needing this device.

Finding the average leg width and height.

Determine if the device is going to target a specific height/weight spec or be a more universal device that can target a range of users.

Begin drafting PDS and reach out to Dr. Puccinelli if the team has any questions.

Team members should navigate the training portion of the website to find the necessary trainings for sophomores/juniors.

Conclusions/action items: After the advisor meeting, the team will continue individual research. Additionally, the team will finish a draft of the PDS to submit Thursday. Lastly, the team will fill out and submit a progress report to the website, and email to advisor/client.

9/29/25 Meeting With Professor Bartels

Violet Urdahl - Sep 29, 2025, 2:58 PM CDT

Title: Meeting with Professor Bartels

Date: 9/29/25

Content by: Violet Urdahl

Present: BME 200/300 Knee Crutch Team

Goals: Establish background/where we are at in our project with Professor Bartels and receive feedback

Content:

Listed below are the ideas that Professor Bartels had for our design.

- The team should conduct research on stats/ testing
 - Also references, patents, standards
- · Consider nixing adjustability if compromising stability
- Evaluate other materials (take inspo from bikes)
 - T-slot rails/ extruded aluminum
- · Maybe no mechanical testing- use load capacities of materials
- Test with user experiences
 - o Ask peers and provide criteria for them to rate the device on
- Create a stabilogram with force plates
- Consider finding a way to measure transverse force/slippage

Conclusions/action items:

Professor Bartels had a lot of useful feedback for the team. We will look into using extruded aluminum for our design, because it sounds like it will make the fabrication of our design significantly easier. Additionally, the team will research testing methods and statistics to prepare for the later portion of our semester.

Violet Urdahl - Oct 10, 2025, 2:06 PM CDT

Title: Advisor Meeting

Date: 10/10/25

Content by: Violet Urdahl

Present: Team and Prof. Bartels

Goals: Discuss action items and plans with Professor Bartels and get advice on materials/fabrication

Content:

- · Presentation went well!
 - · More quantification
 - Long but no teams were under time
- · Talk to department about payment plan with client
 - · Reach out to Dr.P
 - o Maybe inquire with client about sending money before, then reach out to department
- · Maybe think about feet instead of frame
 - · Look on website
- Notebook grading: reach out to Dr.P about helping Bartels get into notebook
 - o Emphasis is on content, not style
- PVC handle: potential for slippage
 - Look at walkers online
 - Look further into extruded aluminum handle
- · Consider security of foam padding
- Plastic to aluminum connection: lips that plastic can fit into and be tightened into
- Figure out extruded aluminum weight of device
- Height adjustment
 - Maybe drill and tap different holes and create analogous mechanism for height adjustment
 - Maybe different high density foam stacking pieces

Conclusions/action items:

We caught Professor Bartels up on what we have done in the past two weeks today. We were seeking advice for how to proceed with fabrication, and he had a lot of useful ideas for us. The team has a lot of material and fabrication decisions to make, so we will continue to discuss his suggestions at our next team meeting.

AUBRIANNA YOUNKER - Oct 17, 2025, 2:43 PM CDT

Title: Advisor Meeting

Date: 10/17/25

Content by: Aubrianna Younker

Present: Aubrianna, Kayla, Lauren, Evan, Violet

Goals: The goal of this entry is to document the notes, decisions, feedback, and advice from Bartels on our project.

Content:

- Consider having a few options of handle configurations to test and compare (they can be easily moved and rearranged)
- If using high-density foam for the knee rest, we could utilize a flat clamp design to apply pressure to the top of the foam and minimize movement
- We can go ahead and order the extruded aluminum set from Home Depot (\$43.70)
- Plan to have a solid prototype ready for show and tell on Halloween, and maybe some preliminary testing by then
- Create an estimated weight of the base materials that will be used
- Short meeting today, but lots of deadlines and fabrication in the future

Consider these handles for if we use extruded aluminum for the base:

https://www.alufabinc.com/product/large-plastic-door-handle-black/

Conclusions/action items: Action items are to order extruded aluminum and connector pieces. In addition to that, we have to estimate the weight of the base so far, so we know how much weight we have to deal with for the knee rest and handle. With that being said, the team still has lots of design ideas to consider moving forward, and we will continue to consult Bartels as issues come up.

AUBRIANNA YOUNKER - Oct 17, 2025, 2:43 PM CDT



Download

Screenshot_2025-10-17_144327.png (150 kB) Picture of a handle

AUBRIANNA YOUNKER - Oct 24, 2025, 12:30 PM CDT

Title: Quick Check-in Meeting before Show and Tell

Date: 10/24/25

Content by: Aubrianna Younker

Present: Aubrianna, Evan, Violet, Kayla, Lauren, Tess

Goals: The goal of this

Content:

- For show and tell prepare a pitch so much that it looks like you didn't prepare, not too forced or scripted, but still well structured and thought out
- Definitely bring the old prototype to show and tell to compare the advantages and upgrades
- Still keep in mind the "clamp" design for the knee rest component to apply pressure and avoid movements

Conclusions/action items:

Tess FITZGERALD - Nov 07, 2025, 1:38 PM CST

Title: Advisor Meeting

Date: 11/7/2025

Content by: Tess Fitzgerald

Present: BME 200/300 Knee Crutch Team

Goals: Check in with advisor, update him on fabrication process, and testing plans

Content:

Discussed feedback from show and tell - changing from 4 legs to base frame.

Discussed removing the plywood component - just bolt the PLA blocks directly to the extruded aluminum

Discussed meeting with client on Monday to confirm hospital visit and possibility for IRB

Advisor still does not have access to LabArchives?

Conclusions/action items: Pretty quick meeting, thinking removing the plywood could be good.

Tess FITZGERALD - Nov 21, 2025, 1:32 PM CST

Title: Advisor Meeting

Date: 11/21/2025

Content by: Tess Fitzgerald

Present: BME Knee Crutch Team

Goals: Update the advisor on testing plans and end of semester timeline

Content:

- · Show the advisor the prototype
- Discussed survey and plans for testing stabilogram (force plate testing / analysis of center of pressure when stepping up to a stool using a control, old prototype, and the team's device)
- Discussed mechanisms for buffing the edges using caps or tapes could have mode of failure (falling off); other option could be a file and just buff it down so no sharp edges
- Thoughts on creating a FMEA not necessary but would be good practice to make.
- Talk to someone at warf if interested in getting a patent must have claims with evidence. Also pretty expensive, so might not be beneficial, but the exercise of applying could be. Not everything patentable is worth patenting

Conclusions/action items: Action items are to finish sewing the foam block component and velcro. Start writing the report early. Start testing Sun/Mon look good.

Violet Urdahl - Oct 06, 2025, 6:28 PM CDT

Title: Team Meeting 10/6

Date: 10/6/25

Content by: Violet Urdahl

Present: Violet, Tess, Aubrey, Lauren, and Evan

Goals: Discuss deliverables and fabrication

Content:

· Feedback fruits due Wednesday

Review due Sunday

Split fabrication into base, knee rest, and handle

Base: Violet and Evan

Knee rest: Tess and LaurenHandle: Aubrey and Kayla

Preliminary report

Due Wednesday night

• Team: finish by 12 on Wednesday, review and turn in that night

• Team divided up sections of preliminary report in shared drive

· Progress report will be completed by team members by 12 on Thursday

Conclusions/action items:

The team has a lot to work on this week. We will finish our preliminary report by Wednesday at 12, and the team will individually review a teammates portion before turning it in. Additionally, the team split up fabrication and will begin working on their respective portions.

Violet Urdahl - Oct 07, 2025, 10:01 AM CDT



Download

IMG_9527.jpg (2.49 MB)

AUBRIANNA YOUNKER - Nov 14, 2025, 2:48 PM CST

Title: Preliminary Design Drawings

Date: 11/14/25

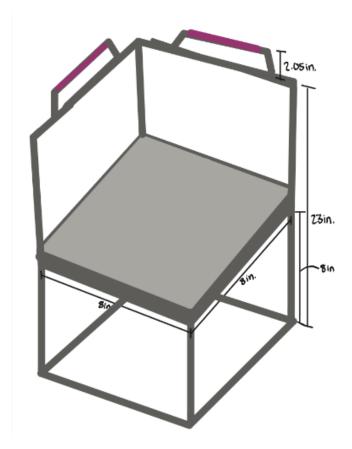
Content by: Drawing by Kayla, Writing by Aubrianna

Present: Aubrianna Younker

Goals: The goal of this entry is to include this drawing as part of our design process.

Content:

This drawing represents the relative dimensions of our prototype. The base is 8in by 8in, and this is consistent throughout the base, knee rest, and handle components. This design, with handles on only two of the sides, allows for optimal comfort for the user and also allows the device to be easily switched/rotated depending on which side the patient is injured on. The square base is implemented between the four legs of the device to ensure the device doesn't slip off the stairs if the device is set close to the edge of the stairs.



Conclusions/action items: In conclusion, this drawing can be a reference for when trying to convey our design ideas to clients, design consultants, advisors, and peers. This can also be a good reference for when creating a more finalized SolidWorks design. Dimensions are subject to change depending on different procedures of the fabrication process.

AUBRIANNA YOUNKER - Dec 10, 2025, 2:04 PM CST

Title: Show and Tell Feedback Notes

Date: 10/31/2025

Content by: Aubrianna Younker

Present: Whole Team

Goals: The goal of this entry is to take notes on the feedback we received during our show and tell with our peers.

Content:

On Friday, October 31st, the team was able to meet with several other groups for a show-and-tell session. Here, not only were we given the chance to help other teams, but we were also able to get advice and ask our peers questions about our preliminary designs.

Feedback from Peers:

- A common idea that was posed during show and tell was to use velcro to attach the cushion to the different adjustable height blocks
- Another common theme was posing concerns about the 4 peg leg base, how it creates a lot of instability if the crutch isn't placed perfectly on the stairs
- Many people commented on the lightweight of the device
- Other concerns included drilling directly into the extruded aluminum for the adjustability component
- Several comments on the clean look of the base

Conclusions/action items: As a result of this advice and feedback, we as a team have decided to move forward with implementing the velcro and square base frame in our design, as well as reconsider how we should attach our blocks to the base frame. Should we still use plywood? Should we still drill into the extruded aluminum? We have scheduled a design consultation meeting to hopefully get answers to some of these questions.

AUBRIANNA YOUNKER - Dec 10, 2025, 2:45 PM CST

Title: Final Prototype Photos

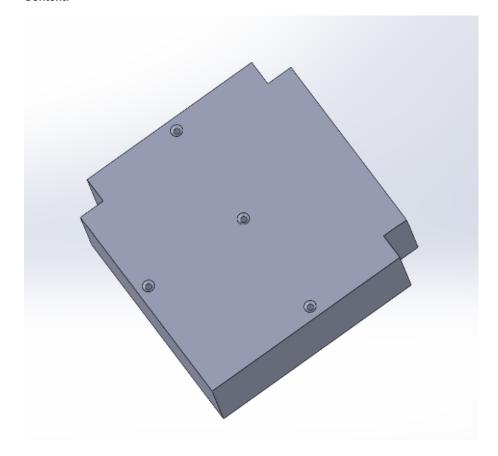
Date: 12/10/2025

Content by: Aubrianna Younker

Present: Aubrianna Younker

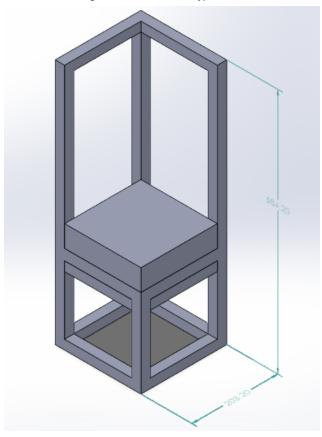
Goals: The goal of this entry is to represent our final prototype.

Content:













Conclusions/action items: The final prototype incorporates a height-adjustable platform system mounted on the middle square base. It uses three interchangeable platform blocks that can be secured with custom-sized bolts corresponding to each block's height. The middle square base supporting these blocks includes a reinforcing support beam that spans from one side to the other to reinforce the support of the PLC blocks placed on top of it. In line with this design, the prototype also features a small foam cushion with velcro compatibility across all block sizes to provide user comfort. Additional components include cushion-grip handles positioned at the front and along one side of the base, extending to approximately hip height, as well as rubber grip tape applied to all four sides of the bottom base. The bottom base itself functions as a structural connector for the four legs, serving to improve overall stability and consistency in stair placement.

AUBRIANNA YOUNKER - Oct 20, 2025, 12:46 PM CDT

Title: BPAG Expense Spreadsheet

Date: 10/20/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document all materials we use and their individual expenses. This helps track our budget and allows other people to

replicate our device in the future.

Content:

Click the link below to see the live spreadsheet:

https://docs.google.com/spreadsheets/d/1kx-1D0AGE_1ZsjhNG-lfMr96wizazA7xNIB-wYU0bcl/edit?usp=sharing

(copy and paste the link into your web browser if having troubles viewing, or reach out to Aubrianna Younker at ayounker@wisc.edu)

Conclusions/action items: In conclusion, this spreadsheet is not only beneficail for us, but it's also benefitcail for our client and any groups that may work on this project in the future. For action items, the BPAG should update this spreadsheet with as much detail as possible whenever materials are found or ordered.

AUBRIANNA YOUNKER - Dec 09, 2025, 9:41 AM CST



Download

Knee_Crutch_Expense_Spreadsheet_FINAL.ods (27.3 kB)

AUBRIANNA YOUNKER - Oct 30, 2025, 1:31 PM CDT

Title: First Round Material Order

Date: 10/17/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document the first round of materials that we ordered.

Content:

10Sets 2020 Corner Bracket Connectors for 2020 Series 6mm Slot Aluminum Extrusion Profile Accessories(Silver) - \$12.99

quantity: 1

 $https://www.amazon.com/dp/B0B9JVW5X8/ref=sspa_dk_detail_3?pd_rd_i=B0B9JXJWY4\&pd_rd_w=jxNTk\&content-id=amzn1.sym.bbb3fb5e-28ad-4062-a3ba-1f7b9f2e4371\&pf_rd_p=bbb3fb5e-28ad-4062-a3ba-1f7b9f2e4371\&pf_rd_r=48Y58K2EQ59WEB6ES6WP\&pd_rd_wg=jNNTz\&pd_rd_r=aed37210-6e2c-44b6-8cdf-e61ba3671177\&sp_csd=d2lkZ2V0TmFtZT1zcF9kZXRhaWxfdGhlbWF0aWM\&th=1$

4 Pieces 47.2 in.T Slot 2020 Aluminum Extrusion Profile, European Standard Anodized Linear Rail, High-Strength Extruded -

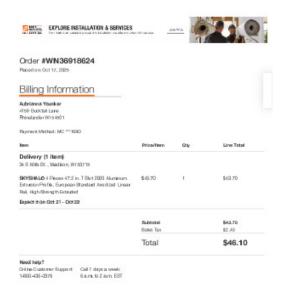
\$43.70

quantity: 1

https://www.homedepot.com/p/SKYSHALO-4-Pieces-47-2-in-T-Slot-2020-Aluminum-Extrusion-Profile-European-Standard-Anodized-Linear-Rail-High-Strength-Extruded-2020OBLXC4JZ2RFAO001V0-S403/335664731#overlay

Conclusions/action items:

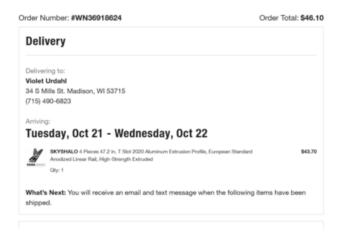
AUBRIANNA YOUNKER - Oct 17, 2025, 2:41 PM CDT



Download

The_Home_Depot_-_Order_Confirmation.pdf (240 kB) Home Depot Order Confirmation

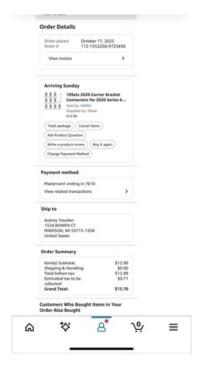
AUBRIANNA YOUNKER - Oct 17, 2025, 2:39 PM CDT



Download

Screenshot_2025-10-17_143921.png (76.2 kB)

AUBRIANNA YOUNKER - Oct 17, 2025, 2:52 PM CDT



Download

IMG_2181.jpg (280 kB) Amazon Connecter Set Order Confirmation



Title: Second Round Material Order

Date: 10/30/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document the second round of material ordering. This way, the exact information and confirmations are all in one place to reference.

Content:

The team decided to use extruded aluminum for the foundation of the handle component since we had extra left over after constructing the base, and since it is easy to assemble. I we got, and there is still one more rod we have to connect to complete that part. This means that for both the completion of the base and the foundation of the handle, we need more 10-piece set we got the first time. It fit well with our aluminum, so it made sense to use the same ones again. The link to these can be found below with an image.

connector set link - https://www.amazon.com/Aluminum-Extrusion-Connectors-Hardware-Accessories/dp/B0FF9TCTJR?th=1

Since it was decided that the handle's foundation would also be extruded aluminum, we were able to find long aluminum handles that slide and secure right onto our rods. We orde below.

4 pack of handles link: https://www.amazon.com/uxcell-Rectangular-Aluminium-Cabinets-Garages/dp/B0DK1XT91N/ref=sr_1_1_sspa?crid=2ZORFAAJGU1BP&dib=eyJ2IjoiMSJ9.r_DJzHjYtlx 4td8y5ovBkyojYq0SNSQilsjgKCWyGxWC04eHlYtnAfylDas0FdERwbCP6dZNVgM0rhiEECvJMdJtP1EuRqFvz6igqKA7TLodbeq__ozs6QoLmHz7AtmMVNEZ8M8ApHkAX6iTC6MVozoUM0NyYt __6W8jXroGb5ETjL3xTCBMpjYaZuLFOQgFzyf0OlRnl.fEYbrgBgZQYKtHyxkhj5nYy0UBzHDEPy8OuRkeZEngs&dib_tag=se&keywords=uxcell%2B4%2Bpack%2Bhandles&qid=1761838072&s=1-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9hdGY&th=1

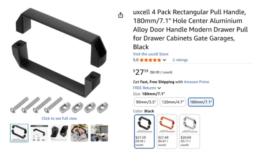
Going along with those aluminum handles, we decided to order a pack of grip tape to wrap the handles with. This will add additional grip for the users, as well as comfort and a way below.

Pack of multicolor grip tape link: https://www.amazon.com/ORBEIN-Tennis-Grip-Tape-Pickleball/dp/B0CDGVTRJ9/ref=sr_1_4?
crid=10F3Q5EZ3LREK&dib=eyJ2ljoiMSJ9.SiTgNuclo8V2qxkVxZBDTAYZo8AAhNQlxHGU4aXQsGiAkyZt8QNKhaG1lzXChMRl3ZhU2wZu8vfNKL5BH06CJFxNWX5UpvMveiyRbKnO_l0bpb0dhQzwjFcOnWHuE7HKaV8LDpU0RArTA9iht0KLucbu14G96lvt03bOyE2wFxSmXVa6yj5SF2WKK4Fi1HiJ2Yanlv5PVD6yOap_BpVsNSwXMuugVGmnXJNV9s4_xmoS69FNYidqVeNUl-qrHJbsRf8NA.SVSNvA1_xxx6wGW4uHkHqsc6txZS0rJM870ORF0EGp8&dib_tag=se&keywords=orbeez%2Bgrip%2Btennis%2Btape&qid=1761846396&sprefix=orbeez%2Bgrip%2Btennis%2B

This order came to a total of \$53.35, bringing our total budget used \$110.37. The order confirmation will be attached below for reimbursement purposes.

Conclusions/action items: This is all that was ordered in this second round of ordering. These items will help us complete the next stage of fabrication and one step closer to completion. Action the knee rest components.

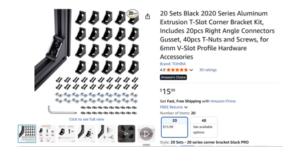
AUBRIANNA YOUNKER - Oct 30, 2025, 1:24 PM CDT



Download

 ${\bf Screenshot_2025\text{-}10\text{-}30_132357.png~(404~kB)}~{\bf Handle~Product~Image}$

AUBRIANNA YOUNKER - Oct 30, 2025, 1:00 PM CDT



Download

Screenshot_2025-10-30_125941.png (583 kB) Image of Connector Set

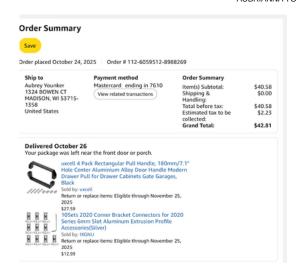
AUBRIANNA YOUNKER - Oct 30, 2025, 1:25 PM CDT



Download

Screenshot_2025-10-30_132500.png (629 kB) Grip Tape Product Image

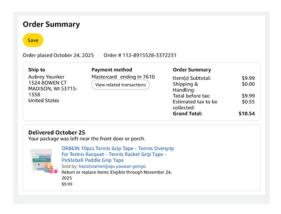
AUBRIANNA YOUNKER - Oct 30, 2025, 1:31 PM CDT



Download

IMG_2261.jpg (398 kB) Order Confirmation

AUBRIANNA YOUNKER - Oct 30, 2025, 1:31 PM CDT



Download

IMG_2262.jpg (309 kB) Order Confirmation

Tess FITZGERALD - Nov 07, 2025, 1:49 PM CST

Title: Knee Rest Bolt and Nut Order

Date: 11/7/2025

Content by: Tess Fitzgerald

Present: BME Knee Crutch Team

Goals: Order bolts and nut for attaching knee rest to base frame

Content:

Amazon.com: BNUOK (24 Sets) 1/4-20 x 4 Hex Head Screw Bolt, Lock Nuts, Flat & Lock Washers Kits, 304 Stainless Steel 18-8, Fully Threaded: Industrial & Scientific

Conclusions/action items: Order done.

Tess FITZGERALD - Nov 10, 2025, 5:59 PM CST

TILLE



Coaseb Custom Polyurethane Upholstery Foam Cut to Size – Couch Cushion Replacement, Foam Padding for Chairs, Sofa...

\$18.50

In Stock

Shipped from: Coaseb

FREE delivery Fri, Nov 21

Customizations:

Foam Type: Medium Density 1.4 lb 36 lb

and 3 more

Gift options not available. Learn more



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Amazon.com: Coaseb Custom Polyurethane Upholstery Foam Cut to Size – Couch Cushion Replacement, Foam
Padding for Chairs, Sofas, Benches, Seat Cushions & DIY Projects, High or Medium Density, CertiPUR-US Certified:
Arts, Crafts & Sewing

custom size:

11"x 11" x 2"

AUBRIANNA YOUNKER - Nov 14, 2025, 3:13 PM CST

Title: Bolt and Washer Purchase - Machine Lab

Date: 11/14/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to keep track of the purchases made during our design project this semester.

Content:

During our fabrication on 11/14/25, we needed to find new bolts and washers that were compatible with both our handle and our t-slot attachment components. The machine lab in the basement of ECB had lots of different options that we were able to test out and find the correct ones for us. This was very helpful and much easier than trying to order ones online and hoping they fit. We bought 4 bolts and 4 washers from them. The receipt will be attached below. The total cost was \$1.48.

Conclusions/action items: In conclusion, it was very nice to have access to the team lab because we could bring our specific parts down in the basement and test different bolts out before we had to purchase anything. This was very easy and convenient.

AUBRIANNA YOUNKER - Nov 14, 2025, 3:12 PM CST



Download

IMG_2418.jpg (2.66 MB) bolt and washer purchase

Violet Urdahl - Oct 23, 2025, 4:30 PM CDT

Violet Urdahl - Oct 23, 2025, 4:40 PM CDT

Title: Base Fabrication Meeting

Date: 10/23/25

Content by: Violet Urdahl

Present: Violet, Aubrey, and Evan

Goals: Figure out base fabrication plan

Content:

• 4 leg dimensions: 7.5"

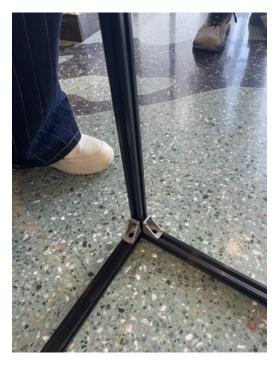
4 frame dimensions: 6.426 (6.5)"

- Frame and legs will be assembled as indicated in picture with connectors shown
- Team currently has 4 extruded aluminum rods at length 47.2"
 - These rods will be cut to size in the Grainger Design Innovation Lab using an aluminum saw
- · After assembly, the team will add rubber base components to the legs
 - Negligible height
- Net weight of base is 1.4 lb

Conclusions/action items:

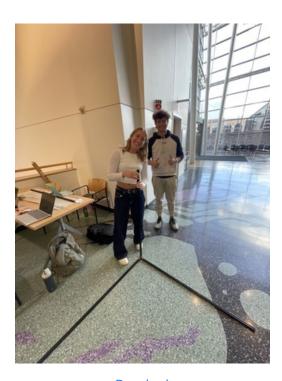
Evan and Violet will meet at 12 on Monday to cut the aluminum rods to size. After this, we will assemble the pieces using our connectors. We will then discuss what rubber components to attach to the bottom.

AUBRIANNA YOUNKER - Oct 23, 2025, 4:37 PM CDT



Download

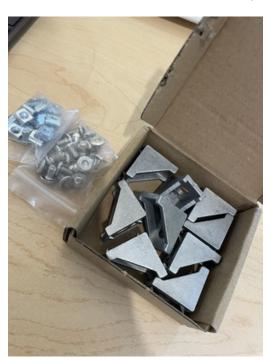
IMG_2212.jpg (4.22 MB) example corner joint for the base component



Download

IMG_2213.jpg (2.98 MB) Team members excited about the fabrication process

AUBRIANNA YOUNKER - Oct 23, 2025, 4:41 PM CDT



Download

IMG_2215.jpg (3.99 MB) connectors

11/7/25 Base Fabrication: Cutting and Assembly

Violet Urdahl - Nov 07, 2025, 11:24 AM CST

Title: Base Fabrication: Cutting and Assembly

Date: 11/7/25

Content by: Violet Urdahl

Present: Violet and Evan

Goals: Complete the fabrication of the base of the knee crutch

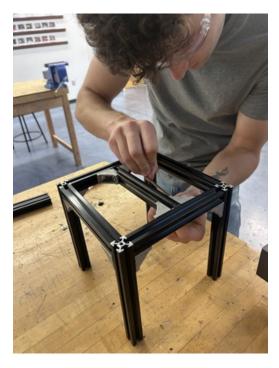
Content:

- After show and tell, the team decided to make the base a frame based on peer feedback to increase stability
- Additionally, the team decided to add a support in the middle of the upper frame for load distribution
- Cut 7 6.5" pieces of extruded aluminum for the upper frame, base frame, and middle support
- Cut 4 8" pieces for the legs
- Connected the upper frame, legs, and middle support with T-slot connectors
 - Waiting to connect base frame for ease of fabrication of knee support

Conclusions/action items:

The team will now proceed with fabrication of the knee support. We will attend a design consultation next week to evaluate how we may best execute. this. Additionally, we have 3D printed the height adjustment blocks, so we will establish how everything fits together.

AUBRIANNA YOUNKER - Dec 07, 2025, 9:59 PM CST



Download

IMG_9920.jpg (2.86 MB)





Download
IMG_9917.jpg (2.73 MB)



11/14/25 Handle Fabrication: extension of base component

AUBRIANNA YOUNKER - Nov 14, 2025, 3:04 PM CST

Title: Handle Fabrication: extension of base component

Date: 11/14/25

Content by: Aubrianna Younker

Present: Kayla, Aubrianna, Evan, Violet

Goals: The goal of this entry is to document the fabrication process for future reference.

Content:

Today, the team was able to make a lot of progress on fabrication, specifically on connecting the different components of the device. First, we were able to remove three of the base legs in order to replace them with longer aluminum rods that will extend right into the handle in order to avoid needing unnecessary connectors, making the device more stable and lighter. We then cut those longer rods to size using our remaining extruded aluminum. Then, to ensure they were all the same size, we used the mill edge finder to even them out for optimal stability. We also had to use the edge finder feature on the mill to shorten a component that connects the top of the handles together. After completing these things, we were able to reassemble everything using the t-slot metal connectors as we had before. Lastly, we were able to find bolts and washers that were short enough, small enough, and wide enough (with a washer) to hold the handle in place. Since we found this, we were able to attach one of the handles to the top of the extension rods at the top. However, with that being said, the two handles are too big to fit on the top together, so we have to consider ordering another set of handles that will be smaller to fit on the top together. Photos of the fabrication process are attached below!

Conclusions/action items: In conclusion, we have to order new handles and also wait for the velcro and foam parts to come in order to complete the final stages of fabrication. Outside of those parts, the device is assembled and ready for testing.

AUBRIANNA YOUNKER - Nov 14, 2025, 2:52 PM CST



Download

IMG_2414.jpg (2.75 MB) fabrication photo

AUBRIANNA YOUNKER - Nov 14, 2025, 2:52 PM CST





Download

IMG_2415.jpg (3.1 MB) fabrication photos

AUBRIANNA YOUNKER - Nov 14, 2025, 2:53 PM CST



Download

IMG_2411.jpg (4.25 MB) fabrication photo

AUBRIANNA YOUNKER - Nov 14, 2025, 2:53 PM CST



<u>Download</u>

IMG_2417.jpg (3.11 MB) prototype photo post fabrication on 11/14/25

AUBRIANNA YOUNKER - Nov 14, 2025, 2:54 PM CST



Download

IMG_2413.jpg (2.84 MB) Fabrication Photo

AUBRIANNA YOUNKER - Nov 14, 2025, 2:54 PM CST



Download

IMG_2410.jpg (3.58 MB) fabrication photo

Lauren Anderson - Dec 08, 2025, 6:13 PM CST

Title: Design Consultation

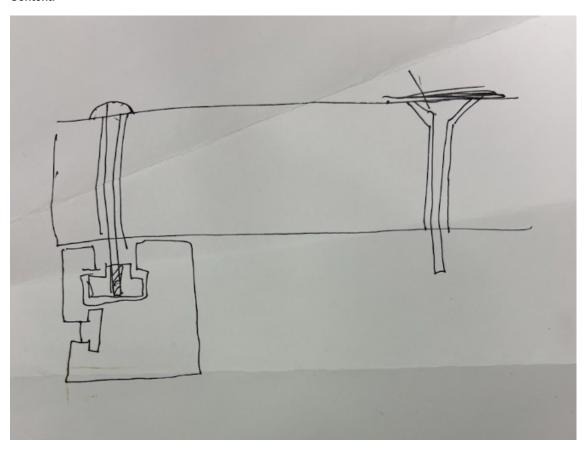
Date: 12/8/25

Content by: Lauren Anderson

Present: Whole group

Goals: Understand how to fabricate the base completely

Content:



Conclusions/action items:

- Fabrication drawing to outline how our adjustable component works
- Continue to make it clear to our client to best show how the adjustable component works



12/02/25 Screw Fabrication: Sawing Screws Down to Length

AUBRIANNA YOUNKER - Dec 09, 2025, 9:35 AM CST

Title: Base Fabrication: Sawing Screws Down to Length

Date: 12/02/25

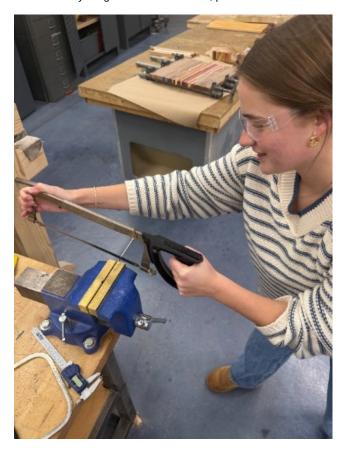
Content by: Kayla Christy

Present: Kayla, Aubrianna

Goals: The goal of this entry is to document the fabrication process for future reference.

Content:

Today, Aubrey and I trimmed screws to the required lengths for our prototype. These screws are needed to secure our different sized 3D printed blocks to the base of our prototype. Since the specific sizes we needed couldn't be delivered in time for the poster presentation, we adapted by cutting longer screws down to size. We carefully measured each one to ensure the flat heads sat flush and didn't protrude. After cutting the screws on the bandsaw, we finished by filling the ends for a clean, precise fit.



AUBRIANNA YOUNKER - Dec 10, 2025, 2:40 PM CST

Title: Cushion Cutting and Casing Fabrication

Date: 11/21/2025

Content by: Aubrianna Younker

Present: Tess, Violet, Lauren, Kayla, Aubrey

Goals: The goal of this entry is to document fabrication notes of the knee cushion and component.

Content:

To create the cushion for the knee rest, the 11x11-inch high-density foam was cut down using fabric scissors to match the 6.5x6.5-inch middle portion of the 3D printed blocks. Following this, a synthetic cloth material was cut and sewn using both machine and hand stitching to create a casing to go over the foam. Four velcro strips (1x2 inch) were then carefully aligned and placed onto each PLC block, as well as the casing with the foam. Hand stitching was then used to aid the adhesion of the velcro strips on the synthetic material of the casing, and super glue for the PLC blocks. During this time, we also wrapped the metal handles with the comfort grip tape. Fabrication photos will be attached below.

Conclusions/action items: In conclusion, the foam component is now ready for the final prototype. It gives the user comfort and some lateral support.

AUBRIANNA YOUNKER - Dec 10, 2025, 2:40 PM CST



Download

IMG_2449.jpg (3.24 MB) Fabrication Photo

AUBRIANNA YOUNKER - Dec 10, 2025, 2:41 PM CST





Download

IMG_2447_1_.jpg (2.91 MB) Cutting and sewing the cushion case

AUBRIANNA YOUNKER - Dec 09, 2025, 9:50 AM CST

Title: Preliminary Testing Protocol

Date: 10/21/25

Content by: Aubrianna Younker

Present: whole team

Goals: The goal of this entry is to document the protocol we had set in place before adding in dynamic testing.

Content:

Testing and Results

Testing

Testing for the Knee Crutch will begin after the initial fabrication of the device is completed. The testing will serve as a way to gauge the stability of the device, as well as a way to evaluate comfort and usability. It will gather stability data using force plates that can be compared to stability data from the existing prototype. With this data, the average path length can be calculated for each device, which gives a quantified value to compare the stability between the two devices. Stabilogram graphs can also serve as a clear visual representation of any differences in stability. For comfort and usability, a comprehensive survey will compile diverse and unbiased ratings for both respective categories. The team will conduct this survey with both peers and patients to best address different user needs and inputs.

Testing Protocol

1. Force Plate Stability Testing

- *i.* Power on the force plate of intended use, open Bertec Acquire 4 Software, and zero the force plate. See Figure 6 for a visual of the power switch.
- *ii.* Place the previous prototype in the center of the force plate and kneel on the device. Once in position, quickly start recording and collect data for 20 seconds before stopping the recording and stepping off. During the 20-second test, the test subject should try to remain balanced and in an upright position. Perform three different data collections under these conditions, exporting each data collection between trials. Export in a .csv file and select output data to be in newtons and meters. Record the test subject's weight in kilograms for later data calculations.
- *iii.* Using the same test subject, repeat step ii with the new, improved prototype. Make sure to differentiate trial names when exporting this data.
 - iv. After all data is recorded and exported, log out of the software and turn off the force plates.
- *v.* Import data trials to MATLAB to create stabiligram graphs and calculate the path length for each trial. Average the three path lengths for each device.



Figure 7: Amplifier boxes for in-ground force plates with indication of the power switch [o]

2. Comfort and Satisfaction Testing

- *i.* Using a random and compliant test subject, have the subject use each prototype (previous and new) to go up and down at least 7 stairs.
- *ii.* Once the test subject has had a chance to use each device, offer a comprehensive survey regarding comfort and stability ratings between the two devices.
- *iii.* Repeat steps i and ii with different test subjects until you have 10-15 data entries to document. Make note of any general demographics of each test subject (age, gender, height, etc).
 - iv. Average the stability and comfort ratings for each device. Record in the corresponding data collection chart.

Results

Once testing is conducted, the results will be recorded and organized in the charts below. Additionally, from the first testing method, a stabilogram will be provided for the trial with the smallest path length for each prototype. See Appendix 3 for example MATLAB code for calculating path length and generating stabilograms.

Conclusions/action items: In conclusion, this needs to be updated based on any additional criteria and added to with the dynamic testing protocol once we talk with Professor Wille for advice, but this gives us a general idea of what our testing will look like.

Violet Urdahl - Dec 10, 2025, 5:59 PM CST

Title: Stability Testing Protocol

Date: 1210/25

Content by: Violet Urdahl

Present: N/A

Goals: Establish testing procedure for evaluating device efficacy

Content:

Static Stability:

- 1. Place a six inch tall block on the second force plate, then place the current knee crutch with the one inch height adjustability component on the block and zero the forces
- 2. Record the test subject's weight in kilograms for later data calculations
- 3. User balances on one knee on the device
- 4. Begin data collection
- 5. User balances for 20 seconds, end data collection
- 6. Place previous semester's knee crutch prototype on the block and zero the forces
- 7. User balances on one knee on the device
- 8. Begin data collection
- 9. User balances for 20 seconds, end data collection
- 10. End static stability data collection

Dynamic Stability:

- 1. Place a six inch tall block on the second force plate, then zero the force plates
- 2. Record the test subject's weight in kilograms for later data calculations
- 3. User stands on one leg on the first force plate, begin data collection
- 4. User places the current knee crutch prototype with the one inch height adjustability component on the block
- 5. User places the knee of their "injured" leg (leg that was being held up in Step 2) on the knee crutch and then steps up onto the block
- 6. User steps down onto block with other leg, end data collection
- 7. Repeat steps 1-5 with previous semester's prototype
- 8. User stands on one leg without a knee crutch on the first force plate, start data collection
- 9. User steps up onto block, pauses on one leg, then steps down with other leg
- 10. End data collection

Conclusions/action items:

The team successfully used this protocol to evaluate the stability of the device. Testing yielded promising results, however, the procedure for dynamic testing could be altered in the future to acquire more relevant data. This protocol could be more standardized across subjects in the future for optimal results.

Violet Urdahl - Dec 10, 2025, 6:09 PM CST

Title: Survey Testing Protocol

Date: 12/10/25

Content by: Violet Urdahl

Present: N/A

Goals: Establish a testing protocol for surveying random participants in use of the knee crutch

Content:

Usability:

- 1. Random participants are instructed to use the current knee crutch with the one inch block to climb five stairs and descend five stairs
 - a. Participants are not instructed on how to use the knee crutch
 - b. Continue testing until there are 10-15 participants that have filled out survey
- 2. Following their trial with the knee crutch, participants are asked the following questions:
 - a. What gender are you?
 - b. How tall are you?
 - c. How much do you weigh?
 - d. How intuitive did the device feel on the first use on a scale of one to ten?
 - e. Rate the comfort of the hand grip on a scale of one to ten.
 - f. Rate the comfort of the knee rest on a scale of one to ten.
 - g. How stable did you feel climbing stairs with this device on a scale of one to ten?
 - h. How difficult was it to maintain balance on a scale of one to ten?
 - i. How easy was it to navigate stairs on the device at a normal pace on a scale of one to ten?
 - j. How comfortable and safe did you feel using the device independently on a scale of one to ten?
 - k. How easy was the weight of the device to manage while using on a scale of one to ten?
 - l. Please list any feedback that you have about the device.

Google form: https://docs.google.com/forms/d/e/1FAlpQLSdCIE0Blqac-CUns51mwhDH-j9DHv4vn4ncj2YCpyORtg_OOg/viewform?usp=header

Conclusions/action items:

This testing protocol was followed to evaluate user comfortability of the device. It helped the team identify strengths and weaknesses of the design. In the future, the team will take this feedback into consideration.



Example MATLAB code for COP force plate analysis

AUBRIANNA YOUNKER - Dec 09, 2025, 9:56 AM CST

Title: Example MATLAB code for COP force plate analysis

Date: 12/9/2025

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to include an example MATLAB script that can be used as a starting point for our force plate center of pressure analysis to get us some quantitative stability numbers.

Content:

```
Generate stabilogram:
figure;
plot(cop1_xso2,cop1_yso2);
title('Stabilogram Two Feet, Eyes Open');
xlabel('Medio-Lateral (m)');
ylabel('Anterior-Posterior (m)');
axis equal;
Calculate path length:
dcpxso1=diff(cop1_xso1(~isnan(cop1_xso1)));
dcpyso1=diff(cop1_yso1(~isnan(cop1_yso1)));
distanceso1 = sqrt(dcpxso1.^2 + dcpyso1.^2)
plso1 = sum(distanceso1)
reference: Wille, C. Lab 1—Force Acceleration (BME 315), Accessed: 2025, October 8, 2025. [Online]
```

Conclusions/action items: For action items, we need to perform force plate testing to gather multiple trials of data and then use this code as a starter for part of our testing analysis. Shout out BME 315 lab for the data collection inspo!



Preliminary Group Testing Implications

AUBRIANNA YOUNKER - Dec 10, 2025, 2:31 PM CST

Title: 11/10/2025

Date: 12/10/2025

Content by: Aubrianna Younker

Present: Whole team

Goals: The goal of this entry is to document key design problems we found when initially testing the device as a team.

Content:

Now that the prototype is coming together more, we have a better feel of how the device is going to function and how users are going to be interacting with it. This allowed us to make some realizations about our current design and potential flaws. Firstly, when trying out the base of the device before adding the handle components, a team member noticed that if handles extended up to hip height on three of the four sides of the base, this would cause the user to straddle one of the handles. This defeats the purpose of having a handle here, so we decided to remove one of the handles, moving the design to only have handles extend on two of the four sides. Along with this, when we first tested out the device, we found that the 2" block (which was originally going to be our highest height adjustability component) seemed to be a little short for our taller teammates, and about the right height for our teammates who are around 5,4". Since our target height is 5,2" - 5'9" and the block seemed to be a good height for someone who was 5'4", we decided to create one additional heihgt block that is 2.75 inches in hieght, this way we have one more option that is higher for the patients who are on the upper end of the height range.

Conclusions/action items: In conclusion, being able to have a tangle device rather than just a design drawing allowed us to find flaws in our current design that would have been harder to notice without actually trying the device. Action items are to update the design drawings and prototype.

Violet Urdahl - Dec 10, 2025, 6:14 PM CST

Title: Testing Evaluation Code

Date: 12/10/25

Content by: Violet Urdahl

Present: N/A

Goals: Use the following code to evaluate testing results

Content:

```
%% BME 300 COP Static Balance Data
% New Knee Crutch
lnew = importdata("laurenbalancenew.xlsx");
anew = importdata("aubreybalancenew.xlsx");
vnew = importdata("violetbalancenew.xlsx");
tnew = importdata("tessbalancenew.xlsx");
timelnew = lnew.data(:,1);
fx2lnew = lnew.data(:,15);
fy2lnew = lnew.data(:,16);
fz2lnew = lnew.data(:,17);
cop2_xlnew = lnew.data(:,21);
cop2_ylnew = lnew.data(:,22);
timeanew = anew.data(:,1);
fx2anew = anew.data(:,15);
fy2anew = anew.data(:,16);
fz2anew = anew.data(:,17);
cop2_xanew = anew.data(:,21);
cop2_yanew = anew.data(:,22);
timevnew = vnew.data(:,1);
fx2vnew = vnew.data(:,15);
fy2vnew = vnew.data(:,16);
fz2vnew = vnew.data(:,17);
cop2_xvnew = vnew.data(:,21);
cop2_yvnew = vnew.data(:,22);
timetnew = tnew.data(:,1);
fx2tnew = tnew.data(:,15);
fy2tnew = tnew.data(:,16);
fz2tnew = tnew.data(:,17);
cop2_xtnew = tnew.data(:,21);
cop2_ytnew = tnew.data(:,22);
dcpxlnew=diff(cop2_xlnew);
```

```
dcpylnew=diff(cop2_ylnew);
distancelnew = sqrt(dcpxlnew.^2 + dcpylnew.^2);
pllnew = sum(distancelnew)
dcpxanew=diff(cop2_xanew);
dcpyanew=diff(cop2_yanew);
distanceanew = sqrt(dcpxanew.^2 + dcpyanew.^2);
planew = sum(distanceanew)
dcpxvnew=diff(cop2_xvnew);
dcpyvnew=diff(cop2_yvnew);
distancevnew = sqrt(dcpxvnew.^2 + dcpyvnew.^2);
plvnew = sum(distancevnew)
dcpxtnew=diff(cop2_xtnew);
dcpytnew=diff(cop2_ytnew);
distancetnew = sqrt(dcpxtnew.^2 + dcpytnew.^2);
pltnew = sum(distancetnew)
lold = importdata("laurenbalanceold.xlsx");
aold = importdata("aubreybalanceold.xlsx");
vold = importdata("violetbalanceold.xlsx");
told = importdata("tessbalanceold.xlsx");
timelold = lold.data(:,1);
fx2lold = lold.data(:,15);
fy2lold = lold.data(:,16);
fz2lold = lold.data(:,17);
cop2_xlold = lold.data(:,21);
cop2_ylold = lold.data(:,22);
timeaold = aold.data(:,1);
fx2aold = aold.data(:,15);
fy2aold = aold.data(:,16);
fz2aold = aold.data(:,17);
cop2_xaold = aold.data(:,21);
cop2_yaold = aold.data(:,22);
timevold = vold.data(:,1);
fx2vold = vold.data(:,15);
fy2vold = vold.data(:,16);
fz2vold = vold.data(:,17);
cop2_xvold = vold.data(:,21);
cop2_yvold = vold.data(:,22);
timetold = told.data(:,1);
fx2told = told.data(:,15);
fy2told = told.data(:,16);
fz2told = told.data(:,17);
cop2_xtold = told.data(:,21);
cop2_ytold = told.data(:,22);
```

```
%figure;
%plot(cop2_xlnew, cop2_ylnew);
hold on;
plot(cop2_xlold, cop2_ylold);
hold off;
axis equal;
title("Center of Pressure Variation (1)");
xlabel("COP (x)");
ylabel("COP (y)");
legend("New Prototype", "Previous Prototype");
%figure(2);
%plot(cop2_xanew,cop2_yanew);
hold on;
plot(cop2_xaold, cop2_yaold);
hold off;
axis equal;
title("Center of Pressure Variation (2)");
xlabel("COP(x)");
ylabel("COP (y)");
legend("New Prototype", "Previous Prototype");
%figure(3);
%plot(cop2_xvnew,cop2_yvnew);
hold on;
plot(cop2_xvold,cop2_yvold);
hold off;
axis equal;
title("Center of Pressure Variation (3)");
xlabel("COP(x)");
ylabel("COP (y)");
legend("New Prototype", "Previous Prototype");
dcpxlold=diff(cop2_xlold);
dcpylold=diff(cop2_ylold);
distancelold = sqrt(dcpxlold.^2 + dcpylold.^2);
pllold = sum(distancelold)
dcpxaold=diff(cop2_xaold);
dcpyaold=diff(cop2_yaold);
distanceaold = sqrt(dcpxaold.^2 + dcpyaold.^2);
plaold = sum(distanceaold)
dcpxvold=diff(cop2_xvold);
dcpyvold=diff(cop2_yvold);
distancevold = sqrt(dcpxvold.^2 + dcpyvold.^2);
plvold = sum(distancevold)
dcpxtold=diff(cop2_xtold);
```

```
dcpytold=diff(cop2_ytold);
distancetold = sqrt(dcpxtold.^2 + dcpytold.^2);
pltold = sum(distancetold)
old = [pltold; plvold; plaold; pllold];
new = [pltnew; plvnew; planew; pllnew];
figure;
data = [old, new];
boxplot(data, {'Previous Prototype','Current Prototype'});
h = findobj(gca, 'Tag', 'Box');
                                 % box handles are returned backwards
colors = [1 0.8 0.8;
                     % light red
         0.8 0.8 1]; % light blue
for i = 1: length(h)
   patch(get(h(i),'XData'), get(h(i),'YData'), colors(i,:), ...
         'FaceAlpha', 0.5);
end
m = findobj(gca, 'Tag', 'Median');
set(m, 'LineWidth', 2);
ylabel('COP Path Length (cm)');
xlabel('Knee Crutch Condition');
title("COP Path Length of Previous Prototype vs. Current Prototype");
ylabel("COP Path Length (cm)");
xlabel('Device Condition', 'FontSize', 16);
ylabel('COP Path Length (cm)', 'FontSize', 16);
title('COP Path Length Comparison', 'FontSize', 18);
meanold = mean(old)
meannew = mean(new)
stdold = std(old)
stdnew = std(new)
[h, p, ci, stats] = ttest(old, new)
%% BME 300 Stepping COP Data
lnew = importdata("laurennew.xlsx");
anew = importdata("aubreynew.xlsx");
tnew = importdata("tessnew.xlsx");
vnew = importdata("violetnew.xlsx");
lold = importdata("laurenold.xlsx");
aold = importdata("aubreyold.xlsx");
told = importdata("tessold.xlsx");
vold = importdata("violetold.xlsx");
lnone = importdata("laurennone.xlsx");
anone = importdata("aubreynone.xlsx");
tnone = importdata("tessnone.xlsx");
```

```
vnone = importdata("violetnone.xlsx");
% New
timelnew = lnew.data(:,1);
fx2lnew = lnew.data(:,15);
fy2lnew = lnew.data(:,16);
fz2lnew = lnew.data(:,17);
cop2_xlnew = lnew.data(:,21);
cop2_ylnew = lnew.data(:,22);
timeanew = anew.data(:,1);
fx2anew = anew.data(:,15);
fy2anew = anew.data(:,16);
fz2anew = anew.data(:,17);
cop2_xanew = anew.data(:,21);
cop2_yanew = anew.data(:,22);
timevnew = vnew.data(:,1);
fx2vnew = vnew.data(:,15);
fy2vnew = vnew.data(:,16);
fz2vnew = vnew.data(:,17);
cop2_xvnew = vnew.data(:,21);
cop2_yvnew = vnew.data(:,22);
timetnew = tnew.data(:,1);
fx2tnew = tnew.data(:,15);
fy2tnew = tnew.data(:,16);
fz2tnew = tnew.data(:,17);
cop2_xtnew = tnew.data(:,21);
cop2_ytnew = tnew.data(:,22);
fx1lnew = lnew.data(:,4);
fy1lnew = lnew.data(:,5);
fz1lnew = lnew.data(:,6);
cop1_xlnew = lnew.data(:,10);
cop1_ylnew = lnew.data(:,11);
fx1anew = anew.data(:,4);
fy1anew = anew.data(:,5);
fz1anew = anew.data(:,6);
cop1_xanew = anew.data(:,10);
cop1_yanew = anew.data(:,11);
fx1vnew = vnew.data(:,4);
fy1vnew = vnew.data(:,5);
fz1vnew = vnew.data(:,6);
cop1_xvnew = vnew.data(:,10);
cop1_yvnew = vnew.data(:,11);
fx1tnew = tnew.data(:,4);
fy1tnew = tnew.data(:,5);
```

```
fz1tnew = tnew.data(:,6);
cop1_xtnew = tnew.data(:,10);
cop1_ytnew = tnew.data(:,11);
figure;
plot(timevnew, fz1vnew);
tStart = 4.725;
tEnd = 5.089;
idx = (timevnew >= tStart) & (timevnew <= tEnd);</pre>
copvnew = sqrt(((cop2_xvnew).^2) + ((cop2_yvnew).^2));
dcpxvnew=diff(cop2_xvnew(idx));
dcpyvnew=diff(cop2_yvnew(idx));
distancevnew = sqrt(dcpxvnew.^2 + dcpyvnew.^2);
plvnew = sum(distancevnew)
figure;
plot(timeanew, fz2anew);
anStart = 3.687;
anEnd = 4.051;
idxan = (timeanew >= anStart) & (timeanew <= anEnd);</pre>
dcpxanew=diff(cop2_xanew(idxan));
dcpyanew=diff(cop2_yanew(idxan));
distanceanew = sqrt(dcpxanew.^2 + dcpyanew.^2);
planew = sum(distanceanew)
figure;
plot(timetnew, fz2tnew);
tnStart = 3.675;
tnEnd = 4.039;
idxtn = (timetnew >= tnStart) & (timetnew <= tnEnd);</pre>
dcpxtnew=diff(cop2_xtnew(idxtn));
dcpytnew=diff(cop2_ytnew(idxtn));
distancetnew = sqrt(dcpxtnew.^2 + dcpytnew.^2);
pltnew = sum(distancetnew)
figure;
plot(timelnew, fz2lnew);
lnStart = 5.4;
lnEnd = 5.764;
idxln = (timelnew >= lnStart) & (timelnew <= lnEnd);</pre>
dcpxlnew=diff(cop2_xlnew(idxln));
dcpylnew=diff(cop2_ylnew(idxln));
distancelnew = sqrt(dcpxlnew.^2 + dcpylnew.^2);
pllnew = sum(distancelnew)
% Old
timevold = vold.data(:,1);
fx2vold = vold.data(:,15);
```

```
fy2vold = vold.data(:,16);
fz2vold = vold.data(:,17);
cop2_xvold = vold.data(:,21);
cop2_yvold = vold.data(:,22);
fx1vold = vold.data(:,4);
fy1vold = vold.data(:,5);
fz1vold = vold.data(:,6);
cop1_xvold = vold.data(:,10);
cop1_yvold = vold.data(:,11);
figure;
plot(timevold, fz1vold);
tStartold = 3.63;
tEndold = 3.994;
idxold = (timevold >= tStartold) & (timevold <= tEndold);</pre>
dcpxvold=diff(cop2_xvold(idxold));
dcpyvold=diff(cop2_yvold(idxold));
distancevold = sqrt(dcpxvold.^2 + dcpyvold.^2);
plvold = sum(distancevold)
timetold = told.data(:,1);
fx2told = told.data(:,15);
fy2told = told.data(:,16);
fz2told = told.data(:,17);
cop2_xtold = told.data(:,21);
cop2_ytold = told.data(:,22);
fx1told = told.data(:,4);
fy1told = told.data(:,5);
fz1told = told.data(:,6);
cop1_xtold = told.data(:,10);
cop1_ytold = told.data(:,11);
figure;
plot(timetold, fz2told);
tStarttold = 3.1;
tEndtold = 3.464;
idxtold = (timetold >= tStarttold) & (timetold <= tEndtold);</pre>
dcpxtold=diff(cop2_xtold(idxtold));
dcpytold=diff(cop2_ytold(idxtold));
distancetold = sqrt(dcpxtold.^2 + dcpytold.^2);
pltold = sum(distancetold)
timelold = lold.data(:,1);
fx2lold = lold.data(:,15);
fy2lold = lold.data(:,16);
fz2lold = lold.data(:,17);
cop2_xlold = lold.data(:,21);
```

```
cop2_ylold = lold.data(:,22);
fx1lold = lold.data(:,4);
fy1lold = lold.data(:,5);
fz1lold = lold.data(:,6);
cop1_xlold = lold.data(:,10);
cop1_ylold = lold.data(:,11);
figure;
plot(timelold, fz2lold);
tStartlold = 4.467;
tEndlold = 4.831;
idxlold = (timelold >= tStartlold) & (timelold <= tEndlold);</pre>
dcpxlold=diff(cop2_xlold(idxlold));
dcpylold=diff(cop2_ylold(idxlold));
distancelold = sqrt(dcpxlold.^2 + dcpylold.^2);
pllold = sum(distancelold)
figure;
plot(timevnew,fz2vnew);
figure;
plot(timevold, fz2vold);
timeaold = aold.data(:,1);
fx2aold = aold.data(:,15);
fy2aold = aold.data(:,16);
fz2aold = aold.data(:,17);
cop2_xaold = aold.data(:,21);
cop2_yaold = aold.data(:,22);
fx1aold = aold.data(:,4);
fy1aold = aold.data(:,5);
fz1aold = aold.data(:,6);
cop1_xaold = aold.data(:,10);
cop1_yaold = aold.data(:,11);
figure;
plot(timeaold, fz2aold);
aoStart = 3.324;
aoEnd = 3.688;
idxao = (timeaold >= aoStart) & (timeaold <= aoEnd);</pre>
dcpxaold=diff(cop2_xaold(idxao));
dcpyaold=diff(cop2_yaold(idxao));
distanceaold = sqrt(dcpxaold.^2 + dcpyaold.^2);
plaold = sum(distanceaold)
% None
timeanone = anone.data(:,1);
fx2anone = anone.data(:,15);
fy2anone = anone.data(:,16);
```

```
fz2anone = anone.data(:,17);
cop2_xanone = anone.data(:,21);
cop2_yanone = anone.data(:,22);
fx1anone = anone.data(:,4);
fy1anone = anone.data(:,5);
fz1anone = anone.data(:,6);
cop1_xanone = anone.data(:,10);
cop1_yanone = anone.data(:,11);
figure;
plot(timeanone, fz2anone);
anoneStart = 2.198;
anoneEnd = 2.451;
idxanone = (timeanone >= anoneStart) & (timeanone <= anoneEnd);</pre>
dcpxanone=diff(cop2_xanone(idxanone));
dcpyanone=diff(cop2_yanone(idxanone));
distanceanone = sqrt(dcpxanone.^2 + dcpyanone.^2);
planone = sum(distanceanone)
timevnone = vnone.data(:,1);
fx2vnone = vnone.data(:,15);
fy2vnone = vnone.data(:,16);
fz2vnone = vnone.data(:,17);
cop2_xvnone = vnone.data(:,21);
cop2_yvnone = vnone.data(:,22);
fx1vnone = vnone.data(:,4);
fy1vnone = vnone.data(:,5);
fz1vnone = vnone.data(:,6);
cop1_xvnone = vnone.data(:,10);
cop1_yvnone = vnone.data(:,11);
figure;
plot(timevnone, fz2vnone);
vnoneStart = 2.63;
vnoneEnd = 2.994;
idxvnone = (timevnone >= vnoneStart) & (timevnone <= vnoneEnd);</pre>
dcpxvnone=diff(cop2_xvnone(idxvnone));
dcpyvnone=diff(cop2_yvnone(idxvnone));
distancevnone = sqrt(dcpxvnone.^2 + dcpyvnone.^2);
plvnone = sum(distancevnone)
timetnone = tnone.data(:,1);
fx2tnone = tnone.data(:,15);
fy2tnone = tnone.data(:,16);
fz2tnone = tnone.data(:,17);
cop2_xtnone = tnone.data(:,21);
cop2_ytnone = tnone.data(:,22);
```

```
fx1tnone = tnone.data(:,4);
fy1tnone = tnone.data(:,5);
fz1tnone = tnone.data(:,6);
cop1_xtnone = tnone.data(:,10);
cop1_ytnone = tnone.data(:,11);
figure;
plot(timetnone, fz2tnone);
tnoneStart = 1.97;
tnoneEnd = 2.334;
idxtnone = (timetnone >= tnoneStart) & (timetnone <= tnoneEnd);</pre>
dcpxtnone=diff(cop2_xtnone(idxtnone));
dcpytnone=diff(cop2_ytnone(idxtnone));
distancetnone = sqrt(dcpxtnone.^2 + dcpytnone.^2);
pltnone = sum(distancetnone)
timelnone = lnone.data(:,1);
fx2lnone = lnone.data(:,15);
fy2lnone = lnone.data(:,16);
fz2lnone = lnone.data(:,17);
cop2_xlnone = lnone.data(:,21);
cop2_ylnone = lnone.data(:,22);
fx1lnone = lnone.data(:,4);
fy1lnone = lnone.data(:,5);
fz1lnone = lnone.data(:,6);
cop1_xlnone = lnone.data(:,10);
cop1_ylnone = lnone.data(:,11);
figure;
plot(timelnone, fz2lnone);
lnoneStart = 3.093;
lnoneEnd = 3.457;
idxlnone = (timelnone >= lnoneStart) & (timelnone <= lnoneEnd);</pre>
dcpxlnone=diff(cop2_xlnone(idxlnone));
dcpylnone=diff(cop2_ylnone(idxlnone));
distancelnone = sqrt(dcpxlnone.^2 + dcpylnone.^2);
pllnone = sum(distancelnone)
% Compile
old = [plvold plaold pltold pllold];
new = [plvnew planew pltnew pllnew];
none = [plvnone planone pltnone];
data = [old; new; none];
figure;
bar(data')
legend('Previous Prototype', 'Current Prototype', 'None')
set(gca, 'XTickLabel', {'Subject 1', 'Subject 2', 'Subject 3', 'Subject 4'}, 'FontSize', 16)
```

```
ylabel('Path Length (m)', 'FontSize', 16);
title('Path Lengths of Users With the Previous, Current, and No Knee Crutch', 'FontSize', 18);
% Knee Crutch Survey Data
% Aubrianna Younker
data_independent = [7; 8; 8; 8; 8; 8; 9; 9; 9; 9; 10; 10; 10];
                = [5; 6; 7; 7; 8; 8; 8; 8; 9; 9; 10; 10; 10; 10];
data_normal
                 = [1; 1; 2; 3; 3; 4; 4; 5; 5; 5; 7; 8; 8; 9];
figure;
data = [data_independent, data_stable, data_normal];
boxplot(data, {'Independence Ranking','Stability Ranking', 'Normal Speed Ranking'});
h = findobj(gca, 'Tag', 'Box'); % box handles are returned backwards
colors = [1 0.8 1; 0.6 0.6 1; 0.8 0.9 0.8];
for i = 1:length(h)
patch(get(h(i), 'XData'), get(h(i), 'YData'), colors(i,:), ...
'FaceAlpha', 0.5);
end
m = findobj(gca, 'Tag', 'Median');
set(m, 'LineWidth', 2);
ylabel('COP Path Length (cm)');
xlabel('Design Criteria');
title("Knee Crutch Survey; Ranking Device Criteria");
ylabel("Rank Value (1-10)");
xlabel('Device Criteria', 'FontSize', 16);
ylabel('Rank Value (1-10)', 'FontSize', 16);
title('Knee Crutch Survey; Device Criteria Rank Results', 'FontSize', 18);
```

Conclusions/action items:

The code outlined above was used to evaluate all three tests. The team used it to generate representative figures and conduct a T-Test on the static stability test. In the future, the dynamic testing procedure should be altered to improve the analysis of its data.

Violet Urdahl - Dec 10, 2025, 6:25 PM CST

Title: Testing and Results Graphics

Date: 12/10/25

Content by: Violet Urdahl

Present: N/A

Goals: Compile data and images from testing

Content:

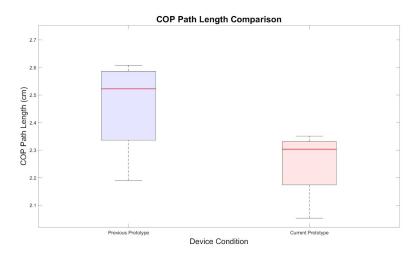


Figure 1. Boxplot of path length of users on the current and previous prototypes

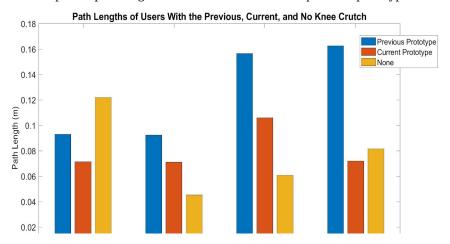


Figure 2. Bar graph comparison of user path lengths on the current knee crutch, previous knee crutch, and without assistance

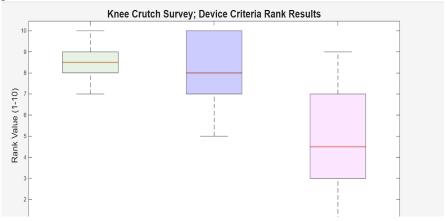
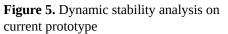


Figure 3. Box plot of survey feedback results on independence, stability, and speed



Figure 4. Static stability analysis on previous semester's prototype





Conclusions laction items:

The team has completed testing. See the above figures for testing results. Additionally, the team took pictures throughout the testing process to help visualize the protocol procedure.

9/18/25 Knee Crutch Preliminary Design Specifications

Violet Urdahl - Oct 09, 2025, 1:23 PM CDT

Product Design Specification

Date: 09/18/25

Project title: Knee Crutch Group members:

- Tram Leader: Violet Usdahl
 Commonicator: Teos Fitage old
 BSAC: Noyla Christy and Lauen Anderson
 BWIG: Eson Kode moy
 BPAG: Aubrianna Yoursler

Client: Duniel Kutschera Advisor: Rarely Bartels

Patient with an injury below the laser are often asked to safate crackes or a case when according and descendings to, but when patients are saable to as these devices, then injury according and descendings of the control of the con

- The product's frame should be beight adjustable and made of steel, with a material stability component at the foot.
 The lace rest should be concave and fitted with padding to allow comfortable, lateral

- A. It should be a length that does not excusive the area of injury.

 The product should be neck barically stress it stred.

 The product should be about 5 ib with a handle to allow users to move it upstains.

Download

9_18_25_Knee_Crutch_PDS.docx (12.4 kB)

Violet Urdahl - Oct 09, 2025, 1:26 PM CDT

Title: Knee Crutch Preliminary Design Specifications

Date: 9/18/25

Content by: BME 2/300 Knee Crutch Team

Present: N/A

Goals: Create a document outlining design constraints

Content:

See attached

Conclusions/action items:

The team worked together on this document to establish parameters for our design this semester. We highlighted key points, like design dimensions/weight, client needs, weight, and all other considerations that we will need to make throughout the semester. This document will guide us for the rest of this project.

Violet Urdahl - Oct 09, 2025, 1:32 PM CDT

Design Idea Descriptions

Wrop Around Hondle
This design leatures a wide Skill-Inch boxe, supported by four small, curved log swith subter capson the boxes to standard stability. Afterbard to this boxe in as long, adjustable square and that supports a for jobe possible with the grownt. This first jobe is written by the boxes of the support is not piece possible with the grownt. This first jobe is written by the best of the support is not seen and when a here custom can be ploaded or advised on wifer. Around their lines support is an extended francis. The principles of the support is not support in the purposition of the support is supported to the principles of the support is not a way to provide of the 4 selected the support is the principles of the support is the support in the support in the support is the support in the support in the support is the support in the support is the support in the support in the support is the support in the support is the support in the support is the support in the support in the support in the support is the support in the support in the support in the support is the support in the suppor

Adjustable There Leg.
This despit leature as these legged base that stabilizes the contribution the lop. The base is a signare shape that is ballow in the middle to avoid access weight in the crudit. There is a efficience option ways around the base to stabilize the twice outsthon sick surfaces. Each of the three leggers and plateable using a pin and the inscheriors. The log have covered and cush and put that uses the outstable of the inscheriors. The legislates adjusted on a cush and put that outstable outstable that the coverage of the customer of the device, and is outdined within the radie. The main state rids for this design would include material jubinitization or steel (and lower.)

Download

Design_Matrix.docx (129 kB)

Violet Urdahl - Oct 09, 2025, 1:41 PM CDT

Title: Knee Crutch Design Matrix

Date: 9/29/25

Content by: BME 2/300 Knee Crutch Team

Present: N/A

Goals: Evaluate three possible designs for our project based on weighted criteria

Content:

See attachment

Conclusions/action items:

Our design matrix was incredibly helpful in aiding the team's decision on a preliminary design. We decided to use two of our teammates' designs and then create a third as a group to evaluate. Our third design included different components from different designs that we all liked, and I think that creating a separate design as a team improved the quality of our design. After rating each of the three based on criteria pertinent to the design, we decided that the Frankenstein is the most promising design to move forward with.

Violet Urdahl - Oct 09, 2025, 3:36 PM CDT



Knee Crutch

BME 200/300

Client:

Advisor:

Team Members: Team Leader: Viola t Urdahl. Communicator: Teas Fittgera ld 89/AG: Aubrianna Younker 88/TG: Evan Koelemay BSAC: Louren Anderson & Kayla Christ

Abstract

The market for assistive mobility devices lacks on emphasis on stability and therefore accessibility, especially for users needing support accessing or descending statis. The train plans to create a design that will

Download

BME_Design_Preliminary_Report_Knee_Crutch.docx (1.96 MB)

Violet Urdahl - Oct 09, 2025, 3:44 PM CDT

Title: Knee Crutch Preliminary Report

Date: 10/8/25

Content by: BME 2/300 Knee Crutch Team

Present: N/A

Goals: Create a preliminary report based on current and future work

Content:

See attachment

Conclusions/action items:

The team finalized the preliminary report this week, and it brought up a lot of great conversations. We actually decided to revise our initial design when discussing fabrication. Instead of opting for a base plate at the bottom of the device, we will use a frame of extruded aluminum. The team will continue to reference this document throughout the semester as we proceed with fabrication and testing.



10/8/2025 Knee Crutch Preliminary Presentation

AUBRIANNA YOUNKER - Dec 10, 2025, 4:31 PM CST

Title: Knee Crutch Preliminary Presentation

Date: 10/8/2025

Content by: Full team

Present: Full team

Goals: The goal of this entry is to have a record of our preliminary presentation in our team's lab archives

Content:

See PDF attached below**

Conclusions/action items: In conclusion, we used this presentation to share the work that we've done so far this semester with our groupmates. We will receive feedback on this, as well as our preliminary report, and we can use that to move forward with other final deliverables.

AUBRIANNA YOUNKER - Dec 10, 2025, 4:32 PM CST



Download

BME_2_300_Knee_Crutch_Preliminary_Presentation.pdf (1.81 MB) Preliminary Presentation PDF

AUBRIANNA YOUNKER - Dec 09, 2025, 9:38 AM CST

Title: Knee Crutch Final Poster

Date: 12/5/2025

Content by: Aubrianna Younker

Present: Full team

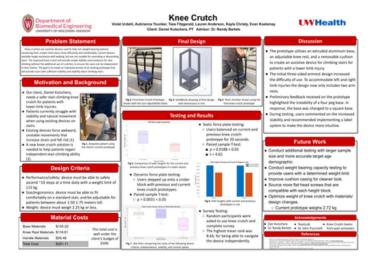
Goals: The goal of this entry is to document the poster we created to display a summary of the work we've completed this semester.

Content:

see attachment below*

Conclusions/action items: Action items include reviewing and editing our final report and preparing our prototype to be given to our client.

AUBRIANNA YOUNKER - Dec 09, 2025, 9:39 AM CST



Download

AubriannaYounker-KneeCrutch_1_1_.png (1.5 MB) Knee Crutch Final Poster

AUBRIANNA YOUNKER - Dec 10, 2025, 7:38 PM CST

Title: Knee Crutch Final Report

Date: 12/10/2025

Content by: Whole team

Present: Whole team

Goals: The goal of this entry is to include a copy of our final report in the lab notebook.

Content:

see attachment below***

Conclusions/action items: In conclusion, we are now done with this project for the semester. Great progress was made and lots of things were learned. We hope our this device has a great impact! Thanks to all those who helped.

AUBRIANNA YOUNKER - Dec 10, 2025, 7:38 PM CST



Knee Crutch

BME 200/300

.....

Divid Kutuchen

Advisor:

Tour Mumbers:
Foun Leader: Violet Undahl
Commonitation: Tour Pitz gerald
BWIG: Evan Koelessay
BBIG: Aubrin una Vounker
BSG: Lauran Anderson, Kayla Christy

Download

Knee_Crutch_-Final_Report.pdf (6.76 MB) Knee Crutch Final Report PDF

Tess FITZGERALD - Sep 10, 2025, 2:46 PM CDT

Title: First Team Meeting

Date: 9/10/2025

Content by: Tess Fitzgerald

Present: BME 200/300 Knee Crutch Team

Goals: Discuss project and brain storm questions to ask client.

Content:

- 1. What is your target demographic for this device?
- 2. Does it need to be adjustable?
- 3. What is our budget?
- 4. Are you hoping to modify the previous project or start from scratch?
- 5. What went right/wrong with the previous project?
- 6. Can you tell us more about the prototype that you mentioned in the project description?
- 7. Why do you want to have us design a knee crutch instead of purchasing one on the market?
- 8. Is it moved by their legs, by their arms, or both?
- 9. Is this product suitable for elderly patients?
- 10. Are there any weight or material constraints that we should be aware of? Does it need to be portable? Just at home or at work too?
- 11. What is the intended use of this crutch?/Are there specific activities or movements that this device is intended for, outside of walking? Is it just for the stairs?
- 12. What type of lower leg injuries would require the use of the crutch? Can the injury be anywhere below the knee or does it need to be lower?
- 13. Can the patient bend their knees?
- 14. Is the user ascending or descending stairs? Both?

Conclusions/action items: Now that we have brainstormed questions, we will be prepared when we meet with the client. After getting more information, we can begin outlining the product design specification.

AUBRIANNA YOUNKER - Sep 16, 2025, 9:56 AM CDT

Title: General Team Meeting

Date: (9/12/25

Content by: Lauren, Evan, Violet, Kayla, Aubrianna

Present: Lauren, Evan, Violet, Kayla, Aubrianna

Goals: The goal of this entry is to document key takeaways from this team meeting regarding

Content:

- -Filled out a whentomeet with our group to find a better time during the week to meet
- Rescheduled team meetings to weekly on Mondays at 5 pm, so no longer meetings on Sundays at 11.
- -Discussed reaching out again to our advisor, ensuring that we can meet and discuss our project this next week
- -Split up responsibilities for the PDS draft due this Thursday (see PDS in shared drive for assignments)
- Discussed expectations for notebook work, research entries, and progress reports

Conclusions/action items: In conclusion, we found a better time to meet; we were finding that early on Sundays were too close to our Friday meeting times, especially since weekends are usually busy. Meeting on Monday nights gives everyone a little more time to have made progress from our prior meeting, making our meetings more productive and necessary. In addition, since it is still early in the semester, we discussed team expectations to ensure we are all on the same page.

Tess FITZGERALD - Sep 19, 2025, 12:51 PM CDT

Title: Third Team Meeting

Date: 9/19/2025

Content by: Tess Fitzgerald

Present: BME 200/300 Knee Crutch Team

Goals: Discuss next steps for this week.

Content:

The team discussed meeting on Monday to work on the design matrix. The team will brainstorm design ideas to bring to the meeting Monday. We will confirm three designs to evaluate and choose the criteria. The team reached out to the advisor to organize a meeting Monday. We will edit the PDS after receiving feedback on the draft. The team also discussed trainings for the 200 and 300s to complete respectfully.

Conclusions/action items: The next steps have been aligned in the content section.

AUBRIANNA YOUNKER - Sep 22, 2025, 10:56 PM CDT

Title: Fourth Team Meeting Notes

Date: 9/22/2025

Content by: Aubrianna Younker

Present: Violet, Tess, Lauren

Goals: The goal of this entry is to record key points and action items from our group meeting.

Content:

- Discussed and showcased everyone's design ideas for the knee crutch
- Decided on criteria for the design matrix: Ease of use, Cost, Weight, Comfort, Ease of Use, and Safety/stability
- Split up the design matrix into different sections to complete by Thursday
- We also took the time to email our client, advisor, and Dr. P, regarding any of the scheduling going on in order to meet.
- Discussed expectations for the week, and planned a time to meet with our client on Thursday to gather equipment and materials.

Conclusions/action items: Action items include each member filling out their assigned portion of the design matrix and progress report by noon on Thursday. Additionally, brainstorm any questions we have for our client now that we've started the design process. Lastly, take the time to update any entries in Lab archives, and continue research.



9/29/25 Preliminary Presentation Organization

Violet Urdahl - Sep 29, 2025, 6:38 PM CDT

Title: Preliminary Presentation Organization

Date: 9/29/2025

Content by: Violet Urdahl

Present: Knee Crutch team

Goals: Create an outline of our preliminary presentation and discuss what will be covered in it

Content:

- · Team caught up on last few meetings/updates
 - o Client's previous prototype
 - Meeting with advisor
 - Mentorship topics from 300 lecture
- Worked on outline/structure of presentation
 - Assigned individual portions to write/present
 - Assigned it to be due to complete at 12 on Thursday
- Started next progress report

Conclusions/action items:

The team will complete their respective portions of the presentation by 12 on Thursday. Additionally, the team will practice individually and meet as a whole to run through the presentation on Friday morning. Finally, the team will complete their portions of the progress report.

Violet Urdahl - Oct 10, 2025, 2:04 PM CDT

Title: Team Meeting

Date: 10/10/25

Content by: Violet Urdahl

Present: Evan, Kayla, Tess, Lauren, and Violet

Goals: Discuss upcoming tasks for the week

Content:

- Team split up fabrication/material selection
- · Discussed feedback fruits and how to proceed
- · Decided on timeline for ordering materials
- · Ask client for iWalk from last group
- Get crutches/ankle boot from teammates
- · Look into handles with extruded aluminum
 - Find handle piece to go over extruded aluminum
- · Lots of different ideas for base adjustability
 - · High density foam
 - o Sliding piece into different slots
 - Lawn chair style tie
- Maybe order extruded aluminum and evaluate fab from there

Conclusions/action items:

The team discussed a lot today, with an emphasis on fabrication. We decided that it is optimal to prioritize material ordering for the base and proceed with the other components from there. The team will meet again on Monday to discuss fabrication plans further.

Violet Urdahl - Oct 13, 2025, 7:13 PM CDT

Title: Team Meeting

Date: 10/13/25

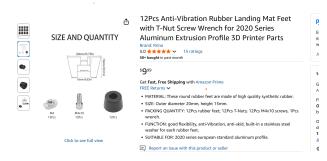
Content by: Violet Urdahl

Present: BME Knee Crutch Team

Goals: Discuss fabrication

Content:

https://www.homedepot.com/p/SKYSHALO-10-Pieces-39-4in-T-Slot-2020-Aluminum-Extrusion-Profile-European-Standard-Anodized-Linear-Rail-High-Strength-Extruded-2020OBLXC10JMQNSK001V0-S403/335664622



rubber stopper feet instead of base frame with rubber base.

8x8 in frame

10 in total height (7.5 inches for upper frame/legs)

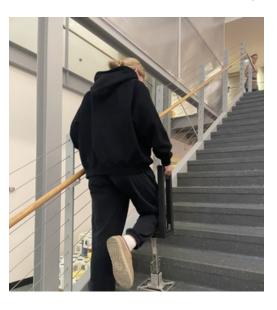
Buying kit from home depot (tentatively) and feet from Amazon

Switching to two handles instead of three so that device can be turned depending on leg being used and handle doesn't encumber working leg

Conclusions/action items:

The team had a lot of productive conversations tonight. We decided to change our handle design because we are worried about the inner handle component creating difficulty for the user/ running into their body and other leg. We have found good resources to purchase our materials from, and we will order the materials for our base in our team meeting on Friday.

AUBRIANNA YOUNKER - Oct 13, 2025, 8:09 PM CDT

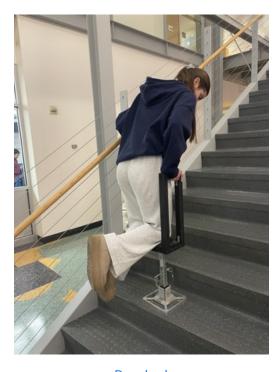




Download

IMG_2161.jpg (2.5 MB) Pictured: Teammate Kayla Experimenting with old prototype

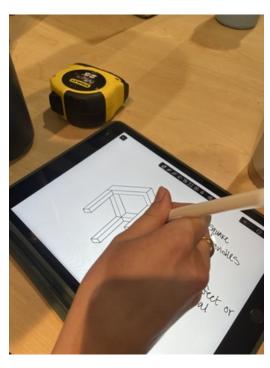
AUBRIANNA YOUNKER - Oct 13, 2025, 8:10 PM CDT



Download

IMG_2164.jpg (3.51 MB) Pictured: Teammate Lauren Experimenting with old prototype

AUBRIANNA YOUNKER - Oct 13, 2025, 8:11 PM CDT



Download

IMG_2166.jpg (2.36 MB) Pictured: Group working on design drawings and dimensions

Violet Urdahl - Oct 17, 2025, 12:47 PM CDT

Title: Team Meeting

Date: 10/17/25

Content by: Violet Urdahl

Present: Knee Crutch team

Goals: Order base materials and evaluate other component updates

Content:

- · Thinking extruded aluminum for handle as well as base
 - Need to investigate foam to slide onto handle
- Ordering kit from home depot (see Team Meeting 10/13)
 - o Consult with Professor Bartels
- · Knee rest component waiting on base
 - Maybe foam with cover that attaches to frame
- Trainings due on 10/31

10/24/25 Finalizing Materials and Fabrication

AUBRIANNA YOUNKER - Oct 24, 2025, 1:24 PM CDT

Title: Team Meeting

Date: 10/18/25

Content by: Kayla Christy

Present: Knee Crutch team

Goals: Order handle material

Content:

Thinking of using a tennis racket grip to put over our handle component. Allows for grip and is comfortable.

Amazon Link

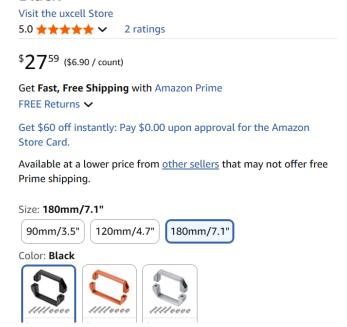


- This would be cheap, comfortable, light, and replaceable.
- Also comes in fun colors:)

Also, for the handle component, we plan to order a large aluminum handle that will slide into the t-slot of the extruded aluminum rods. We will need to attach three more vertical extruded aluminum rods to the base to have the handle at the correct height, and additionally, two horizontal rods to connect them. This may require more connectors to be ordered, which is something to be considered. The handles will be linked here.



uxcell 4 Pack Rectangular Pull Handle, 180mm/7.1" Hole Center Aluminium Alloy Door Handle Modern Drawer Pull for Drawer Cabinets Gate Garages, Black

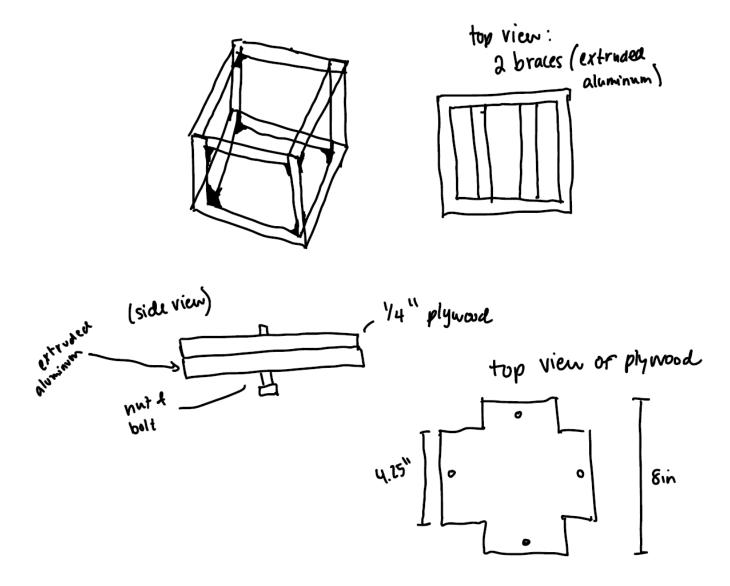


For the knee rest:

Conclusions/action items:

Tess FITZGERALD - Nov 03, 2025, 5:36 PM CST

Materials for the knee rest will come from the makerspace and design innovation lab. We plan to use a 1/4" plywood directly on top of the base. Following, will be varying sized high density plastic blocks that will be bolted into the wood.



10/27/25 Fabrication of Base/Show and Tell Prep

AUBRIANNA YOUNKER - Oct 27, 2025, 6:00 PM CDT

Title: Base Fabrication/Show and Tell

Date: 10/27/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document any important notes from our meeting and about the Show and Tell.

Content:

Violet Urdahl - Nov 03, 2025, 6:20 PM CST

Title: Fabrication Continued

Date: 11/3/25

Content by: Violet Urdahl

Present: Knee Crutch Team

Goals: Discuss fabrication action items

Content:

- Team moved design consultation to 11/11 for knee rest
- · Reached out to client about meeting/ testing with patients/ poster presentation
- Discussed show and tell recommendations
 - Decided to change to one brace on knee crutch frame for knee rest support
 - To optimize fabrication of knee rest and center of mass placement
 - o Considering velcro for attachment of foam component
 - Switching from legs to base frame
- · Need to order more connectors
- Tess will print out high density blocks at Makerspace this week for height adjustment
- · Team has Tong lecture on Friday
- Need to order/ find different bolts for handle

Conclusions/action items:

Our main action item this week is to continue fabrication. The team will complete the base frame of the knee crutch this week. Additionally, we will order the materials listed above. Finally, the team will begin fabrication of the knee rest this week.



Title: Finalize Materials

Date: 11/10/25

Content by: Whole Team

Present: Aubrey, Violet, Tess, Lauren

Goals: Finalize materials

Content:

 $https://www.amazon.com/Fastener-Reclosable-Interlocking-Adhesive-Mushroom/dp/B09G5L4LSF/ref=sr_1_3?crid=1LCS9RG0PFV8D\&dib=eyJ2ljoiMSJ9.300F2YSV-XI57t_iyWpELBmef2_saD0KMhGzVS4hlJNj6bEj5FRo4T5iGbbTpfpEfupQPB4NR3ZY6gtttAor3V8o2RVidZRAOO_2mReHtTt7K5le-$

 $MJMyUIYVi2FjXODs6yEeT8DklxfV3o6H1KC4wqf2J9XwCoQd6DQtcDnQxDJLSNjTUA7R98g.LhRK9qgQfMorh1OF0xDBjQOLYEze86_OQ43PrmO68UI\&dib_tag=se\&keywords=double%2Bhoo3\&th=1-Velco panels$



Lauren Anderson - Nov 11, 2025, 9:21 AM CST

Title: Design Consulation

Date: 11/11/25

Content by: Lauren

Present: Tess, Kayla, Lauren, Violet

Goals: Understand the fabrication of our design

Content:

- Talked about switching to a T nut

Violet Urdahl - Nov 17, 2025, 6:10 PM CST

Title: Team Meeting

Date: 11/17/25

Content by: Violet Urdahl

Present: Knee Crutch Team

Goals: Create a plan for finalizing fabrication and testing

Content:

- Team needs to cut foam, put fabric around the foam, and attach velcro this week
 - Sew a cover for foam piece
 - Cut foam to size
 - Superglue and safety velcro to cover
- Handles: one side is too long, need to order new handles
- Printing 2 in and 0.5 in block for height adjustment
- · Need rubber tread for bottom
 - Purchasing this tape
- · Violet: making SolidWorks of design
- · Aubrey: revising testing plans
- · Lauren: creating testing survey
- · Tess: making user guide for height adjustment
- Team meeting at 5:40 in Wendt on Wednesday to cut foam and sew cover
- Testing next Monday

Conclusions/action items:

The team is wrapping up the project! We aim to get testing done before Thanksgiving break, so the team will be meeting on next Monday to test. This means we have to wrap up fabrication this week, so we will follow the above plan to finish up loose ends. Additionally, we will begin working on final deliverable content.

Violet Urdahl - Dec 01, 2025, 5:59 PM CST

Title: Poster Preparation

Date: 12/1/25

Content by: Violet Urdahl

Present: Knee Crutch team

Goals: Final deliverable prep

Content:

- · Making team due date for poster on Wednesday night
 - Less words, more figures
 - Teammates practice portions individually
 - Meet Friday morning to practice going through presentation
- · Aubrey and Kayla meeting to cut screws down to size
- 2 3/4 inch block being printed
- · Have final report parts done on Sunday
 - Edit report as a group on Monday
- Presentation
 - o Kayla: Introduction, problem statement, motivation and background
 - o Evan: Design criteria
 - Aubrey: material costs and final design
 - Violet: testing and results
 - · Lauren: discussion
 - o Tess: future work, acknowledgements
- Meet at 11 in ECB on Friday to practice going through presentation

Conclusions/action items:

The team is wrapping up the semester. We are prioritizing our final deliverables and wrapping up loose ends for fabrication. This week, the team's primary focus is preparing for poster presentations.

AUBRIANNA YOUNKER - Dec 10, 2025, 4:59 PM CST

Title: Final Report Revisions

Date: 12/8/2025

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document the last team meeting we had to revise the final report.

Content:

The team met today to revise our final report. Coming into this meeting, the report is almost finished; we just need to revise and make some formatting changes. Each member read and revised a different team member's section of the final; this way, we could have multiple sets of eyes on each part of the report. During this time, we also talked about the upcoming deadlines in the class, including feedback fruits and the team notebook. We have decided to have an edit deadline for the personal and team notebooks on Wednesday at 5 pm, this way we have time to download it and submit on time. Lastly, we cleaned out our space in the closet.

Conclusions/action items: In conclusion, this was our last meeting as a team. We used the time to wrap up any last united ends, and we are happy with the work and project we've made this semester.

Lauren Anderson - Sep 19, 2025, 11:50 AM CDT

Title: 9/19/25 BSAC Executive Meeting

Date: 9/19/25

Content by: Lauren Anderson

Present: Lauren

Goals:

- Go over the last BSAC meeting takeaways
- Determine the topics of focus for the next BSAC meeting w/ faculty

Content:

- Talked about potentially having a different committee to design the website Dr. P liked the idea of a break to decide the your potential next few options
- 2-3 credits mean that there should be 6 hours put into it outside of class therefore should be using 3 hours on LabArchives
- Some weeks need more time in LabArchives other times there is not as much to add
- Communicate the importance of finding your track early on and figure out your future classes because of the specific classes available
- Having a 3rd choice on project proposals Would propose to one and then have two other choices
- having a client and team meeting already set when the projects are picked

Topics of discussion for meeting with faculty -

- curriculum options being offered at the beginning of classes as well not just over the summer
- if the advisors get a say in what projects they are advising for

- Share this information with my team to increase communication of these topics
- created a list of topics that will be discussed for faculty
- continue to think about possible solutions to be prepared to share at the next BSAC meeting

Lauren Anderson - Sep 26, 2025, 11:47 AM CDT

Title: BSAC General Meeting

Date: 9/26/25

Content by: Lauren Anderson

Present: Lauren and Kayla

Goals:

- Meet the BME faculty

- go over the topics decided in the last BSAC meeting to discuss with faculty

Content:

- Talked about how the PDS went for each group
- Have a prototype by the preliminary presentations
- Making multiple design matrix one for materials?
- talked about how to continue to train throughout the curriculum
- talked about adding an suggestion form for the trainings that you complete
- advisor expectations talk about how you should approach your advisor meeting

- discuss with the team about having different tracks and "training throughout the curriculum"
- go talk to advisor about the new classes that should be scheduled

Lauren Anderson - Oct 10, 2025, 11:44 AM CDT

Title: BSAC General Meeting

Date: 10/10/25

Content by: Lauren Anderson

Present: Kayla and Lauren

Goals: discuss preliminary presentation and report

Content:

- having an online lecture format that gives updates
- the new faculty get to chose their projects first, and all advisor should have some experience
- list of topics to discuss between mentors and mentees
- how to get resources on getting into research labs
- talked about how the preliminary presentations
- timing of the presentations was hard, give warnings on timing
- talked about the preliminary reports
- turning in the report due on friday and the feedback fruits later
- having list of what is required for each section of the preliminary report more clarity of the bullet points of each section
- discussed where we were at this point many people are looking at ordering materials
- encouraging deviation from the structure or just the requirements listed in the PDS

- talk about these items with the whole group
- communicate any further ideas with BSAC
- reflect of the feedback received in the feedback fruits

Lauren Anderson - Oct 17, 2025, 11:25 AM CDT

Title: BSAC Exec

Date: 10/17/25

Content by: Lauren

Present: Lauren

Goals: Discuss major topics and prepare for faculty meeting

Content:

- having a flowchart for the course progression
- bringing in programing through the engineering school into this class making resources more known

Faculty Topics

- flowchart
- BME mentor feedback
- Show and tell
- advisor help
- course enrollment questions
- talked about how ordering has been going and how we have been able to access funds

- cancelling BSAC before poster presentations
- prepared for the BSAC meeting with faculty
- talked through conclusions from the last meeting

Lauren Anderson - Oct 24, 2025, 11:46 AM CDT

Title: BSAC General Meeting with Faculty

Date: 10/24/25

Content by: Lauren

Present: Lauren and Kayla

Goals: Discuss key BSAC points with faculty and receive feedback

Content:

- start IRB process now for any person testing
- stability testing
- control group for the knee crutch
- talked about having a pre paid credit card for paying
- software based projects should attempt to just have an output even if it is not accurate
- failed prototypes is still a prototype
- piazza questions can all be answered by any design
- rabbit campus
- potentially reach out to an expert in that area could be a good resources and second opinion to advisors
- statistics think about the tests that would give you good numbers
- complete the fabrication folder

- complete the fabrication folder
- talk to advisor about testing
- complete prototype

Lauren Anderson - Nov 07, 2025, 11:35 AM CST

Title: BSAC General Meeting

Date: 11/7/25

Content by: Lauren Anderson

Present: Lauren and Kayla

Goals: Review answers to the topics and discuss new topics

Content:

- discussed how show and tell went and if we found the feedback was helpful
- discussed our current projects and where we were in our projects
- projects should be done by thanksgiving
- poster presentation will be that Friday
- went over important courses to look out for

- continue to wrap up fabrication
- solidify course choices for next semester
- attend the tong lecture

Lauren Anderson - Nov 21, 2025, 11:40 AM CST

Title: BSAC meeting with faculty

Date: 11/21/25

Content by: Lauren

Present: Lauren

Goals: Give final updates to the faculty

Content:

- went through our plans for the remainder of the semester
- include videos, visuals, and have a model for a poster presentation
- maybe getting a mock step or having video of us using it
- IRB needs?
- Look at PDS for the criteria and try to make sure we are testing for that criteria
- think about if we need a table or a cord or anything additional
- there will be feedback fruits for a poster evaluation!!
- pizza at poster sessions!!

- get testing done before thanksgiving
- enroll in any not opened courses on December 1st
- remind team about the feedback fruits assignment at poster presentations look at requirements
- print the poster by the 3rd!!

Violet Urdahl - Sep 23, 2025, 8:27 PM CDT

Title: Anthropometric Data

Date: 9/23/25

Content by: Violet Urdahl

Present: N/A

Goals: Research anthropometric data and find feasible dimensions for knee crutch design

Citation:

D. A. Winter, Biomechanics and Motor Control of Human Movement, 1st ed. Wiley, 2009. doi: 10.1002/9780470549148.

Content:

Segment Definition Hand Wrist axis/knuckle II middle finger Forearm Elbow axis/ulnar styloid Upper arm Glenohumeral axis/elbow axis Forearm and hand Elbow axis/ulnar styloid Total arm Glenohumeral join/ulnar styloid Lateral malleolus/head metatarsal II Leg Femoral condyles/medial malleolus Foot and leg Femoral condyles/medial malleolus Foot and leg Greater trochanter/femoral condyles Foot and leg Greater trochanter/femoral condyles Foot and leg Greater trochanter/medial malleolus Total leg Greater trochanter/medial malleolus Stoulder mass Sternoclavicular joint/glenohumeral Thorax C7-T1/T12-L1 and diaphragm* Abdomen T12-L1/L4-L1.5*	Body Weigh 0.006 M 0.016 M 0.028 M 0.050 M 0.050 M 0.0145 M 0.0465 M 0.100 M 0.061 M 0.061 M 0.081 M	0.506 0.430 0.436 0.682 0.530 0.50 0.433 0.433 0.606 0.447	Distal 0.494 P 0.570 P 0.564 P 0.318 P 0.470 P 0.50 P 0.567 P 0.567 P 0.594 P 0.553 P	C of G 0.297 0.303 0.322 0.468 0.368 0.475 0.302 0.323 0.416 0.326	0.587 0.526 0.542 0.827 0.645 0.690 0.528 0.540 0.735	Distal 0.577 M 0.647 M 0.645 M 0.565 P 0.596 P 0.690 P 0.653 M 0.653 M 0.572 P 0.650 P	Density 1.16 1.13 1.07 1.14 1.11 1.10 1.09 1.05 1.09 1.06
Foream Elbow axis/ulnar styloid Upper am Glenohumeral axis/elbow axis Forearm and hand Total arm Foot Lateral malleolus/head metatarsal II Leg Femoral condyles/medial malleolus Thigh Greater trochanter/femoral condyles Total leg Femoral condyles/medial malleolus Total leg Greater trochanter/medial malleolus	0.016 M 0.028 M 0.022 M 0.050 M 0.0145 M 0.0465 M 0.100 M 0.061 M 0.161 M 0.081 M	0.430 0.436 0.682 0.530 0.50 0.433 0.433 0.606 0.447	0.570 P 0.564 P 0.318 P 0.470 P 0.50 P 0.567 P 0.567 P 0.394 P	0.303 0.322 0.468 0.368 0.475 0.302 0.323 0.416	0.526 0.542 0.827 0.645 0.690 0.528 0.540 0.735	0.647 M 0.645 M 0.565 P 0.596 P 0.690 P 0.643 M 0.653 M 0.572 P	1.13 1.07 1.14 1.11 1.10 1.09 1.05 1.09
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	0.216 PC	0.82	0.18	_	_	_	0.92
	0.139 LC	0.44	0.56	_	_	_	_
Pelvis L4-L5/greater trochanter*	0.142 LC	0.105	0.895	_	_	_	_
Thorax and abdomen C7-T1/L4-L5*	0.355 LC	0.63	0.37	_	_	_	_
Abdomen and pelvis T12-L1/greater trochanter*	0.281 PC	0.27	0.73	_	_	_	1.01
Trunk Greater trochanter/glenohumeral join	t* 0.497 M	0.50	0.50	_	_	_	1.03
Trunk head neck Greater trochanter/glenohumeral join	t* 0.578 MC	0.66	0.34 P	0.503	0.830	0.607 M	_
Head, arms, and Greater trochanter/glenohumeral join trunk (HAT)	t* 0.678 MC	0.626	0.374 PC	0.496	0.798	0.621 PC	_

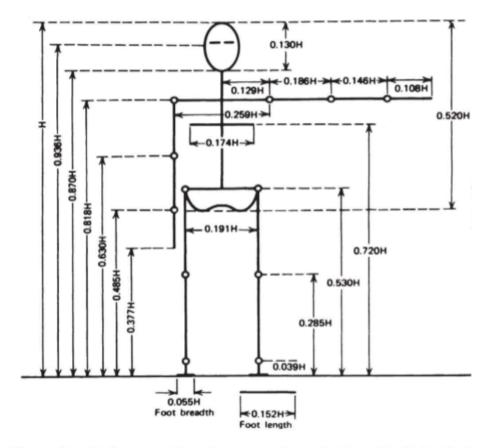


Figure 4.1 Body segment lengths expressed as a fraction of body height L

- Thigh/height ratio is 0.245
- Client says patients vary from 5'2" to 5'9"
- · Without adjustability component, would want knee crutch to be sized to height of shortest patients
 - Still able to be used by taller patients
- Length for 5'2" individuals:
 - o 0.245 * 62 in = 15.19 in
- Would this length work for taller patients?
 - What if the team made several different "bases" depending on height
 - Customization instead of of adjustability
 - Allows for security and would be made to fit
 - May not be feasible depending on fab process

Conclusions/action items:

This anthropometric table was very useful for getting an idea of dimensions for our design. Our team may opt to go with a design that isn't adjustable, but this creates difficulty when considering height variation between different patients. Though a taller patient would be able to use a shorter device, it would be significantly less comfortable. I want to talk to the team about designing several different base components that vary in height depending on the height of the patient at our next meeting.

Violet Urdahl - Oct 17, 2025, 11:57 AM CDT

Title: Stair Climbing

Date: 10/17/25

Content by: Violet Urdahl

Present: N/A

Goals: Learn more about stair climbing and risks associated with it

Citation:

Y. Wei *et al.*, "Stair Climbing, Genetic Predisposition, and the Risk of Hip/Knee Osteoarthritis," *J Gerontol A Biol Sci Med Sci*, vol. 80, no. 1, p. glae223, Dec. 2024, doi: 10.1093/gerona/glae223.

Content:

- · Study focused on relationship between stair climbing and osteoarthritis
- Knees and hips are most commonly affected joints of OA
 - Traditional treatment is pain management and joint replacement
 - Need to identify risk factors to prevent onset
- Stair climbing is a means of reducing OA susceptibility in knees, but can also lead to risk of OA
 - Separate studies done, invalidate each other
 - Increase in anterior posterior shear forces and patellofemoral pressure
- Sample set between 40-79 without OA
- Results
 - Positive correlation between OA development (hip/knee and knee) and frequency of stair climbing
 - Joint effects more pronounced in younger patients as well as patients with higher BMI/ lower physical activity
 - Overall: increased risk of knee OA but not hip
- Why:
 - Stair climbing accelerates cartilage loading, leads to knee OA
 - Higher compressive load
 - Increase in patellofemoral pressure, lateral force distribution, and lateral force during stair climbing

Conclusions/action items:

The team should be wary of possible risk factors involved in stair climbing. Regular stair climbing has a lot of risk factors, so we should investigate what other stresses in the body are occurring due to our device. I think that the lateral support mechanism will help with this, but we should see what other design changes could be made.

Violet Urdahl - Oct 17, 2025, 11:20 AM CDT



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has been seen.

Section Office Levis A. Limits MS 7500 Medical Sciences Section

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11/1/25 EMG Activity in Single Crutch Use

Violet Urdahl - Nov 01, 2025, 5:56 PM CDT

Title: EMG Activity in Single Crutch Use

Date: 11/1/25

Content by: Violet Urdahl

Present: N/A

Goals: Research motor recruitment and muscle activation in the use of single crutches

Citation:

C. Dewar et al., "EMG Activity With Use of a Hands-Free Single Crutch vs a Knee Scooter," Foot Ankle Orthop, vol.

6, no. 4, p. 24730114211060054, Dec. 2021, doi: 10.1177/24730114211060054.

Content:

- Using the hands free single crutch produced higher peak muscle activity in the rectus femoris, lateral gastrocnemius, and gluteus maximus compared with a knee scooter
- The vastus lateralis did not show a significant difference in peak activity between the two devices
- For average muscle activity, only the lateral gastrocnemius showed greater activation with the hands free single crutch
- Both assistive devices increased muscle activity in the rectus femoris, vastus lateralis, and lateral gastrocnemius compared with normal walking, while the gluteus maximus did not differ significantly
- · Participants reported higher perceived exertion when using the hands free single crutch than with the knee scooter
- The authors concluded that the hands free single crutch may help maintain rhythmic muscle contractions and greater lower limb engagement, which could reduce muscle atrophy during non weightbearing recovery
- The higher muscle activation with the hands free single crutch suggests that designs encouraging partial limb engagement and natural gait motion may help preserve muscle strength during recovery
- Because users reported greater effort, the design should balance stability and energy demand by optimizing weight distribution, padding, and adjustability to reduce fatigue while maintaining therapeutic muscle use

Conclusions/action items:

Based on this study, the knee crutch may aid users in their recovery and promote them to use muscles in their injured leg that may not be activated as frequently while in a wheelchair. I wonder about the implications of this for weaker users- some may initially need assistance in using the device if this physical exertion is too high. Overall, I think that the indication of higher muscle activity in use is a net positive for users.

Violet Urdahl - Sep 09, 2025, 10:10 PM CDT

Title: Acute Knee Crutch Use Provokes Changes to Postural Strategy

Date: 9/9/2025

Content by: Violet Urdahl

Present: N/A

Goals: Investigate current products on the market that fit project description

Citation:

[1] C. Maron, A. Jendre, D. Goble, C. Marks, and J. Haworth, "Acute knee crutch use provokes changes to postural strategy," *Percept. Mot. Skills*, vol. 131, no. 3, pp. 805–817, 2024, doi: 10.1177/00315125241246390.

Content:



Figure 1. Individual Performing Baseline (Panel A) and Crutched (Panel B) Balance Testing During the Limits of Stability Test on a BTrackS Force Plate. [1]

- Study aimed to evaluate balance ability in healthy population upon exposure to knee crutch
- · Balance control evaluated under static and dynamic balance conditions
 - Used BTrackS Balance Plate to evaluate static and dynamic balance with force plates
 - Static: standing still on force plate
 - Dynamic: participants sway within base of support
- Findings:
 - Significant alteration to balance control from baseline when using the knee crutch device
 - Large increase in movement during static stance
 - Large decrease in movement during dynamic
 - Indication of lateral bias
 - Note: I assume this was toward leg not in knee crutch
 - No falls/support needed during testing
 - Participants reported comfort with device in under five minutes during familiarization
 - Findings may indicate preference of single-leg strategy in balance control
 - Smaller size of pseudo foot may have reduced physical abilities of participants

Conclusions/action items:

This knee crutch looks like it meets many of the project requirements listed, but we haven't met with our client yet, so I would like to ask him about this article and get his feedback. I also would like to see how these results vary from results on a population in need of a knee crutch for ambulation because it was conducted on "healthy" individuals. It is slightly disappointing, though not unexpected, that balance was observed to be significantly affected, so I wonder if a variation of this design with a larger "foot" may aid in mediating stability. This article brought up a lot of useful considerations that our team will have to make this semester.

Violet Urdahl - Sep 09, 2025, 10:22 PM CDT



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maron-et-al-2024-acute-knee-crutch-use-provokes-changes-to-postural-strategy.pdf (920 kB)

9/9/2025 iWalk Hands-Free Crutch

Violet Urdahl - Sep 09, 2025, 10:41 PM CDT

Title: iWalk Hands-Free Crutch

Date: 9/9/2025

Content by: Violet Urdahl

Present: N/A

Goals: Look into the iWalk Crutch and find what components of its design meet/do not meet our specifications

Citation:

[1] iWALKFree, Inc., "iWALKFree Home Page." [Online]. Available: https://iwalk-free.com/ [Accessed: Sep. 9, 2025].

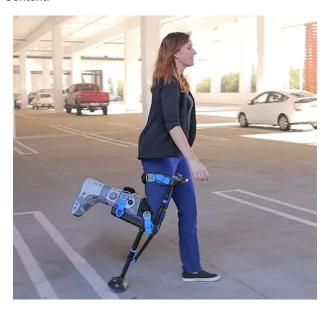


Fig 1. Person using iWalk [1]



Fig 2. Dimensions of iWalk [1]

- One of the leading options on the market for hands-free crutches
- Components:

- Height adjustable
- o Thigh size adjustability
- o Calf strap slider
 - Accommodates area of injury
- Handle
 - Learning/long distance travel
- o Buckles for attachment/removal
- Strap to tighten/loosen
- Knee gate strap (stability)
- Platform pad for comfort
- Knee platform
 - Primary support/stability mechanism for load bearing
- · Clamp for height adjustment security
- Foot
 - Offset to outside to improve stability
 - Note: clients must purchase a right/left knee crutch depending on side of injury based on this component- does our team want to consider this?
- · Constraints:
 - o Prior to injury, must be able to climb stairs easily without handrail
 - o Injury must be below knee
 - o 275 pounds or lower
 - Upper high circumference of 15.5"-27"
 - Height between 5'2"-6'2"
- Price: \$179

This design seems very promising, and I intend to bring it up with our client to identify why he is looking to create a new design instead of using this option on the market for patients. It is not incredibly expensive, especially when compared to the price of a stair chair. I do worry about some of its limitations, particularly the prerequisites for prior to injury physical abilities. This product is marketed as an "easier" alternative to crutches, but I think that our team is looking to design something for people that are not physically able to use alternatives.

Kayla Christy - Oct 24, 2025, 1:04 PM CDT

Title: BME 400 Step-by-step: A comprehensive approach to stair climbing

Date: 10/9/25

Content by: Violet Urdahl

Present: N/A

Goals: Research the previous team's work on this project

Citation: [1] M. Amatuzio, G. Kreissler, R. Toth, D. Wille, C. Owens, "Evaluating the Effectiveness of a Stair-Assisting Bench in Enhancing

Mobility for Patients with Below-Knee Injuries," May 2024.

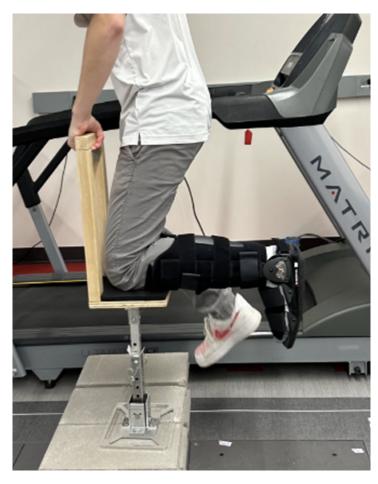


Figure 1: Stair assist bench [1]

- The used a very similar design to the hands free crutch for the bench for its base
- The report findings were that in calculating COP, the knee crutch was heavily favored in comparison to no assistive device or the iWalk
- When planning for our testing, I didn't really think about the need for a height offset to mimic the stair
 - However, I see discrepancies in their testing
 - I think that we will have to further standardize the way that test subjects are standing on the force plate/knee crutch
 - Lots of potential for variation in test results
- I think that we should consider solely placing weight on the device for testing to create less room for error

This report brought critical components of testing to my attention. I did not consider that we will have to simulate stair use in testing our device. However, I am unsure about the validity of the previous team's testing, and our team will have to reevaluate testing procedures later in the semester.

Violet Urdahl - Nov 01, 2025, 5:41 PM CDT

Title: Public Use of Mobility Aids

Date: 11/1/25

Content by: Violet Urdahl

Present: N/A

Goals: Research where our device can be used

Citation:

"ADA Requirements: Wheelchairs, Mobility Aids, and Other Power-Driven Mobility Devices," ADA.gov. Accessed: Nov. 01, 2025. [Online]. Available: https://www.ada.gov/resources/opdmds/

Content:

- The ADA recognizes manually powered mobility aids such as wheelchairs, walkers, crutches, canes, braces, and similar devices as acceptable for use in any public area
- · People with disabilities must be allowed to use these aids in all areas open to pedestrian traffic
- Businesses and facilities must modify policies to accommodate individuals using mobility devices unless doing so would fundamentally alter the nature of the service
- Other power-driven mobility devices, like Segways or electric scooters, may also be permitted if they can be used safely in the environment
- Facility staff can only ask two questions: whether the device is needed because of a disability and what type of mobility device it is
- Reasonable restrictions may be placed on devices if they cannot be operated safely in specific conditions, such as narrow spaces or areas with heavy pedestrian traffic

Conclusions/action items:

Based on this standard, our users will be free to use the knee crutch anywhere they may need it. Many will likely exclusively use it in their homes, but it is good to know that they have this option. This provides an opportunity for expansion of this product to public use.

Violet Urdahl - Sep 23, 2025, 7:59 PM CDT

Title: Preliminary Design Idea

Date: 9/22/25

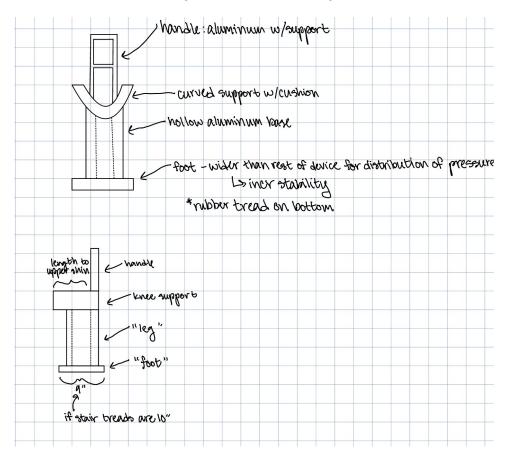
Content by: Violet Urdahl

Present: N/A

Goals: Create a preliminary design idea to evaluate with my team

Content:

- I took inspiration from last year's project for this design with the handle, but I am not sure how it could be manufactured if not made of wood
- I made sure to include all components brough up by the cliet
- I think that the foot being the widest component of the design could increase its overall stability
 - Got rid of adjustability for the same reason
 - Will have to research anthropometric tables to identify what the ideal height would be if not adjustable
- I also made the base wide and hollow for stability
 - Worried about weight/fabrication of this "leg" with aluminum



Conclusions/action items:

I will discuss this design with my teammates at our meeting today. We will evaluate if it is a suitable candidate for our design matrix, or if some components of it can be used in our final design. I will also discuss my concerns with my own design with them to see what their thoughts are and if they have any solutions.

Violet Urdahl - Sep 23, 2025, 8:55 PM CDT

Title: Dimensions of Design

Date: 9/23/25

Content by: Violet Urdahl

Present: N/A

Goals: Research stair standards to identify dimensions of stairs in the US and the height/width of the base

Citation: Stairways, 1910.25(c), Occupational Safety and Health Administration, Dec. 17, 2019.

Content:

- Stair treads legally must be at least 9.5"
 - The corresponding rise to this tread is 8"
 - The minimum width is 22"
- Based on these standards, I think that the depth of the 'foot' should not exceed 8"
 - Minimize risk of foot being misplaced on stair
- Width of foot should not be constrained by length of stair
 - None of our designs came anywhere close to 22"
- The team will subtract 8" from a typical leg length
 - o Device must be level with knee when placed on the next stair

Conclusions/action items:

The team must take this standard for stair dimensions into consideration when designing and prototyping. I think that the tread depth is especially relevant because our client initially said stair depth is 10", so this is an important clarification. Additionally, I had yet to research the height of stairs, and this will be very important when designing the leg of the knee crutch.



10/2/25 Extruded Aluminum Components for Fabrication

Title: Extruded Aluminum Components for Design

Date: 10/2/25

Content by: Violet Urdahl

Present: N/A

Goals: Research materials to fabricate our design with

Citation

[1] "80/20 Inc. - Base Plate: Use With Series 15," MSC Direct. Accessed: Oct. 02, 2025. [Online]. Available: https://www.mscdirect.com/?&cid=ppc-google-Returning++Brand+Core+--
+E&mkwid=s5nyqVjCb%7Cdc&pcrid=708942448001&rd=k&product_id=&gclsrc=aw.ds&gad_source=1&gad_campaignid=847580810&gbraid=0AAAAADPhDjGexKEYzyY9_oslReoCOD0cu&gclid=CiwKCAjwxfjGBhAUEiwAKW

["Frame Connectors - Parts Library." Accessed: Oct. 03, 2025. [Online]. Available: https://vention.io/parts-library?category=SF&sub_category=FC

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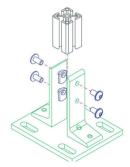


Figure 1. Extruded aluminum base plate [1]

- · There are a wide variety of extruded aluminum options, but most of them seem targeted toward shelving units
- MSC has options that seem more versatile, like the base plate seen in Figure 1.



Figure 2. ST-EXT-001-108045x45mm (1080mm) Aluminum Extrusion [2]

- · Vention has customizable components that come pre-assembled
 - The above figure seems like a good candidate for leg components
 - Vention also lists technical specs that would be useful for our team's assessment of the strength and durability of the structure
 - Second area moment of inertia
 - Cross sectional area

- Torsional constant
- Yield strength
- Based on the assemblies available online, I think that some revision would be necessary to utilize extrudable aluminum for our design
 - o Instead of a base 'plate', I think that a base frame would be more feasible
 - Connections are easier made to other frame components
 - Provides more structural stability in connections
 - Height created by frame on base may create structural instability

I think that utilization of extrudable aluminum components would make our fabrication process significantly smoother. However, this may require the team to considering a flat base plate, but the extrudable aluminum parts online connect best with other rods. I will discuss a base frame component with my teammare evaluate the stability of this possible design.



10/29/25 Human Subjects Research Training

Violet Urdahl - Nov 01, 2025, 4:32 PM CDT

Title: Human Subjects Research Training

Date: 10/29/25

Content by: Violet Urdahl

Present: N/A

Goals: Achieve certificate for training in human subjects research training

Content:



Completion Date 29-Oct-2025 Expiration Date 29-Oct-2028 Record ID 73304861

Violet Urdahl

Has completed the following CITI Program course:

Not valid for renewal of certification through CME.

Basic/Refresher Course - Human Subjects Research

(Curriculum Group)

UW Human Subjects Protections Course

(Course Learner Group)

1 - Level 1

(Stage)

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Conclusions/action items:

I achieved my certificate of completion for human subjects testing. This course was very interesting and informative. I hope to use this new knowledge to get an IRB for testing with our prototype.

Violet Urdahl - Sep 10, 2025, 2:04 PM CDT

Title: BME 300 Career Prep

Date: 9/10/2025

Content by: Violet Urdahl

Present: BME 300

Goals: Learn about best practices for the career fair

Content:

Speaker: Stephanie Salazar Kann, ECS

- Job search tips
 - · Keep track of what you've done
 - Where you applied, with what, etc.
 - ECS Tracking Sheet
 - Quality of source matters
 - Real sites vs. aggregator sites (bad)
 - Go to the source
 - o Make connections
 - Don't let application sit in the abyss
 - o Applying is only step one
 - Make sure to follow up (2-3 weeks)
 - o Make sure role fits you- title isn't all that matters
- · Resume tips
 - Tailor resume to the position
 - Create balance
 - Make sure to have:
 - MS Word
 - No columns, charts, colors
 - Design projects without years or semesters (messes up algorithm, makes it seem like a job)
 - Technical skills and coursework
 - Jobs:
 - Organization, location, position title, dates
 - Objective: what do you want specifically
 - Do not need an objective when actually applying- more for handing them out
 - Skills: real and relevant (technical)
- · Cover letter tips
 - · Always based off of job posting
 - Custom to each job
 - Amplifying greatest selling points
 - Clear, concise support
 - Demonstrate employer knowledge
 - Address to person
 - Docommonded versus required

- Recommended: will It help your case?
- BME specific advice
 - Identify your own purpose
 - Look into overlap with other disciplines
 - I'm pretty much a mechanical engineer
 - Research the employer
 - Develop value added statement
- · Career fair:
 - Sept 15-18, 2025
 - EH Lobby, ME Lobby, and ECB Lobby
 - o Different employers each day
- Applying
 - o If due date is before career fair, apply before
 - Otherwise talk to recruiter at career fair and then apply
 - Opting out of AI parsing: could take longer

This was a great presentation to have right before we begin the career fair. I am going to further tailor my resume based on her recommendations, and I will also keep this presentation in mind as I begin applying. I didn't know that we shouldn't have years/ dates for our projects on our resumes or that when applying online, it isn't beneficial to have an objective. I also plan to use the ECS Tracking Sheet as I apply.

9/17/2025 BME 300 Leadership Style

Violet Urdahl - Sep 17, 2025, 2:07 PM CDT

Title: BME 300 Leadership Style

Date: 9/17/2025

Content by: Violet Urdahl

Present: BME 300s

Goals: Learn about different leadership styles

- Speaker: Angela Kita
 - Leads InterEgr 303
- Leadership
 - People oriented
 - Communicative
 - Organized
 - Lead by example
 - Self-awareness
 - Vision
 - Transparent
 - Decision making
 - Empathetic
- Levels of leadership
 - Organizational
 - Collaborate beyond individual teams
 - Team
 - Facilitate team interactions, support others' development
 - Interpersonal
 - Active listening, building trust, difficult convos
 - Personal
 - Self-awareness, competency, goals
- Self awareness tools: Clifton Strengths
 - o Identifies areas of talent
- · Leadership styles
 - o Power model
 - Hierarchy, command, authority
 - Servant
 - Empathetic, empowering, shared decision making
 - Authentic
 - Transparency, genuineness, honesty
- · What is it like to work with these leadership styles
 - Power: feel like you don't have a say/role in the project, clear idea of role in group but no room for creativity
 - Servant: feel more involved in the group, room for creativity and individualism, might be more difficult to navigate with less experience

- Authentic: have a clear idea of everything that's happening/who you're working with, everyone is on same page, bear full weight of project
- · Leadership styles contd
 - People-oriented
 - Know everyone as individuals, build trust
 - o Process oriented
 - Sets pace for team
 - · Thought oriented
 - Big picture, gravitates toward future
 - Impact oriented
 - Push for excellence
- · How you want to lead
 - Self-assess
 - Observe and reflect
- Goal setting
 - · Coaching and mentoring
 - Create an environment that pushes teammates while also helping them to learn
 - I want the 200s to be in a better spot as leaders and BMEs than I was at the end of my semester in 200 so that they are better prepared for 201.
 - Make sure teammates have full clarity on what's happening at every meeting
 - Advertise and encourage that they ask questions
 - Provide resources
 - E.g. examples of my work from previous semesters, library resources I use, citation resources, advice on shop trainings
 - By the end of the semester I want them to feel confident enough in their understanding to lead client/advisor meetings.

I learned a lot about different styles of leadership today. I think that my style of leadership is people-oriented service and authentic based on the presentation. I also set goals for this semester, and I have an emphasis on my mentorship of the BME 200s as a primary goal.

Violet Urdahl - Sep 24, 2025, 2:06 PM CDT

Title: BME 300 Mentorship

Date: 9/24/25

Content by: Violet Urdahl

Present: BME 300s

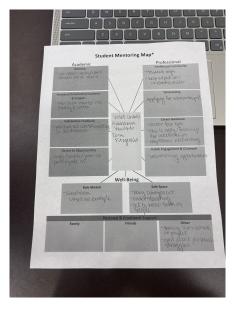
Goals: Learn about and discuss my role as a mentor to BME 200s

Content:

Speaker: Professor TJ Puccinelli

- Why are we mentoring 200s?
 - o Mutually beneficial
 - 300s learn how to be leaders, 200s learn from 300s experience
 - Important experience for future careers
 - Teams in industry have varying levels of experience
 - Additional instructional and emotional support for 200s
 - o Peer mentors are more approachable
 - Share experiences
 - o Increases belonging
- Transferable skills (reference in interviews)
 - Leadership
 - Communication
 - Active listening
 - Study practices
 - Self awareness
 - Interpersonal skills
- · Benefits of mentoring
 - Increased self esteem/confidence
 - Patience
 - Positive habits
 - Personal growth
 - o Identify gaps in knowledge
- · What makes a good mentor?
 - Building trust
 - Sharing without fear
 - Reliability
 - Support/enthusiasm
 - Availability
 - Transparency
 - · Humanizing challenges
- Listening effectively
 - No distractions
 - Stop talking
 - Be interested

- Be engaged
- Ask questions
- Verify understanding
- React to ideas, not the person
- What do you wish you knew in BME 200?
 - LabArchives: how many entries to make, how to research, the library, citations, etc.
 - Scheduling: deadlines/ personal research
 - What is expected of me
 - BME tracks
- Student Mentoring Map:



Aubrey, Tess, and I came up with a lot of ideas for how to proceed in our mentorship. We should implement our plans on the student mentoring map in future meetings and be conscious of our style as leaders. Overall, we hope to be supportive and informative leaders that make them into better 300s than us.

Violet Urdahl - Oct 01, 2025, 2:06 PM CDT

Title: Sustainability in BME

Date: 10/1/25

Content by: Violet Urdahl

Present: BME 300 Lec

Goals: Learn about sustainability in BME

Speaker: Andrea Hicks

- Sustainability- everything needed for survival and well-being
 - Create and maintain conditions where human and nature can coexist
 - Environmental, social, and economic components
- · Coffee pot vs. Keurig
 - Actually equal from sustainability standpoint
 - Consider efficiency of use in coffee grounds, electricity, plastic etc.
 - Life cycle assessment
- Exam table paper actually does not reduce spread of infection
 - · Getting rid of them eliminates expense and waste
- · Speculum life cycle assessment
 - One use plastic vs. metal
 - Metal is washed then autoclaved
 - Environmental impacts of washing
 - Autoclaving takes up a lot of resources
 - Metal costs more to manufacture, plastic costs less but is produced more frequently
 - More frequent use should use metal
 - Less frequent use should use plastic
- · Different anesthetics
 - Evaluate cost
 - Evaluate environmental impact of making, packaging, transport, and delivery
 - Carbon dioxide equivalent: effective impact that 1 unit of something has in comparison to CO2 on environment
 - N2O is a very high CO2 equivalent considered in these anesthetics
- How to make medical device industry a circular economy
 - Class of medical devices goes up as risk of infection with reuse goes up
 - Medical device has another layer to consider when increasing sustainability because of possibility of infection
- Example: hospital gowns
 - Equally effective to wash than use single use
 - Wash 12 is when you break even from a sustainability standpoint
- · Wide variety of different factors to consider depending on what problem you're approaching
 - Life cycle assessment has different bounds depending on the problem
- · Our project considerations
 - Criticality of materials

- o One knee crutch that is adjustable instead of several at set heights
- Lifetime of materials
- Cost/labor efficiency of materials
- Does not need to be single use/sterile

When approaching an engineering problem, it is critical to consider the variety of sustainability impacts that the design has. These can range from cost to environmental impact, with many other considerations depending on the problem. Our group identified that cost/labor, lifetime, and reusability of materials are key components of the sustainability of our project.



10/8/2025 WARF, IP, Disclosing, and Licensing

Violet Urdahl - Oct 08, 2025, 2:09 PM CDT

Title: WARF, IP, Disclosing, and Licensing

Date: 10/8/2025

Content by: Jeanine Burmania (Senior Director of IP and Licensing at WARF) and Justin Anderson (Senior IP at WARF)

Present: BME 300s

Goals: Learn about WARF and licensing

- · Technology transfer
 - o Intellectual property licenses
 - Industry sponsored research
 - Consulting arrangements
 - Fee for service
- · WARF involved in patenting (for the most part)
 - · Licensing technology
 - Return on product
- Components of IP (intellectual property)
 - Patents (innovations)
 - Copyrights
 - Trademarks
 - Trade secrets
- · Other WARF IP
 - o Biomaterials
 - Technique and know how
 - o Data
- Non-patent IP
 - Copyrights
 - Protection for creative works expressed in a tangible medium
 - Less time sensitive than patents
 - Wide range of subject matter
 - Trademarks
 - Protection of names, marks, logos, etc.
 - Use in commerce
 - Trade secrets
 - Protects anything of value
 - Ex) Coca-Cola
- Patents
 - Government grants timed property right to innovation
 - Excludes others from making, using, selling, or importing invention
 - Three types
 - Design
 - Used by WARF to allow students to continue working on design with more time

- 15 year term
- Plant
- Utility
 - Provisional- one year placeholder
 - Non provisional- 20 year placeholder
 - Issued for invention of nw and useful process, machine, manufacture, or composition of matter
 - Timed monopoly on invention
 - Applicant must teach others how to make and use invention
 - Takes 2-5 years to issue after filing
 - Costs about 30k
 - 90% of patents are non-provisional utility
- · Requirements for patents
 - Eligible- can't be element of nature, abstract idea, or natural phenomenon
 - Novel- must be new
 - Non-obvious- cannot be simple change or combination of existing concepts
 - Enabled and described- must teach others how to show/make invention
- WARF receives ~400 new innovation disclosures each year
 - Disclosing
 - Describe
 - Identify advantages/applications
 - Contributors
 - Funding and public disclosure details
 - Meet with WARF
 - Discuss innovation in more detail
 - Ask questions about WARF and patenting processes
 - Discuss next steps
- · Decision on accepting invention based on
 - IP considerations
 - Type of IP protection
 - Breadth and strength- the broader the better
 - Public disclosure
 - Stage of development
 - · Licensing considerations
 - Applications
 - Likelihood of commercial partner
 - Likely return from licensing
- · Marketing and licensing
 - Market analysis
 - Market status
 - Size and type
 - Potential licenses
 - License negotiation
 - Type and terms
 - Consideration
 - Ongoing
 - Tech development
- · Value of licensing

- Company benefits
 - Reduced R&D costs
 - Improved time to market
 - Opportunity to enter new markets and grwo quickly
 - Additional revenue opportunities
- o Determining the value
 - Technology application
 - Key selling points/features/benefits
 - Technology trends
 - Market size
- · Al and IP
 - Patents
 - Al cannot invent
 - Can assist in inventing under Pannu Factors
 - South Africa is only exception
 - Copyrights
 - Original works of human authorship
 - Al must be incidental to conception and creation

This presentation provided a lot of useful insight into the patenting process. Previously, I wasn't aware of all of the resources available for students looking to patent on campus. I also didn't know how the general patenting process worked, so this was a lot of useful information.

Violet Urdahl - Oct 15, 2025, 2:11 PM CDT

Title: Protecting Inventions

Date: 10/15/25

Content by: Violet Urdahl

Present: BME 300

Goals: Learn about intellectual property and legal procedures of inventions

Speaker: Andrea L. Arndt (Attorney)

- IP protection allows research to safely transfer into products, processes, and/or systems
 - Medical device->patent filing->marketplace
- Legal careers (engineers in IP)
 - o Technical advisor
 - Patent agent
 - Patent examiner
 - Patent attorney
 - Patent litigator (requires patent BAR)
 - IP license attorney
 - Tech transfer manager (business side)
 - Engineers talk to lawyers all the time
- · Real life example
 - o Patent litigation: cease and desist sent to Dave and Busters
 - Selling knock off of client product as a prize
 - IP licensing with US and China was a three year process
 - o Not always contentious: sometimes mutually beneficial
- IP in BME industry
 - University
 - Disclose before publishing, university owns IP, possible license opportunities
 - Company
 - Employer owns IP
 - Startup
 - You own IP, use NDAs, document development
- Timing and publication
 - Disclose internally first
 - · Cannot publish before filing and offers for sale
 - Posters/abstracts = public disclosure
 - · First to file system
- · Steps of IP
 - Invent something new
 - Conduct patentability search
 - File patents early
 - Use NDAs
 - File trademarks

- Form business entity/assign IP rights
- o Obtain business insurance
- Funding, licensing, and franchising
- · IP protection
 - Patent
 - Creates a monopoly
 - Utility and design
 - Very important in BME- innovation drives competitive advantage
 - Trademark
 - Copyright
 - Trade secret
- · Parts of a patent
 - Lots of components that can change patent
 - New product that can get patented can infringe someone else's patent
 - Extra feature on top of other components of preexisting patent infringes on patent (freedom to operate)
- Trademark
 - Words, devices, symbols, or composite of both
 - Also sounds, smells, colors, buildings, package shapes
 - Distinguishes your goods or services from others
- · Trade secret protection
 - Don't have to file anything
 - Keep it secret, but when it gets out, you lose it
- Counterfeit
 - Threaten patient safety
 - · Huge market for counterfeits
 - Ex) fake Ozempic and Viagra

This presentation introduced opportunities outside of engineering for BMEs. I never considered law as a potential path of action with my degree prior to this presentation. The speaker touched on a lot of the same points as WARF, but I really enjoyed hearing her personal stories and experiences.

10/22/2025 Advising: Post Grad Planning

Violet Urdahl - Oct 22, 2025, 2:01 PM CDT

Title: Advising: Post-Grad Planning

Date: 10/22/25

Content by: Violet Urdahl

Present: BME 300

Goals: Learn about post-grad planning

Speaker: Dr. John Puccinelli

- Use undergraduate experience to build your story
 - Writing your story
 - Start with what you want to do: thesis statement
 - Personal statement: reasonable idea of what
 - Personalize to institution
- · Prepare references
- · Graduate school
 - Masters
 - Stepping stone
 - Opportunity to change directions
 - Gain depth and build experience
 - Industry focused
 - One year (generally)
 - Why
 - Rewrite story
 - Makes you more desirable
 - Fills gaps in resume
 - Higher level of skills and experience
 - Increased maturity
 - Really powerful combined with industry experience
 - Get paid more starting
 - o PhD
 - Desire to be an independent researcher
 - Write research grants
 - Work in academia
 - Lead projects in industry, startups, and consulting
- Masters degrees at UW Madison
 - Research (1.5-2 years)
 - People on their way to PhD do this
 - Can be funded as a RA/TA/PA with tuition and stipend
 - Thesis required
 - Need a lab PI identified and willing to support before applying
 - Accelerated programs (1 year)
 - Funding: TA only, stipend only (\$1200 per credit)

- No co-ops allowed
- Accelerated
 - Coursework only
 - Independent study/research allowed
- BME innovation, design, and entrepreneurship
 - Project based project required (BME design project continuity)
 - Partnership with business school
- Applying
 - Online application
 - Statement of purpose
 - Research MS only: PI supporting you
 - Apply senior fall by 12/15 to get in the following fall
 - Input Jana Pollock three separate addresses
 - Need at least a 3.0 overall, special consideration given to BME undergrad students
- · Masters elsewhere
 - MEng
 - MS in global health
 - MS in other eng dept (takes longer)
 - MBA (industry generally pays for credits)
- Medical school
 - Research required
 - Volunteer (clinical setting)
 - Shadow physicians
 - Patient contact time
 - Build relationships (letters of rec)
 - Use design experiences
 - Requirements vary by degree
- Research
 - o Opportunity to apply skills outside of the classroom
 - · Also BME design projects
 - Build skill sets to get into labs
 - Previous research experiences
 - Get published
- Find a balance between class and experience
 - Show you can work with others
 - Leadership
 - Extracurricular activities

I have minimal interest in pursuing a masters degree directly following receiving my undergraduate degree, but I have considered an MBA program. As discussed in this presentation, employers typically pay for this degree. My ideal route would be straight to industry after graduation and then to receive my MBA in a few years.

Violet Urdahl - Oct 29, 2025, 2:11 PM CDT

Title: Regulation

Date: 10/29/25

Content by: Dr. Kip Ludwig, Dept of Neurological Surgery

Present: BME 300 Lec

Goals: Learn about regulatory affairs

- · Drugs: receptor engagement
- · Diagnostics very different from therapeutics
- · Regulatory pathway
 - Class 1, 2, and 3
 - 1: very low risk
 - Exempt
 - or exceeds limits of exemption, goes to 510(k)
 - 2: moderate/ controlled risk
 - Goes through 510(k) pathway (can skip over some testing based on predicate devices), sometimes 510(k) De Novo (no predicate device, can become a predicate)
 - or HDE pathway (probable benefit outweighs risk)
 - 3: high risk
 - HDE
 - or PMA (reasonable assurance of safety and efficacy)
 - General controls: all pathways
 - Special controls: all pathways except exemption
 - Clinical data: De Novo, HDE, PMA
 - Many clinicians aren't familiar with regulatory pathways
 - Materials are not FDA approved- approved for specific devices
 - FDA approval does not mean safe
 - Phases pertain to drug pathway
- FDA
 - o Did not regulate medical devices until 1976
 - An event with a negative outcome leads to large regulation increase
 - Industry usually pushes back against these regulations
 - o Dalkon shield
 - Contraceptive device
 - High pregnancy rate
 - High amount of complications
 - No system to communicate this back to company/ link complications to the device
 - Constant system fluctuation of leniency
- Philips CPAP recall
 - o CPAPs are 510(k) devices
 - Killed 500 people

- Not widespread knowledge
- Abbott recall of 200k+ neurostim systems (class 1)
- · Whistle blower on fake implantation that is just piece of plastic exposed fraud in company
- · Alzheimer's disease
 - Growth hormones from cadaver pituitaries (with Alzheimer's) inserted into patients to promote growth
 - Patients started to exhibit symptoms of Alzheimer's around age 30
 - Regulatory process: took 15 years for disease to develop, no company can sustain
 15 years of animal trials prior to introduction to market

Regulation is not a perfect process. Many things are overregulated, and many are underregulated. Unfortunately, these errors in the system frequently require many negative events to identify. Regulation varies significantly on a device-by-device basis, and it is a constantly changing process. As a consumer of medical products and devices, I am going to keep these considerations in mind if considering a new product.



11/5/25 Regulatory Strategy in Therapeutics

Violet Urdahl - Nov 05, 2025, 2:10 PM CST

Title: Regulatory Strategy in Therapeutics

Date: 11/5/25

Content by: Violet Urdahl

Present: 300 lecture

Goals: Learn about regulatory strategy

Speaker: Professor William Murphy, PhD

- FDA structure and advanced therapeutics
 - Device (CDRH)
 - Drug (CDER)
 - IND: investigational new drug application
 - Approval for clinical studies
 - NDA: new drug application
 - Biologics (CBER)
 - IND
 - BLA: biologics license application
 - Advanced therapeutics (CDER or CBER)
 - Genome editing
 - Gene delivery
 - Cell therapy
- FDA framework
 - US laws (congress)
 - Federal food, drug, and cosmetic act (made FDA)
 - Public health service act
 - 21st century cures act (regenerative medicine advanced therapy framework)
 - Coronavirus aid, relied, and economic security act (FDA responsibility for managing disruptions in drug manufacturing)
 - Regulations (FDA)
 - FDA guidance (FDA and public)
 - CGT products for hemophilia
 - Design of early phase CGT trials guidance (2015)
 - Regenerative medicine framework (2017)
 - CGT therapy for hemophilia guidance (2018)
 - Updated CGT framework (2020)
 - CGT manufacture during COVID (2021)
- 351 products versus 361
 - 361: product taken from a patient and goes back into the patient with minimal manipulation (homologous use- same function)
 - Largely unregulated
 - Can be quickly implemented
 - 351: human cell and tissue based product that are not homologous
 - Doquiro DLA

- Require DLA.
 Take a long time to move through regulatory process
- Labelled for very specific purpose
- Potency assured
- Pure
- Novel
- High barrier to entry
- Product development life cycle
 - o Critical path vs. good research projects
 - Target product profile (TPP)
 - Living document for therapeutic product
 - Like a PDS
 - When, why, and how to use it
 - Is it medically and commercially compelling
 - Will patients and prescribers want it
 - Will regulators accept it
 - Will payers reimburse for it
 - Why should development be funded
 - Core info
 - Indication and patients
 - Efficacy
 - Safety
 - Dose and regimen
 - Route of administration
 - Dose form
 - Clinical development planning
 - Clinical pathway
 - Regulatory pathway
 - Timelines
 - Cost
 - Risk
 - CMC
 - Product attributes (purity, degradants, biocompatability)
 - Storage
 - Stability
 - Container
 - Pharmacopoeial compliance
- · Considerations of 351 regulated CGTs
 - Manufacturing process repeatability
 - Potency assay after manufacturing
 - GMP batches release and method validation
 - Defined product characterization and potency assays
 - Filing and launch prep
 - TPP interact meeting
 - o Pre-IND and IND submission
 - Special protocol assessment
 - Pre BLA meeting
 - All followed by BLA submission
- Quality management system

 System that documents policies, processes, internal rules, procedures, and other records to ensure consistent quality

Conclusions/action items:

It was really interesting to learn about FDA regulations specific to therapeutics today. I worked with a lot of the processes that he discussed this summer (good manufacturing process, documentation, GXP in general), but I still didn't know about the specifics of what went into getting the biologic approved by the FDA. After this presentation, my coworkers' discussions of how long getting approval for even the smallest changes in the manufacturing process makes a lot more sense!



11/7/25 Tong Lecture: Building a Career of Impact

Violet Urdahl - Nov 07, 2025, 12:56 PM CST

Title: Tong Lecture: Building a Career of Impact (Why Healthcare Needs More Engineers)

Date: 11/7/25

Content by: Violet Urdahl

Present: BME 2/3/400

Goals: Learn about having an impactful career in BME

Speaker: Kristin Myers, BME Class of 2002, COO of Blue Cross Blue Shield

- Run towards the hard problems: they are the ones that change the world
- Kristin Myers' career journey
 - Foundation
 - Had a myriad of jobs throughout school
 - Interned at RW Baird, Abiomed, and Guidant (now part of Boston Scientific)
 - Then worked full time at Medtronic for five years
 - Harvard MBA
 - Worked at venture capitalist investor in healthcare startup (Skyline Ventures)
 - Then VC in Michigan
 - o Climbing the Growth Curve
 - Aetna (now part of CVS)
 - Ultimately President
 - Willingness to take on tasks/challenges that others weren't
 - Also starting a cycling studio somehow
 - Unified Women's Healthcare
 - President and COO
 - COVID: lots of layoffs, difficulties with adapting (eg masks)
 - Build and Transform
 - Making systematic change
 - Hopscotch Health: founder and CEO
 - Blue Cross Blue Shield: COO
- · The healthcare system
 - Access to care, patient experience, and patient outcomes
 - Provider experience
 - 18% of GDP spent on healthcare
 - Americans spend 2x individually compared to other companies
 - o America lacking in most respects in healthcare
 - Underlying challenges
 - Misaligned incentives
 - Fee for service: doctors not incentivized to pursue individual issues further
 - Region individuals are born in dictates lifetime expectancy
 - Integrated system to align incentives
 - Need infrastructure for improved telehealth (ex wifi accessibility in rural areas)

- Engineers fit for the task: requires alignment of multiple factors and data sets
- Primary/preventative care is one of the solutions for the system
 - These physicians make significantly less money- less physicians want to go into it
- Takeaways
 - Work hard and build range
 - Pursuing opportunities results in opportunities being brought to you
 - Don't underestimate value of working face-to-face
 - Opportunities come from human interaction and breadth of experience
 - Seek diverse exposure
 - Different places, teams, and companies create perspective
 - Helps to find value in what you do and figure out what you enjoy
 - Your community helps you find direction and opportunities
 - Choose your people wisely
 - The people around you directly reflect on and influence yourself
 - Shape your trajectory
 - Know and stick to your values
 - Importance of health and family
 - Embrace challenge and growth
 - Seek discomfort

This presentation was very inspirational. I am attending the luncheon with Ms.Myers after this presentation, and I really look forward to talking with her and asking my (many) questions. Her career trajectory is not one that I would have considered in the past, but in my limited experience with healthcare, I really resonate with her values and may pursue a similar path.



11/12/25 Institutional Review Board Introduction

Violet Urdahl - Nov 12, 2025, 1:58 PM CST

Title: Institutional Review Board Introduction

Date: 11/12/25

Content by: Violet Urdahl

Present: 300 lecture

Goals: Learn about the IRB

Speaker: Stephanie Metzger, PhD, Health Sciences IRB Analyst

- · Historical research has been problematic
 - US Public Health Service Untreated Syphilis Study
 - WWII Nazi prisoner experiments
 - US Public Health Service Guatemala syphilis experiments
 - Prisoners deliberately infected with syphilis
 - Willowbrook State School hepatitis experiments
 - Developmentally disabled children deliberately infected with hepatitis
- · Ethical research frameworks
 - Nuremberg Code voluntary consent
 - Declaration of Helsinki focus on medical research (do no harm)
 - o National Research Act US response to US Public Health Service Untreated Syphilis Study
 - Prompted the Belmont Report and creation of the IRB
- · Belmont report
 - Respect for persons/autonomy
 - Beneficence
 - Maximize possible benefits and minimize possible harms
 - Justice
 - Who ought to receive the benefits of research and bear its burdens
 - Application
 - 1991 Dept of Health and Human Services 45 CFR 46 (Common Rule)
 - Criteria for approving research
 - Protections for vulnerable groups
 - Requirements for IRB operations
- IRB composition
 - Diversity of membership required
 - Race, gender, and cultural backgrounds
 - Scientific expertise
 - MD, PhD, MPH
 - Faculty, clinicians
 - Non-scientists
 - Community members
 - IRB staff
- IRB purpose
 - Protect rights and welfare of people enrolled in research
 - Ethical principles

- Eurical principles
 Federal regulations
- State law
- Institutional policy
- IRB review requirements
 - o UW Madison requires IRB review of all research involving human subjects
- · Common rule criteria
 - Risks
 - Benefits
 - Risk/benefit ratio
 - Equitable selection of subjects
 - Informed consent
 - Privacy and confidentiality
- · Common rule definitions
 - research: a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge
 - Human research: a living individual about whom an investigator conducting research obtaining information through intervention or interaction
- · De-identifying data
 - Directly identifiable
 - Identifiers included with data
 - Coded/indirectly identifiable
 - Identifiers removed from data but linked via study ID code
 - Anonymized/deidentified
 - No study ID code linking to identifiers
- Exemptions
 - Linked in slides
- Category 2 exemption: Research involving surveys and interviews
- Category 3: Research involving benign behavioral interventions
 - Research involving only cognitive/behavioral tasks and/or manipulation of subject's environment
- Category 4: Research with Data and Samples
 - · Allows for secondary use of information and samples
- Examples of non-exempt research
 - Surveys of children
 - Analysis of identifiable samples
 - Intervention with patients that exceeds category 3
- · Medical devices examples
 - Prostheses
 - Contact lenses
 - Magnetic resonance imaging hard/soft ware
 - Diagnostic software
 - Assay for detecting antibodies in blood
 - Bandage adhesive
 - o Olive oil
- · How to submit study for IRB review
 - Create a study in ARROW (protocol based application)
 - Application type page
- IRB review process
 - Administrative review

- IRB pre-review
- Committee or non committee review
- · After approval
 - Begin study
 - Get approval for any changes of protocol
 - Reportable events
 - Continuing reviews (annual progress report)

Conclusions/action items:

Our team is considering submitting an application to the IRB for testing of our knee crutch. I think that it may exempt for our purposes. We hope to conduct a survey on usability of our device, so I will further research what permissions we may need to pursue.

Violet Urdahl - Nov 19, 2025, 2:00 PM CST

Title: New Product Development in the Medical Device Industry

Date: 11/19/25

Content by: Violet Urdahl

Present: BME 300

Goals: Learn about new product development in the medical device industry

Speaker: Russ Johnson, PhD in Materials Science and Engineering (25 years in industry)

Content:

- NPD in industry
 - Highly regulated
 - Expensive
 - · Resource intense
 - Competitive
- Selecting and prioritizing projects
 - Corporate business strategy: define how the business will sustain itself over the next 3-5 years
 - Product portfolio review: define which product categories to develop/sustain/eliminate
 - o Project review: select and prioritize projects to support
 - Budget: what projects do you have the resources for
- Types of NPD projects
 - · Line extensions: addition of additional sizes and configurations
 - o Product improvements: existing product change
 - New-to-company: not new to market but new to the company
 - New-to-world: innovative products that create completely new markets (most resource intense, highest risk)
- · Managing NPD: stage-gate process
 - Stage 0: ideation
 - Stage 1: exploration
 - Stage 2: concept development (go/no-go decision)
 - Stage 3: design development
 - Stage 4: design confirmation (V and V: longest) (design freeze)
 - Stage 5: design transfer and commercialization (launch)
 - Post-market surveillance
- Case study of fluid management solutions for high volume cases
 - Manual: suction canisters (Cardinal Health)
 - Manual disposal of fluids, require purchase of different containers for disposal
 - Automated: Stryker Neptune
 - On-board vacuum system, disposable manifold, 20 L canister for collection, docking station empties and cleans the container
 - o Cardinal Health Response: ORwell Fluid Management System
 - Stage 0: Met with current clients to see how clinicians interacted with their system and the new system
 - Confusing set up for manual product

- Automated product smelled (didn't clean effectively) and took up a lot of space
- Created ideas to address these issues
- Stage 1: came up with eight different designs, defined the problem
 - Need a system to maximize clinician safety and OR productivity
- Stage 2: narrow down to 1 leading concept, develop business case, IP examination, go/no-go business decision
- Stage 3: move to functional prototype, continue iterative design process, confirm regulatory pathway, begin design control documentation
 - Difficulties with controlling piston and identifying correct bag to attach to puck
 - Documented customer needs, design requirements and reviews, testing, aligned with risk management
- Stage 4: design confirmation
 - Extensive V and V testing
 - Finalize product and component drawings/models
 - Accelerate manufacturing process
 - Freeze design as is and submit to FDA
 - Biggest challenge with alignment of disposal and waste pump
- Stage 5: design transfer and commercialization
 - Complete any remaining testing, create instructions for use, create service plan and resources, finalize go-to-market strategy
 - Created container for bag so that it doesn't get punctured during shipping
- Post-market surveillance
 - Stryker launched Neptune 2 shortly after ORwell was introduced to the market
 - Reduced price of consumable manifold by 50%, cost of installation and service was high for ORwell, ORwell was discontinued
- Med device development is a tough market
 - Limited resources lead to processes like stage-gate
 - Product design and development is only part of commercial success

Conclusions/action items:

I have a lot of interest in working in product development, so this presentation was very interesting to me. We have learned a lot about the constraints on medical device development federally, so it was fascinating to hear about the internal regulations and pathways that determine what products go to market. I would like to learn more about how these corporate decisions are made, like the go/no-go decision.

Evan Koelemay - Sep 18, 2025, 3:31 PM CDT

Title: Standard Stair Measurements

Date: 9/17/2025

Content by: Evan Koelemay

Present: Evan Koelemay

Goals: Understand the standards for residential stair measurements to aid the design of the foot and leg for the prototype

Content:

The main measurements we are concerned about for this project are tread depth and riser height in a staircase. According to OSHA regulations, stairs must have a minimum tread depth of 9.5in (though many residential homes have treads of 10-11in for comfort). Stairs must also have a maximum riser height of 9.5in. We can design our prototype around these measurements to ensure the product will be able to be comfortably maneuvered up and down residential stairs

Source:

https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.25

Conclusions/action items:

The "leg" of the prototype should be built with the maximum riser height in mind. The leg should be at least 9.5 inches shorter than the length from the patient's knee to the bottom of their foot. The client expressed that he would prefer to minimize the amount the patient needs to "squat" in order to stand up after placing the device. If the leg is too short, the patients will need to do more of a squat to get up each step. The "foot" should be able to fit comfortably on the minimum size of tread depth. Since most residential homes do not go below 10in of tread depth, a 9in square should work for the size of the foot, however, if we can go lower while maintaining adequate weight distribution, that can be an option.

Evan Koelemay - Dec 10, 2025, 12:16 PM CST



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Screenshot_2025-12-10_121315.png (160 kB)

Evan Koelemay - Dec 10, 2025, 12:16 PM CST

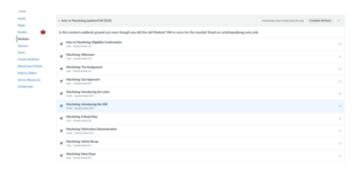


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Screenshot_2025-12-10_121351.png (151 kB)



Evan Koelemay - Dec 10, 2025, 12:17 PM CST



Download

Screenshot_2025-12-10_121545.png (123 kB)

Evan Koelemay - Nov 07, 2025, 12:52 PM CST

Title: Building a career of impact

Date: 11/7/2025

Content by: Evan Koelemay

Present: All BMEs

Goals: Note important information given by guest speaker

Content:

- · Actively pursue difficult problems to solve
- Journey:
 - UW-Madison BME —> Medtronic (5 years) —> Harvard MBA —> Skyline Ventures —>
 Arboretum Ventures (investors in healthcare startups)
- · Climbing the growth curve
 - Aetna (Chief of staff to CEO President, Student health president) —> Unified women's healthcare (president & chief operating officer)
- · Build & Transform
 - Hopscotch Health (Founder and CEO, advanced primary care for rural communities) —> Blue cross blue shield association (Chief operating officer, enable access, affordability, outcomes and experience for 1 in 3 Americans)
- Quadruple Aim
 - Improved provider experience
 - Improved patient outcomes
 - o Improved patient experience
 - · Lower cost of care
- Measuring quadruple aim
 - US ranked very low in many categories for healthcare
- Underlying challenges:
 - Misaligned incentives
 - Fragmented financing and regulation
 - Data silos and legacy IT
 - Inequities
- Future of healthcare should be an integrated ecosystem of health and care
 - Digital
 - Food/nutrition
 - Transportation
 - Social support
 - Employment
 - Education
 - Housing
- 5 pieces of advice
 - · Work hard and build range

- Take on the hardest projects, classes, and experiences
- Seek diverse exposure
 - Explore different sectors, teams and geographies.
- Choose your people wisely
 - Surround yourself with curious, driven, high-integrity people.
- Know your values and protect them
 - Define what matter most: family/friends, health, career/impact, values
- Embrace challenge and keep growing
 - Run towards hard problems
- How to avoid burnout
 - Find the time of day you work best
 - Learn to say no

Conclusions/action items:



Anthropometric Tables and Calculations

AUBRIANNA YOUNKER - Sep 22, 2025, 1:57 PM CDT

Title: Anthropometric Tables and Calculations

Date: 9/22/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to put anthropometric tables in our notebook to have as a reference, and to document any calculations we do when

 $\label{eq:figuring} \mbox{ out measurements for our design.}$

Content:

See the written work below for content, calculations, and anthropometric tables.

Conclusions/action items: In conclusion, we can revisit these tables and calculations to predict the leg and arm lengths of typical patients that our client sees. With these predictions, we can design and plan out our height adjustments for our prototype. We can also use these values to pick a comfortable height for our handle.

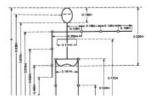
AUBRIANNA YOUNKER - Sep 22, 2025, 1:52 PM CDT

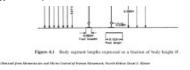
Anthropometry Table Colculations
most patients are 5'2'-5'9" in height → (62-69 inches)
leg length for 62in height: 62.0.530=32.86 inches
leg length for 69 in height: 69 · 0.530 = 36.57 inches
length from hand to foot for 62in when arm is resting by the side: 62 . 0. 377 = 23.374 in.
length from hand to foot for 69 in when arm is resting by the side: 69 . 0.377 = 26.013 in
restrict of the state of the st

Download

bc2b7da8-56c5-4b51-b46b-e45b103b2da7.pdf (257 kB) This picture includes some basic anthropometry calculations using the average heights given by our client.

AUBRIANNA YOUNKER - Sep 22, 2025, 1:32 PM CDT





Download

AnthropometryTables.pdf (604 kB)



How much load can aluminum extrusion withstand?

AUBRIANNA YOUNKER - Nov 17, 2025, 1:35 PM CST

Title: How much load can aluminum extrusion withstand?

Date: 10/17/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document and understand the load capacity of different extruded aluminum rods.

Content:

Since our client put an emphasis on making the device lightweight, we have chosen to find an extruded aluminum option to use for our base. These rods feature special cutouts that eliminate excess weight and facilitate easy attachment, while still providing support where needed to maintain structural integrity. This entry will focus on the specifics of the load bearings and the methods to test them.

How are these rods tested:

- stress-strain analysis
- finite element analysis examining structures under different loads and conditions, simulating real-life situations
- Computer-assisted design testing is used to predict potential failures before physical testing
 - using CAD tests first saves time and money on testing

These tests provide weight-bearing capacity data under a variety of conditions.

Putting coatings on or finding corrosion-resistant alum can be the best way to avoid potential weaknesses over time due to corrosion. (This point may be applicable depending on whether the patient plans to use the device on the porch or deck stairs, so it is good to keep in mind)

Aluminum can have different strengths depending on how thick it is and the type of cross-sectional area it has. We are looking for a piece with a t-slot, but oftentimes in automotion and aerospace, they use extuded aluminum that is completely hollow with a thick wall surrounding it. These are found to be very strong and can carry very large loads.

Another factor to consider is the type of aluminum; an alloy mix can be made to customize and maximize the needs of a specific project, device, machine, etc. Making these different combinations also allows it to withstand extreme temperatures in some cases. For our case, I don't think this would be a consideration we would need to keep in mind, as our device would be operated in conditions that a human could withstand as well.

Reference:

How much load can aluminum extrusion sustain? A detailed analysis—Foshan xihui aluminium. (n.d.). Retrieved October 17, 2025, from https://www.xhalufactory.com/industry-knowledge/how-much-load-can-aluminum-extrusion-sustain-a-detailed-analysis/

Conclusions/action items: In conclusion, when we are looking for extruded aluminum, there are some key takeaways here to keep in mind. The cross-sectional area of the rods; deciding how much support we need versus extra weight. The mix of aluminum we get; are we looking at a special mix of aluminum that we may not need? Can we find one that's cheaper and not mixed? And lastly, we need to ensure we look at the specifications of their load-bearing capacities and their testing methods.

AUBRIANNA YOUNKER - Oct 17, 2025, 12:03 PM CDT





Download

Screenshot_2025-10-17_120309.png (221 kB) Example of different types of cross sections for extruded aluminum



5 year Rehabilitation Outcomes of Amputations below the Knee

AUBRIANNA YOUNKER - Nov 17, 2025, 2:01 PM CST

Title: 5-Year Rehabilitation Outcomes of Amputations below the Knee

Date: 11/17/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to conduct research and hopefully further understand the rehabilitation outcomes of patients who have lower limb amputations below the knee. This will give us more insight into what is most helpful for them in assistive devices.

Content:

Article Title: A five-year audit of lower limb amputations below the knee and rehabilitation outcomes: the Durban experience

Reference: Manickum, P., Ramklass, S., & Madiba, T. (2019). A five-year audit of lower limb amputations below the knee and rehabilitation outcomes: The Durban experience. *Journal of Endocrinology, Metabolism and Diabetes of South Africa, 24*(2), 41–45. https://doi.org/10.1080/16089677.2018.1553378

This article covers the implications and results of a study in Durban, South Africa, regarding lower limb, below-the-knee amputations. This study took place between the beginning of 2011 and the end of 2014, looking at the rehabilitation progress over the 5 years. During the study, information about the patients was recorded: age, gender, diabetes status, type of amputation, rehabilitation referral status, # of physiotherapy sessions attended, and rehabilitation results.

Information that was collected during the study:

- 667 patients received amputations (some receiving more than 1, making the total number 767)
- -The average age of the patients receiving amputations was 59.5 years of age
- 354 (53.1%) of patients had diabetes mellitus
- 1:1 ratio of male and female patients
- 57% of the amputations were below the knee, these are called transtibial
- In this specific hospital, only 116 (17.4%) of the patients were referred to physiotherapy, and of those who were referred, only 81.9% actually attended
 - The median number of visits for those patients with diabetes was: 5 physiotherapy visits
 - The median number of visits for those patients without diabetes was: 4 physiotherapy visits

What is Physiotherapy?

- a medical treatment that aims to restore and improve movement and physical function
- includes treatments such as electrical stimulation, acupuncture, hands-on care, and other similar procedures

Rehabilitation results of those who attended Physiotherapy:

- 49% were able to walk with a walking frame
- 32% were able to use crutches
- 8% used crutches and had a prosthesis attachment
- 9% remained wheelchair bound
- 1% were able to achieve an independent gait

Conclusions/action items: In conclusion, it is clear that lots of patients who suffer from lower leg amputations below the knee don't get referrals to treatment plans, and lots that do still don't regain full functionality. This emphasizes the need for our device to improve the quality of life for these patients affected, and even provide a cost-effective option compared to other accessible devices out there.

AUBRIANNA YOUNKER - Nov 17, 2025, 12:45 PM CST



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A_five-year_audit_of_lower_limb_amputations_below_the_knee_and_rehabilitation_outcomes_the_Durban_experience.pdf (771 kB) Article PDF

AUBRIANNA YOUNKER - Nov 23, 2025, 6:54 PM CST

Title: Psychological Distress Associated with Severe Lower-Limb Injury

Date: 11/23/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to hopefully further understand the psychological effects of having a severe lower limb injury, and also understand how we can best meet their needs with our device, with ideas we may not think of right away.

Content:

Reference:

McCarthy, M. L., Mackenzie, E. J., Edwin, D., Bosse, M. J., Castillo, R. C., & Starr, A. (2003). Psychological distress associated with severe lower-limb injury: The Journal of Bone and Joint Surgery-American Volume, 85(9), 1689–1697. https://doi.org/10.2106/00004623-200309000-00006

This article discusses a study that examined the psychological distress in adults who have had severe lower limb injuries that required either reconstruction or amputation. The goal of the study was to further understand the psychological effects of the injury and possibly pinpoint what types are most prevalent. They were also able to draw conclusions about what factors could put an individual in a higher risk group for a psychological disorder.

Study Details:

total number of patients studied: 569

gender: 75% male

race: 75% white

Average age: 35.8 years of age

treatment: limb reconstruction - 73%, amputation - 27%

percentage that completed one psychological assessment: 96%

percentage that completed all four assessments

(assessments recorded every three months, starting at 3 months until 12, and then one final check-in at 2 years after injury)

Results:

Timeline of distress -

3 months - 43.6% had moderate distress, 19.2% had severe distress

6~months - 40.6%~had moderate distress, 18.7%~had severe distress

12 months - 37.7% had moderate distress, 19.2% had severe distress

24 months - 39.7% had moderate distress, 21.2% had severe distress

This data shows that there isn't a strong correlation between time increase and distress level increase.

Types of Symptoms that are most severe:

- phobic anxiety and depression had the highest percentage of severe symptoms
- depression and psychotiscm had the highest percentage of moderate symptoms

Functional Outcomes:

- 50% of patients who couldn't walk independently screened positive for psychological disorder, compared to 38% for those who could walk independently
- 50% of patients who can't climb stairs screened positive compared to 37% for those who can climb stairs

Key Risk Factors:

- poorer physical function
- young age
- non-white race
- living in poverty
- low social support

Conclusions/action items: In conclusion, it has been proven here with numbers that having lower limb injuries that affect physical function can greatly increase a person's chances of developing a psychological disorder. This adds to the motivation for designing the most efficient stair-climbing device we can. The numbers especially showed that individuals who can climb stairs on their own have a significantly lower chance than someone who can't. Our device should aim to help the largest number of patients to be able to climb stairs.

AUBRIANNA YOUNKER - Nov 23, 2025, 6:25 PM CST



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psychological_distress_associated_with_severe.6.pdf (163 kB) Article PDF



Observations and Notes based on previous work

AUBRIANNA YOUNKER - Sep 10, 2025, 11:54 AM CDT

Title: Observation and Notes based on previous work

Date: 9/10/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document and lay out important information from the work previously done on this project.

Content:

The problem statement for the previous group of students was to create a mechanical device that helped stroke patients get up and down 3-5 stairs. The idea was to replace/have an alternative to expensive electric stair climbing devices for those who maybe only needed assistance going up stairs on their porch (3-5 stairs) versus a whole flight of stairs. Their designs included some devices with chairs, but their final design included a vertically lifted platform using pulleys to lift the patients to a height where they can walk on flat ground onto the porch and vice versa.

From my understanding at this point, our project will look quite different than the previous project did. We have been asked to make a knee crutch, which does not specifically relate to electric chair climbing devices. However, maybe there is a relation in which our knee crutch device is intended specifically for going up and down stairs.

Conclusions/action items: In conclusion, we have to be prepared to meet with our client and our advisor with questions that will help us get a better feel for what our project parameters are going to look like.

AUBRIANNA YOUNKER - Sep 19, 2025, 1:28 PM CDT





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Screenshot_2025-09-19_132655.png (1.13 MB)

Under Arm Aluminum Pain Free Knee Crutch

AUBRIANNA YOUNKER - Sep 19, 2025, 1:25 PM CDT

Title: Under Arm Aluminum Pain Free Knee Crutch

Date: 9/19/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document notes and features of a competing design, noting what could and could not be helpful for us

Content:

- This device combines the features of a knee support and a crutch. It has a cushion up at the top for under the arm, as well as down by where the knee sits. There are adjustable features for the arm length and the leg/knee height.
- This device is \$109 on eBay
- -It is adjustable from 35.6 to 60 inches
- The frame of the device is all made out of aluminum
- -This competing design has a wide square base for added stability, and rubber grips on the four legs to avoid slipping. Both of these features would be particularly useful in our design
- The hand and shoulder stable feature could be useful for our design, as the patients using our device may be weaker and need more support, and this feature could provide stability.
- This device supports a weight of up to 300 pounds.
- The biggest setback of this device is the concerns about the ease of going up the stairs. This idea was one of our client's biggest concerns; he said most devices on the market weren't specific to stair climbing.

https://ebay.us/m/i12AOw

Conclusions/action items: In conclusion, I think this device is very usable for walking and getting from one place to another comfortably, but not useful for stair climbing. With this being said, we can take inspiration from some of the safety, stability, and comfort features to integrate into our design. Also, the material they used could be useful to look into as it supports a lot of weight.

AUBRIANNA YOUNKER - Sep 19, 2025, 12:54 PM CDT





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Screenshot_2025-09-19_124445.png (177 kB)

ISO 13485 - QMS for medical devices

AUBRIANNA YOUNKER - Oct 13, 2025, 5:09 PM CDT

Title: ISO 13485

Date: 10/06/25 updated on 10/13/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The purpose of this entry is to document an understanding of this standard of Quality Management System for medical devices

Content:

- One point that this standard highlights is the requirement for well-detailed documentation of fabrication as well as testing protocols.
- These testing protocols must verify and validate all claims made about the device (ex: if we say the device can hold over 200 pounds, it is required to have well-documented testing protocols verifying this weight limit and validating the claim)
- The last two bullet points also play into the traceability component of this standard; is there research from trusted, peer-reviewed sources, can the materials and parts be traced back to manufacturers and etc.
- Going along with materials, this standard outlines the need to evaluate suppliers if you are buying materials from anywhere (are they reputable? Do they have testing to back their claims about the parts/materials?)
- It is also important to note that this clause was recently updated in 2016 and could be revised in the future as well. Revisiting standards every couple of years can be helpful to stay up to date.

Reference:

ISO - ISO 13485—Medical devices. (2019, December 18). ISO. https://www.iso.org/iso-13485-medical-devices.html

Conclusions/action items: In conclusion, this standard regarding Quality Management Systems for medical devices is very relevant to our project and our design process. I think the biggest takeaway from this for our group is the importance of in-depth documentation throughout our design process, fabrication, and testing. If this is done well enough, hopefully we can easily identify what parts of our device don't meet standards or qualifications. For action items, I think we should dig deep into the verification and validation portion of this standard, making sure we have the data and documentation to back our claims.

AUBRIANNA YOUNKER - Oct 13, 2025, 5:07 PM CDT





Download

ISO13485.pdf (441 kB) ISO 13485 Document Attachment



ISO 7176-24 - Testing Methods for Stair-climbing Devices

AUBRIANNA YOUNKER - Oct 13, 2025, 8:37 PM CDT

Title: ISO 7176-24 - Testing Methods for Stair-climbing Devices

Date: 10/6/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to summarize and attach the content of ISO 7176-24 for us to use and reference

Content:

The standard focuses on wheelchairs overall, but it has several internal portions that regard stair climbing devices, which apply to our device. As a result of this, this entry will focus on the portions that apply to our intended task: creating a device for climbing stairs.

- No components should have visual cracks or fractures (this does not include outside features such as paint)
- Handgrips should not be displaced easily upon use
- Testings are recommended to be carried out at maximum speed, as this is likely where problems occur
- It is required to document any time the test had to terminate prior to completion, and any notes on how it met the given requirements of the test
- Testing should also be conducted on regions that require crawling use (on platforms between flights of stairs
- -It is important to note this standard has not been updated since 2004. With this being said, this is still the national standard regardless of when it was revised.
- It seems as though a new version is being reviewed and approved.

Conclusions/action items: In conclusion, it is important to keep all these factors in mind when creating and testing our device. Although the standard doesn't directly align with our project, the things highlighted in this entry are great considerations to keep in mind, no matter the project. For action items, I will share this with the group so we can discuss how to implement it into our reports and design.

AUBRIANNA YOUNKER - Oct 06, 2025, 2:02 PM CDT

INTERNATIONAL STANDARD 7176-24

Wheelchairs —
Part 24:
Requirements and test methods for user-operated stair-climbing devices

Reference number

[50:7176-243004] https://emdosh.schorross.bry/contests/44/sec/7085-0003-438-5c46ct.halcos/44676c-7176-24-2004

Download

ISO-7176-24-2004.pdf (440 kB) ISO 7176-24 PDF

AUBRIANNA YOUNKER - Nov 02, 2025, 8:53 PM CST

Title: Submitting an IRB - Research

Date: 10/30/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document the process and requirements for submitting an IRB for research clearance.

Content:

Since our team has considered testing directly on Dan's patients, we have been advised to submit an IRB before doing so. Testing on the patients would add a lot to our testing validation.

General IRB Requirements:

- All personnel involved with conducting the study must have completed the Human Subjects Protection Training
- Must provide a detailed research protocol, consent forms, recruitment materials, and a confidentiality plan
- There are three core principles considered when reviewing a research request: Respect for Persons, Beneficence, and Justice
- Respect for Persons this principle focuses on ensuring individuals are being treated as beings with rights and dignity (informed consent is important here)
 - Beneficence must act to benefit others, maximizing benefits and minimizing possible harms and risks
 - Justice fairness between those who participate in the study and those benefitting from its findings

How to submit an IRB within UW-Madison:

- Specifically at UW-Madison, there is a University Portal for submitting all IRBs, which goes through the Human Research Protection Program.
- On this site, you can access instructions for submitting a new review, a change in protocol, a reportable event, or a continuing review

(Our group is looking to submit a new review)

- There are two main types of new review submission types: nPBA (Non-protocol Based Application) and PBA (Protocol Based Application)
- nPBA for minimal risk research, and these types of studies often qualify for expedited review (see attached document below for expedited review application requirements)
- PBA more than minimal risk studies, often times clinical studies, requires a study protocol document (see attached document below for example protocol application)

ex: biomedical studies with multiple physical interventions, studies investigating a drug or device, studies where UW Madison will serve as a reviewer for 2-3 locations

Our testing protocol would likely be considered minimal risk and may qualify for expedited review, as our testing only includes a short demonstration and a survey.

Reference:

New study – human research protection program. (n.d.). Retrieved November 2, 2025, from https://irb.wisc.edu/submission-guidance/new-study/

Conclusions/action items: In conclusion, IRBs are a bit of a process to be approved, but UW has great resources to guide you through the process. IRBs are important to ensure the safety and fair treatment of individuals participating. This helps avoid corrupt people taking advantage of individuals through their research. Three of our group members have completed the required training to participate in conducting research, so that shouldn't be of concern.

AUBRIANNA YOUNKER - Nov 02, 2025, 8:42 PM CST



Download

IRB-Review-Process-Visual-Workflow-2-2-22-1-1.pdf (75.7 kB) IRB Flowchart

AUBRIANNA YOUNKER - Nov 02, 2025, 8:43 PM CST



Download

MockupPBAapp.pdf (156 kB) Example Protocol Based Application

AUBRIANNA YOUNKER - Nov 02, 2025, 8:44 PM CST



WORKSHEET: Expedited Review

The purpose of this worksheer is to provide support for <u>Designated Bearburg</u> conducting reviews using the expectation procedure. It does not recent to be completed or retained.

1. Humanitarian Use Device (PUD) (Check # "res" or TMA", Must be checked)

Continuing eview of non-escentin-UD using the expected globocidure ("NA" # not HUD) | MA

2. Additional Crisisal for Research involving <u>Propagues</u> (Check # "Yes" or TMA". Nust be checked)

The remarks histories framework involving <u>Propagues</u> (Check # "Yes" or TMA" # not HUD) | MA

2. Additional Crisisal for Research involving <u>Propagues</u> (Check # "Yes" or TMA" # no property such such as a subjects OR for prisoner information with prisoners as subjects OR for prisoner information, includes when the modification close not involve information with prisoners.] | MA

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3. Minor Medifications (Check # "Yes" or TMA", All must be checked)

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Wrap Around Handle Design - Preliminary Design Idea

AUBRIANNA YOUNKER - Sep 22, 2025, 4:46 PM CDT

Title: Wrap Around Handle Design - Preliminary Design Idea

Date: 9/22/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

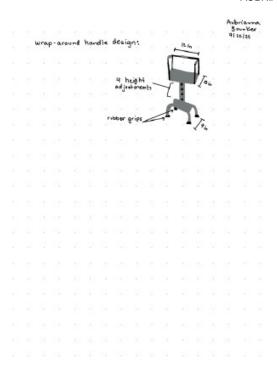
Goals: The goal of this entry is to document the preliminary design details of the "wrap-around handle" design.

Content:

See the picture attached below for the design drawing.

Conclusions/action items: For action items, I can show this design drawing to my fellow group members at our next meeting. From there, we can discuss the potential pros and cons of this design. Additionally, we can see if any of these components would mix well with components of a different design in order to find a possible combined design that best fits our needs.

AUBRIANNA YOUNKER - Sep 22, 2025, 2:03 PM CDT



Download

WrapAroundHandleDesign.pdf (450 kB) This PDF is the Wrap Around Handle design drawing

AUBRIANNA YOUNKER - Oct 20, 2025, 1:54 PM CDT

Title: Extruded Aluminum Attachable Handles

Date: 10/20/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document this design idea to highlight different stages of our design procress and serve as a reference for other

teammates.

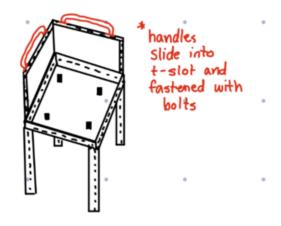
Content:

The team has been going back and forth between a lot of option for the handle portion of our device. Our biggest concern being attachability to the knee rest component. While ordering materials, I came across different sized handles that can be slid right into the t slots of the extruded aluminum rods we are using. To ensure patient comfort, these handles may require a cushion over the top of them, but besides that, they would provide a strong foundation for gripping and lifting. See the design drawing below as well as the product photo and link.

website link: https://www.alufabinc.com/product/large-plastic-door-handle-black/

Conclusions/action items: In conclusion, these handles could be the answer to our problems regarding attaching the wrap around handle. Although it would require further thought regarding comfort, it would a simple fix that works with our extruded aluminum rods we are already utilizing. Action items include bringing this idea up at the next full group meeting.

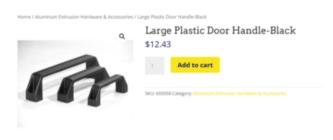
AUBRIANNA YOUNKER - Oct 20, 2025, 1:52 PM CDT



Download

Screenshot_2025-10-20_135215.png (83.7 kB) Rough Sketch of the Design Drawing

AUBRIANNA YOUNKER - Oct 20, 2025, 1:53 PM CDT



Download

Screenshot_2025-10-20_135307.png (153 kB) Image of product



Bottom Square Base Grip Tape Drawing and Design 11/20/2025

AUBRIANNA YOUNKER - Dec 10, 2025, 3:01 PM CST

Title: Bottom Square Base Grip Tape Drawing and Design

Date: 11/20/2025

Content by: Aubrianna Younker

Present: Aubrianna Younker

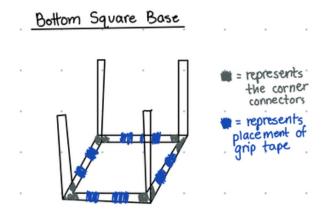
Goals: The goal of this entry is to provide a design drawing of an idea of where to apply the grip tape to the bottom square base.

Content:

The team has been deciding where and how to place the grip tape on the bottom base frame. Due to interference with the corner connectors, we cannot place the grip tape along the entire length of the sides of the bottom base. However, it is still important to have an even grip in the many areas as possible. This way we can find a good in-between grip and stability of the bottom. My solution to this is wrapping the grip tape once around the rod in two different places on each of the side bars of the frame. Design drawing can be seen below.

Conclusions/action items: In conclusion, I need to share this idea with my team and see what they think, and see if they have any other ideas. With the grip tape we ordered, there should be enough length to execute this design idea.

AUBRIANNA YOUNKER - Dec 10, 2025, 3:01 PM CST



Download

IMG_0243.jpg (454 kB)

CITI - Human Subjects Training - Completion

AUBRIANNA YOUNKER - Oct 24, 2025, 11:51 AM CDT

Title: CITI - Human Subject Training - Completion

Date: 10/24/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document the completion of my CITI Human Subject Training

Content:

**See attached document below

Conclusions/action items: In conclusion, this training now allows us to submit an IRB if we want the opportunity to test our device on a human subject. This would potentially allow us to test the device on our clients' actual patients. For action items, we should decide if this route of testing would give us the relevant information to validate claims we've made about our device.

AUBRIANNA YOUNKER - Oct 24, 2025, 11:46 AM CDT



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CITICompletionCertificate.pdf (77.5 kB) Completion Certificate

AUBRIANNA YOUNKER - Oct 24, 2025, 11:54 AM CDT





Download

citiCompletionReport.pdf (78.6 kB) Completion Report

AUBRIANNA YOUNKER - Sep 10, 2025, 2:06 PM CDT

Title: Career Prep - Lecture 1

Date: 9/10/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document important notes and information from the lecture regarding career prep

Content:

Career Fair Dates: Sept. 15-18th in the different engineering campus buildings

General Tips:

- Use your connections/network and reach out and communicate before you are a candidate for a job
- Make sure to be applying to sites that are primary and most direct to the company: Company website, Handshake, LinkedIn
- Step 1 is applying, but an important step 2 is following up 2-3 weeks after applying
- -Connections are so important; talking to someone in a company helps your chances of someone actually looking at your application
- Experience is still experience, even if it is adjacent to what your primary goal is
- Develop your "valued added" statement, why me?, also an elevator pitch
- Objective statements are recommended for career fair situations, but not 1 on 1 applications
- Do not double up the name tag flags; stick to BME

Resume Tips:

- Tailor your resume to the position you are applying for
- Make sure to show a full picture of your experience
- No columns, charts, or colors
- Put technical skills and coursework
- -Jobs organization + location, position title + employment dates
- -Design projects WITHOUT years or semesters

Cover Letter Tips:

- -custom to each job and based on a specific job posting
- amplifying your greatest selling points
- demonstrate employer knowledge
- clear and concise, shorter is often better
- see templates and examples on the website

Conclusions/action items: In conclusion, there are lots of resources on campus to help us navigate this stressful time of job searching. With that being said, there are lots of things we can do on our own to give us better chances when applying and where we are applying. Take the time to refine resumes, elevator pitches, and other materials before the career fair.

AUBRIANNA YOUNKER - Sep 17, 2025, 2:07 PM CDT

Title: Leadership Style

Date: 9/17/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document key points on being good and effective leaders for the sophomores on our team and in general.

Content:

Lecture Presentation by Angela Kita

Some qualities we came up with that describe a good leader:

- organized, confident, assertive, understanding, patient, humble, detail-oriented, open-minded, responsible
- overall good general people skills
- lead by good example

Anatomy of a good leader: Self-awareness, vision, transparency, communication, decision-making, and empathy

Leadership can be practiced at any level:

Personal- self-awareness, competency, and goals

Interpersonal- recongixing and responding to others' needs, active listening, and having difficult conversations

Team- Facilitate team interactions, supporting others' development

Organizational- large scale, overseeing multiple groups and teams

Leadership Styles:

Power Model - hierarchy, authority, command

Servant - empathetic, empowering, shared decision making

Authentic - transparency, genuineness, honesty

Discussion: What was it like to work with these leadership styles?

With power: feeling like you don't have a key role in the project

With Servant: feel like you are more involved, more room for individualism, but expectations might be less clear, might feel like you want more guidance under this leader

With Authentic: everyone feels on the same page, bears more weight of the project potentially

It can be helpful to use your Clifton Strengths results to understand your leadership style and how your mind is oriented.

It is so important to receive feedback from others.

Goal Setting:

Personal Leadership Goal: My goal is to work on being confident in my own knowledge, skills, and abilities. I think that if I do this, I would then, as a result, feel more comfortable taking on larger roles or leading certain things.

Team Leadership Goal: My goal is to find something that I feel very confident in within our project and use that as a chance to lead a particular aspect of the project to practice my leadership.

Conclusions/action items: In conclusion, there are so many different aspects to being a good leader; it takes lots of time and practice to be a good leader. And at the end of the day, no one is a perfect leader. So, always strive to become a leader and understand your personal leadership strengths and weaknesses. Keeping this in mind throughout this semester as well as throughout my life.

AUBRIANNA YOUNKER - Sep 24, 2025, 2:05 PM CDT

Title: Peer Mentoring

Date: 9/24/2025

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals:

Content:

Lecture by Prof. Tracy Jane Puccinelli

Why are we mentoring BME 200 students?

- Both sides learn and benefit from the setup; 200s learn how to do a real design project, and 300s get to practice their leadership skills.
- See one, do one, teach one; by the end, you should have a strong understanding of the process and responsibilities
- Reflects industry work, teams are often comprised of varying levels
- We are more approachable than faculty as their peer mentors
- It allows everyone to be more immersed in the community by blending generations

Transferable Skills:

- Leadership
- Communication
- Active Listening
- Study practices
- Self-awareness
- Interpersonal skills

General Benefits of Mentoring:

- Increases self-esteem
- increased patience
- build positive habits
- personal growth
- identify gaps in knowledge

What does it mean to be a "good mentor"?

- Being a mentor all around, not just in one discipline
- Building trust and a safe place
- Being available
- Humanizing their struggles
- Listen Effectively (stop talking, avoid distractions, be interested, ask questions, react to ideas, not to the person, avoid judgement)

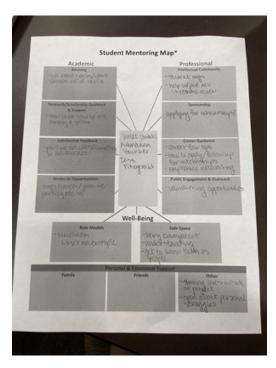
What are the things you wish you knew in BME 200?

- How to use/ expectations with Lab Archives

- Scheduling/deadlines
- Overall expectations
- Information about BME tracks
- Research skills
- Importance of networking and getting involved

Conclusions/action items: In conclusion, it is important for us to share our experiences with our 200s so they can become familiarized with the process and be comfortable being a 300 leader next year. Also, we need to acknowledge that this is also a great learning experience for ourselves to strengthen our leadership skills. As an action item, we can reference our mentor map below to ensure we are hitting all realms of being a mentor.

AUBRIANNA YOUNKER - Sep 24, 2025, 1:55 PM CDT



Download

IMG_2075.jpg (3.62 MB) Group Mentor Map

AUBRIANNA YOUNKER - Oct 01, 2025, 2:08 PM CDT

Title: Sustainability in BME

Date: 10/1/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document the important notes regarding how we can use sustainability in BME

Content:

Presentation by Andrea Hicks

Circular economy - keeping resources in the economy; for example, recycling a can to be reused and back into the system

In addition to a carbon footprint, you can also calculate a water footprint

Example: Kuregig vs coffee pot, which has a better carbon footprint?

- The answer to this question is that these two are very similar in carbon footprint. The Kuregig uses a lot of plastic; however, the coffee pot uses a lot of energy to heat the hotplate. These two things cancel each other out, making their impact similar. Also, both of these involve a lot of microplastic concerns.
- We can access these factors using a life cycle analysis

Steel reusable vs plastic single-use vaginal exam devices

How much plastic and steel go into making these?

What materials are used to clean the reusable steel ones?

How frequently is this device getting used in the specific clinic?

What if you are in a situation where new medical devices are no longer available?

What is the environmental impact of making a single device of either material?

Life Cycle Greenhouse Gas Emissions of Anesthetic Drugs:

Different impacts include manufacturing, packaging, transporting, and delivering these drugs.

Propofol has by far the least amount of environmental impact, with the small amount coming from delivery and waste management

Environmental impact is not the only criterion to consider when making a decision, but it is definitely still something to consider in the choice

Medical Devices can be divided into groups with risk levels based on how they come in contact with the patient, whether it is internal or not

How do we use these tools to engineer a more sustainable world?

- Look at supply restrictions, economic impacts, and environmental impacts
- Consider both reusable and disposable options and their impact over time
- Look into all factors, including time, money, availability, and the size range of the device

How can we implement these things into the design of our project?

- Consider the impacts of making one adjustable device vs multiple different-sized devices
- Our device is a low-risk device, so making a disposable device doesn't make sense when it can be easily reused
- Buying material that is already prepared would involve less labor time than if we try to weld it because professionals are much faster than we are

- Consider how much material is being used/wasted during the prototyping stage (how much material is going into each failure, for example, during testing)

Conclusions/action items: In conclusion, while we are continuing our design projects this semester, and later in our lives, we can add environmental impact to our list of things to consider when finalizing a design. Answers to this might not always be as obvious as they may seem; sometimes it takes looking deeper into the factors to figure out how different the environmental impacts actually are. Action items are to use the ideas that we learned today in our project designs.

AUBRIANNA YOUNKER - Oct 08, 2025, 2:05 PM CDT

Title: Introduction to WARF, IP, Disclosing, and Licensing

Date: 10/8/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to highlight any key points and takeaways from the speaker and lecture on licensing

Content:

Speakers: Justin Anderson and Jeanine Burmania

WARF works on facilitating the securing of IP requests

WARF gives money to new campus buildings, such as the new Morgridge building and potentially the new engineering building

Four types of common IP:

- Patents
- Copyrights
- Trademarks
- Trade Secrets

Other Warf IPs:

- Biomaterials
- technique and know-how (akin in some ways to trade secrets)
- Data

Overview of Non-Patent IPs:

Copyrights - protection for creative works that are expressed in a tangible medium, software

- not as time sensitive as copyright

Trademarks - Protection for names, marks, logos,

- source identifying function

Trade Secrets - used to protect anything of value, good as long as the concept is not generally known

- An example would be a receipt

Patents - a property right granted by a government agency

- USPTO (US Patent and Trademark Office)
- no global patent
- excludes others from making, using, selling, or importing the claimed invention
- Types of Patents: Design, Plant, Utility

Most common patents in the WARF portfolio

- Issued for the invention of a new and useful process, machine, manufacture, or composition of matter
- time-limited monopoly on your invention (20 years from filing)
- applicants must teach others how to make and use the claimed invention (does not keep anything secret)

- Often takes 2-5 years to issue after filing (patent examination)
- Costs on average, \$30K mostly attorneys' fees (If working with WARF on a patent, they will cover these costs)
- 90% of patents issued by USPTO are non-provisional utility patents

Requirements of Patenting:

- 101 Eligible; cannot be a product of nature, an abstract idea, or a natural phenomenon
- 102 Novel; it must be new
- 103 Non-obvious; it cannot be a simple modification or combination of existing concepts
- 112 Enabled and Described; must provide enough detail to teach others how to make or use the invention

Patent Examiners are real people, not Al!

WARF receives about 400 new innovation disclosures each year

Disclose:

- Describe the innovation
- identify advantages and disadvantages, and applications
- Name contributors (intentors, authors)
- Provide funding and public disclosure details

Meeting with WARF:

- Discuss the innovation in more detail
- Ask questions about WARF and patent processes
- Discuss next steps

Assessing University Inventions:

IP Consideration

- Type of IP protection
- Potential breadth and strength of IP protection
- Public disclosure (past and planned)
- stage of development

Licensing Considerations:

- Applications of the device or invention
- Likelihood of identifying a commercial partner
- Likely return from licensing

Marketing and Licensing:

financial considerations - how much does it cost to make, versus how much profit they make on each, and what the specific royalties are Reduced R&D costs, improved time to market, new features, and additional revenue opportunities are of benefit to different companies

Al versus IP:

- Can AI invent? (No!)
- Can AI assist in inventing? (Evolving, but likely yes under Pannu Factors)
- Limited to the US only? (No!)
- Al must be incidental to conception and creation

- Original works of human authorship
- Combinations of derivative works require more than a de minimis contribution from a human

Conclusions/action items: In conclusion, it is very helpful to have this knowledge on our radar as we make our way through our design projects. It is nice to know that these things are options for us, even though we are still students. It is also good to keep in mind some disclosure factors when we are going through our design process, things as presenting, putting it into AI or ChatGPT, and etc.



Bioengineer it, Protect it - Lecture 6 (10/15/25)

AUBRIANNA YOUNKER - Oct 15, 2025, 2:10 PM CDT

Title: Bioengineer it, Project it

Date: 10/15/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to take notes about Andrea's take on the legal side of engineering and her journey with it.

Content:

Presentation by: Andrea L. Arndt - Biomedical Engineer - Dickinson Wright PLLC - Patent Attorney

Key points of Intellectual Property for Biomedical Engineers:

- Biomedical Engineers create life-changing and life-saving solutions
- Patent Holder wants the biggest fence around their property, and the patent examiner wants the smallest fence around the property
- Have to analyze what the damages were, in order to sue with patenting, this can look different in every situation
- A lot of times, it is to benefit both sides, more of a collaboration
- Patents have to be business smart in order to be taken through with, since they are so expensive to get
- The university usually owns IP rights if you go through the WARF process, because they are paying for the process
- Companies also own inventions and IP rights through the terms of employment that you sign
- In start-ups, you own your inventions and IP rights!

Legal Career Paths for Engineers in IP:

Technical Advisor - STEM degree (no law degree or Patent Bar) - looking to see if the idea already exists

Patent Agent - STEM degree + Patent Bar - you can have conversations with the patenters, like a mini lawyer

Patent Examiner - STEM degree (Patent Bar eventually) - US Government Job

Patent Attorney - Law degree + Patent Bar - you can choose your clients, start by identifying the paths that need to be taken

Patent Litigator - Law degree (STEM degree + Patent Bar optional) -

IP License Attorney - Law Degree (STEM degree + Patent Bar optional) -

Tech Transfer Manager - STEM degree preferred (Law degree optional) -

Engineer - STEM degree (work with IP lawyers to protect your inventions) -

Skills from Engineering to IP:

Research - determine if an invention is actually new

Analytical reasoning - claim/drafting/infringement analysis

Technical Writing - translate complex technical concepts into clear, precise language

Communication-explaining tech to non-experts and Patent Examiners

Creativity - problem-solving in patent/creating competitive products

Collaboration - cooperate with colleagues and external professionals

Project Management - manage resources, meet deadlines, and organize tasks

- These are ways in which engineers influence law and innovation

Legal and Ethical Duties of Engineers

- Respect others' IP it's a small world
- Keep invention notebooks proves that you are the inventor, and can help you in court
- Understand inventorship vs. authorship those who didn't actually contribute to the project may just be authorship
- Maintain confidentiality agreements

Common Types of IPs:

Patent - new, non-obvious, utility, enablement (must describe how to make and use), must share what you are doing

- monopoly for 20 years, stops people from making, using, selling, or importing the invention
- Utility and Design Patents are the two main types (design patents help avoid counterfeit products and keep customers safe)

Trademark - words, devices, symbols, colors, smells, sounds

- Distinguishing your goods or services from others - so customers know it is your project

Copyright - creative work, expression of a work, fixation, music, photos

Trade Secret - formulas, recipes, manufacturing processes, ex: Coca-Cola

Huge counterfeit market in BME and Pharmaceutical companies

Conclusions/action items: In conclusion, it is nice to hear the story of someone who didn't take a typical engineering route. It is a nice reminder to know that there are so many different opportunities in this field outside of just pre-med or industry. It is also a great reminder to be aware of the opportunities to protect your design ideas as engineers.

BME Advising Session Part II - Lecture 7 (10/22/25)

AUBRIANNA YOUNKER - Oct 22, 2025, 2:01 PM CDT

Title: BME Advising Session Part II: Fall Post Graduate Planning

Date: 10/22/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document key parts of this advising session to have to look back on in the future when deciding my future.

Content:

General Pointers:

- Use undergraduate experience to build a resume and build a unique story
 - Gain experience while you can easier while you are in school
 - Research very important for all post-graduation degrees and industry
- Do your homework what different options are there and what do I want my future to look like
- Think about who you'd want to write reference letters
- Prepare for any relevant exams MCAT, etc
- Do not just say you want the position because you just want any experience; they are looking for something more specific and personal

Cover Letter - the better way

- Start with what you want to do your thesis statement
- call out a specific facility that you may think would be good to work with

Graduate School Options

- Master's MS
 - stepping stone/change directions/ gain depth / expand credentials
 - great way to fill a gap year while you study for the MCAT, or if you cannot find funding for a PhD yet
 - makes you more desirable and fills in gaps in your resume
 - more experiences, more projects, more lab time
 - more opportunities for internships
- Doctoral, PhD
 - desire to be an independent researcher/start-ups like Phd for leading groups

BME-specific MS options - 24 credits for you

Research (typically 1.5-2 yrs)

- for those continuing on for a PhD here
- can be funded as an RA/TA/PA (tuition remission and stipend)

Accelerated Programs (1 year)

- Funding (TA) stipend only (no tuition remission \$1200/credit)
- no co-op allowed (internship is allowed)

Accelerated

- coursework only
- independent study/research is allowed

Biomedical Innovation, Design, and Entrepreneurship

- project-based project required (BME design project continuity)
- partnership with business school

Applying for this program:

- -Apply online, pay the fee, and submit
- need statement of purpose
- research MS only: List the PI who plans to support you
- 3 letters of recommendation
- Easy to meet deadline of 12/15 (some flexibility), spring entry allowed
- Your application is reviewed separately, but we give special consideration to BME undergraduate students who had a 3.0 or higher at graduation

Other Master's Options:

- Some companies will pay for you to go back to school to get your Master's in Business, or offer evening options

PhD Specifics:

- Find out who is working in that area and network!
- go to conferences, conferences
- Research is a must! potentially honors in Research
- -External funding NSF GRFP!!!!
 - apply Fall senior year (1st time)
- Apply early and list names most do rolling reviews
- generally >3.5 GPA and 75%ile Quantitative GRE

Medical School Specifics:

- go to premed (pre-health) advising CHECK REQUIREMENTS EARLY
- Special Requirements for most Medical Schools
 - two semesters of gen chem and o chem I and II + lab
- 2 semesters of Physics
- 2 semesters of English

Beyond the classroom

- research is required
- volunteering
- shadow physicians
- patient contact time
- use design experiences

Class vs Experience - Find Balance!

- Tell your story in a way that makes sense and explains your specific path
- They like to see that you can work with other people!

- Extra time: work in leadership positions and extracurricular activities

Conclusions/action items: In conclusion, it is so important to be thinking about our future and what resources we can take advantage of to get to where we want to be.



To regulate, Or to not regulate.... - Lecture 8 (10/29/25)

AUBRIANNA YOUNKER - Oct 29, 2025, 2:09 PM CDT

Title: To Regulate, Or not to Regulate... That is the Question

Date: 10/29/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document key notes and takeaways from Dr. Kip's presentation about the FDA.

Content:

Dr. Kip Ludwig, Department of Neurological Surgery and Surgery

FDA - Food and Drug Administration

- Drugs are very different than other medical devices

Regulatory Pathways:

- There are three classes of medical devices; these are classified based on their risk level
 - Class I low risk oftentimes exempt unless far out of the lines of exemption (then 510K)--> clearance to go to the market
 - Class II moderate/controlled risk 510K or HDE if less than 4,000 patients per year --> clearance or approval to go to market
 - Class III high risk PMA mainly, or HDE again if less than 4,000 patients per year ---> approval to go to market
- FDA can approve your device, but still request post-market surveillance to ensure problems don't show up in larger-scale studies

Circulation:

Cardiac Pacing, 1960-1985

- The first pacemaker was implanted in a 40-year-old man patient by Ake Senning in 1985
- This pulse generator failed within a few hours
- This patient has 26 pacemakers total

The FDA had a lot fewer regulations before the Modernization Act of 1977:

- This act redid the FDA system
- The FDA is often referred to as pre and post Modernization Act of 1977
- Congress said they have to regulate devices because it was causing health problems, but did not say how to regulate them

Product Recalls in the Medical Device Industry:

- 1. Abnormal returns attributable to medical device recalls are negligible
- 2. Abnormal returns attributable to recalls are less negative for firms with greater project scope

Philips CPAP Nightware exposes shortcomings in medical device regulation:

- Foam came off from the mask during use and created holes in the patient's lungs
- killed 500 people
- This device had 510K approval

Abbott's recall of nearly 200k neurostim systems given FDA Class I rating:

- MRI compatible device mode, when turned off during MRI, can never be turned back on
- This could lead to a loss of therapy

When devices are being distributed to millions of patients, problems that seem very unlikely and small become very critical and could lead to death!

Investigational Device Exemptions for the medical device clinical Studies are Failure Mode Analysis Based - list, explain, and rank all potential failures of a specific device

Conclusions/action items: In conclusion, this lecture was very intriguing and eye-opening. It highlights the importance of strict testing and verification for medical devices. When creating a design and a prototype, it is important to think of any potential harm, because if it ever reaches the market, it can be a huge liability to your users' health. It also serves as a reminder to be aware of what is going into your body and what testing and regulations it passes, and how.

AUBRIANNA YOUNKER - Nov 05, 2025, 2:07 PM CST

Title: Regulatory Strategy: Framework Guiding Advanced Therapeutic Product Development

Date: 11/5/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document notes taken during this lecture about Regulatory Strategy.

Content:

Presentation made by: Cathy Rasmussen, Ph.D. Straditech

Speaker: Bill Murphy

Focusing on the FDA today

FDA Structure and Advanced Therapeutics:

Device (CDRH):

- PMA
- -510(k)
- -IDE

Drug (CDER):

- -NDA (new drug application)
- -IND (investigational new drug)

Biologic (CBER)

-BLA (Biological License Application)

-IND

FDA Framework:

U.S. Laws ----> regulations (CFR Title 21) -----> FDA Guidance ----> various CGT requirements throughout the years (trial guidance, therapy for hemophilia guidance, manufacturing)

Public Health Service Act - a law that gives the FDA more pathways and manufacturing information for biological drugs

Federal Food, Drug, and Cosmetic Act (FD&C) - key law giving the FDA responsibility to oversee the safety of drugs, medical devices, and other products like food and cosmetics

- The FDA does not like to give a step-by-step guide on how to achieve these things and set up clinical studies

Dramatic Implications:

Homologous Use - meaning for the same function (ex: liposuction fat being used for cosmetic filler elsewhere in the body)

Autologous Use -

351 products might take years to get through the regulatory system

361 products are largely unregulated in comparison, and can possibly be used on the same day, based on the surgeon's discretion

Product distinction based risk analysis question - answering no to the safety question might kick the device into the 351 device category

Good Research Projects vs. On the Critical Path?

A target product profile (TPP) is your Product Vision:

- Components
 - Core: indication and patients, efficacy, safety, dose and regimen, route of administration, dose form
 - Clinical Development Planning: clinical pathway, regulatory pathway, timelines, cost, risk
 - CMC (Quality TPP): product attributes, biocompatibility, storage, stability, container, pharmacopeial compliance

This profile works to answer the following questions:

- Will patients and prescribers want it?
- Will regulators accept it?
- Will payers reimburse for it?
- Why should I fund development?

Time = \$\$, so consider this when developing a 351-regulated CGT

Quality Management System Implementation:

- Risk Management
- Asset Management
- Equipment Management
- Document Management
- Audits and Inspections
- Corrective and Preventive Actions
- Supplier Management
- Training Management

Very important to learn good documentation now, because it will be required later down the line. Very important to have very specific and comprehensive documentation

Conclusions/action items: In conclusion, this information is good to think about throughout our design projects, but this will likely be extra beneficial in industry when working with a company to ensure testing, manufacturing, etc. Additionally, this would be very prevalent if you were trying to develop your own device and get it approved by the FDA. As with lots of other 300 lectures, this information is good in order to help us start to build a well-rounded knowledge of the biomedical engineering world. This is a light overview, but a great introduction.



Tong Distinguished Entrepreneurship Lecture - Kristin Myers

AUBRIANNA YOUNKER - Nov 07, 2025, 12:50 PM CST

Title: Building a Career of Impact

Date: 11/7/25

Content by: Aubrianna Younker

Present: All BMEs

Goals: The goal of this entry is to document the key notes of Kristin Myers' entrepreneurship lecture.

Content:

"Run towards the hard problems... they are the ones that change the world"

Kristin Myers Journey:

Chapter 1 (education and experience) - the foundation

- BS in biomedical engineering at UW-Madison
- several internships and co-ops (Abiomed, Baird, Guidant)
- Medtronic employee
- Master's at Harvard
- Skyline Investor Start-up journey
- -This chapter was mostly about her growth

Chapter 2: Climb the Growth Curve

- Aetna (Chief of Staff to CEO, President of Student Health, President of Great Lakes Region commercial and Medicare)
- Opened her own cycling studio!!
- -Unified Women's Healthcare (President & Chief Operating Officer)
- -This chapter was more about working in teams and growing together

Chapter 3: Build and Transform

- Hopscotch Health (Founder and CEO, advanced Primary Care for Rural Communities)
- Blue Cross Blue Shield Association (Chief Operating)
- -She wanted to help make healthcare available to everyone, for example, in rural areas

Overall Notes:

Quadruple AIM

- Improved provider experience
- improved patient outcomes
- lower cost of care
- improved patients' experience

What if we build an integrated system to enable health and wellness for all? How can we do this?

- -providing aligned incentivized care (everyone is rewarded based on outcomes, not services)
- -human-centered design
- -connected care delivery platforms

- -simplified and automated infrastructure
- -interoperable data infrastructure

Advice for us:

Work Hard and Build Range - take on the hard projects, classes, and experiences you can find. Effort is your range, are your foundation.

- Getting experience in different areas and places can give you an added range

Seek Diverse Exposure - explore different sectors, teams, and geographies. Gain perspective and learn how systems connect, not just how parts work

- get diverse exposure and experiences and find things that motivate you

Choose your people wisely - surround yourself with curious, driven, high-integrity people. They will shape who you become.

- This makes a huge difference in who you are and who you become

Know your values and protect them - Define what matters to you most - family/friends, health, career/impact, values - and make decisions that align with those

- prioritize things that make you feel best and most successful

Embrace Challenge and Keep Growing - run towards hard problems. Growth lives on the edge of discomfort - where big impact starts

- operate from a place of curiosity and a growth mindset
- we've already made it so far past most individuals in this country, and we should be so proud of how far we've become

Conclusions/action items: In conclusion, Kristin Myers is an extremely successful person. She is a great example of hard work pays off. She has always been striving to do her best and takes advantage of every opportunity she can. We can all take her journey as an inspiration for our own journey. There are so many opportunities out there for us in this field; we need to explore as much as we can and gain experience and range.

AUBRIANNA YOUNKER - Nov 12, 2025, 2:04 PM CST

Title: An Introduction to Research and the IRB

Date: 11/12/2025

Content by: Aubrianna Younker

Present: all BME 300 Students

Goals: The goal of this entry is to document key points and notes about the IRB, potentially relating to the testing of our project.

Content:

Speaker: Stephanie Metzger, PhD, Health Sciences IRB Analyst

Belmont Report: Three main principles

1. Respect for Persons/Autonomy

The principle of respect for persons thus divides into two separate moral requirements: to acknowledge autonomy and the requirement to protect those with diminished autonomy

2. Beneficence

maximize possible benefits and minimize possible harms

3. Justice

who ought to receive the benefits of research and bear its burdens.

1991 Department of Health and Human Services (DHHS) 45 CFR 46

- common rule
- criteria for approving research

IRB Composition:

- Diversity of membership required
 - · race, gender, and cultural backgrounds
 - Scientific expertise MD, PhD, MPH, Faculty, clinicians
 - · non-scientists community members, IRB staff

IRB Purpose:

Protect the rights and welfare of people enrolled in research

- participants/subjects

IRB's review of human research

Common Rule Criteria (45 CFR 46)

Risks - no unnecessary risks, unavoidable risks as low as possible

Benefits - potential direct benefits to participants, or scientific/societal benefits

Risk/Benefit Ratio - Risks are reasonable in relation to potential benefits

Equitable Selection of Subjects - appropriate to answer the research question, and appropriate recruitment strategies

Informed Consent - participants make an informed choice about taking part in research, and the criteria for waiver of consent are met

Privacy and Confidentiality - adequate privacy and secure containment of the lab information

Not Considered Research:

Quality and improvement consideration may not be considered research

HIPAA Considerations:

De-identifying Data -

- · directly identifiable identifiers included with data
- · coded/indirectly identifiers are "hidden" between different locations and files
- · anonymized/deidentified all identifiers are removed

Exemptions: see slides to fill in gaps in this section

Category 2: surveys and interviews

Category 3: Research Involving Benign Behavioral Interventions (only cognitive/behavioral tasks)

Category 4:

Examples of Non-exempt Research:

Surveys of children

analysis of identifiable samples

intervention with patients that exceeds category 3

Examples of Medical Devices:

Prostheses

contact lenses

magnetic resonance imaging hardware and software

diagnostic software

assay for detecting antibodies in blood

olive oil!

How to Submit an IRB for review:

Application type page - pick what option your project falls under

Create a study in ARROW

amending an existing study if possible

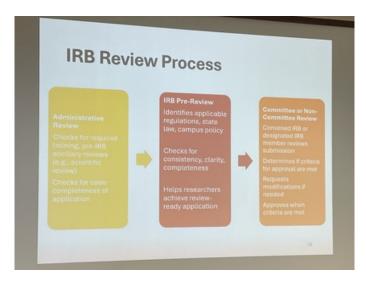
*See the image attached below for details on the IRB review process

Tips for a successful Submission:

- Do not copy old templates; templates are updated consistently on the website, so use that template directly

Conclusions/action items: Our team has been considering submitting an IRB for review in order to test our device with the patients in Dan's clinic. In conclusion, this was a very quick outline of the IRB as a whole, and we will have to look into more specifics if we decide to move forward with this plan. Additionally, our testing may be exempt or considered to be non-research.

AUBRIANNA YOUNKER - Nov 12, 2025, 1:57 PM CST



Download

IMG_2397.jpg (930 kB) IRB Review Process

AUBRIANNA YOUNKER - Nov 19, 2025, 2:01 PM CST

Title: How New Product Development Works in the Medical Device Industry

Date: 11/19/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document key parts of Russ's lecture on New Product Development

Content:

Russ Johnson, PhD - Biomedical Engineering Design and Leadership

About Russ:

BSE Biomedical Engineering, University of Iowa

MS Engineering, Clemson University

PhD Materials Science and Engineering, Clemson University

25 years of experience in the medical product industry

Selecting and Prioritizing Projects:

Corporate business strategy --> product portfolio review --> project review --> budgeting and resource allocation (this is an annual process)

Types of NPD Projects:

Line extensions - addition of additional sizes and configurations

Product improvements - existing product change due to market feedback and/or new customer needs

New to Company - product line that is new to your company, but not new to the global market

New to the World - very new and innovative products with a completely new market

NPD - Stage to Gate Process:

The Cloud - (stage 0) ideation, the initial idea

The Funnel - (stage 1 and 2) exploration and concept development (there is a gate review between stage 1 and stage 2)

The Tunnel - (stage 3, 4, 5) design development, design confirmation, and design transfer and commercialization (gate review between every step between 2-5, specifically a go/no-go response after step 2, and launch gate review after stage 5)

Case Study: Fluid Management solutions for high volume cases existing in 2007

Stage 0: choose area of opportunity (more automated, or less room for infection), review market trends and potential threats, primary and secondary market research

- They found that the users did not enjoy using the current product because it was difficult to use, smelled, and wasn't very sanitary

Stage 1: define the problem to be solved and customer requirements, review and refine initial ideas from stage 0, conduct preliminary technical scouting, and intellectual property, try to find a good balance between clinical safety and productivity

- Was trying to decide between a totally automated design vs a more manual design

Stage 2: narrow down design ideas from 8-10 to 2-3 and then 1 leading concept, develop a robust business case (process expenses, market opportunity)

-They had three main ideas, and ended up going with the second option because it looked totally different than the current market design, and it had a retractable chamber

Stage 3: move to functional prototype, continue design process including testing, confirm regulatory pathway

- They had to try lots of different bag materials to ensure they could find one that doesn't leak

Stage 4: conduct extensive verification and validation testing, finalize product and component drawings and models, "freeze" your design at this point in order to get approval from the FDA

- They had lots of precise and accurate drawings of all components to represent them best

Stage 5: complete any remaining tests, make final design changes, build molds, create instructions for use, finalize go-to-market strategy, and start limited release

- They made sure the fluid was visible to the users so they can see how much fluid there is, and so they can monitor the color of the fluid to ensure they properly help the patients

Post Market Surveillance: On a 4-6 month cadence, project teams report out to stakeholders to account for sales, business, and regulatory issues observed, complaints, products, and process improvement opportunities, and continuously track customers and salesforce feedback via interviews and surveys

Conclusions/action items: In conclusion, designing a new product in health care is especially difficult because of the regulatory side of things. It is so important to have good product design and development in order to get to market in time and to stay on top of the market. Limiting resources and time can also make the process even harder.

AUBRIANNA YOUNKER - Sep 26, 2025, 12:28 PM CDT

Title: BPAG Meeting Notes

Date: 9/26/25

Content by: Aubrianna Younker

Present: All BPAGs from every group

Goals: The goal of this entry is to document key points and notes regarding the role of being a BPAG

Content:

The easiest way to go about BPAG: Get your client to purchase things for you; alternatively, you pay and then get reimbursed later

- -It is your job to get expenses approved by your client prior to purchase
- -Any purchases over \$1000 need department approval
- -Keep track of all expenses with original receipts
- -If it is not UW funds being used, anything is fair game (ex., Amazon, etc)
- -If it is using UW funds, you have to use ShowUW+ and follow guidelines (90-day reimbursement rule)
- -Can submit a request form for BME funding for projects if there is no UW affiliation
- -Only BPAG should be making purchases and seeking reimbursements
- -Each team gets a \$50 budget in the Design Innovation Lab under account name: BMEDesign
- -If you need to exceed the \$50 budget by a lot in the Design Innovation Lab, have your client set up their own account
- -Stockroom supplies is free to all groups and clients screws, nuts, plastic

E-Reimbursement from UW-Client:

- -Start the process before the poster session
- -Orthopedics Accountant: Julia Mumms said she will not process reimbursement

Expenses that are non-reimbursable:

- -poster printing
- -lab archives notebook

The expense template is on the design website to copy

1080, blue room, can use all materials in that room (document anything used from that closet or gifted to you, can write free if you cannot find where to buy it online)

Conclusions/action items:

AUBRIANNA YOUNKER - Dec 01, 2025, 12:12 PM CST

Title: BPAG Expense Spreadsheet

Date: 10/20/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document all materials we use and their individual expenses. This helps track our budget and allows other people to replicate our device in the future.

Content:

Click the link below to see the final spreadsheet:

https://docs.google.com/spreadsheets/d/1fQt7S75i3m0mnH_JoKUPyMASEXRlpW04o7hkgurBdp4/edit?usp=sharing

(copy and paste the link into your web browser if having trouble viewing, or reach out to Aubrianna Younker at ayounker@wisc.edu)

I will also attach a PDF copy and an Opendocument below, in case these options are preferred.

Conclusions/action items: In conclusion, this spreadsheet is not only beneficial for us, but it's also beneficial for our client and any groups that may work on this project in the future. For action items, the BPAG should update this spreadsheet with as much detail as possible whenever materials are found or ordered.

AUBRIANNA YOUNKER - Dec 01, 2025, 12:12 PM CST



Download

Knee_Crutch_Expense_Spreadsheet_FINAL.ods (27.3 kB) OpenDocument Spreadsheet

AUBRIANNA YOUNKER - Dec 01, 2025, 12:13 PM CST



Download



First Round Material Order - Aubrianna Younker

AUBRIANNA YOUNKER - Oct 30, 2025, 1:33 PM CDT

Title: First Round Material Order

Date: 10/17/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document the first round of materials that we ordered.

Content:

10Sets 2020 Corner Bracket Connectors for 2020 Series 6mm Slot Aluminum Extrusion Profile Accessories(Silver) - \$12.99

quantity: 1

 $https://www.amazon.com/dp/B0B9JVW5X8/ref=sspa_dk_detail_3?pd_rd_i=B0B9JXJWY4\&pd_rd_w=jxNTk\&content-id=amzn1.sym.bbb3fb5e-28ad-4062-a3ba-1f7b9f2e4371\&pf_rd_p=bbb3fb5e-28ad-4062-a3ba-1f7b9f2e4371\&pf_rd_r=48Y58K2EQ59WEB6ES6WP\&pd_rd_wg=jNNTz\&pd_rd_r=aed37210-6e2c-44b6-8cdf-e61ba3671177\&sp_csd=d2lkZ2V0TmFtZT1zcF9kZXRhaWxfdGhlbWF0aWM\&th=1$

4 Pieces 47.2 in.T Slot 2020 Aluminum Extrusion Profile, European Standard Anodized Linear Rail, High-Strength Extruded -

\$43.70

quantity: 1

https://www.homedepot.com/p/SKYSHALO-4-Pieces-47-2-in-T-Slot-2020-Aluminum-Extrusion-Profile-European-Standard-Anodized-Linear-Rail-High-Strength-Extruded-2020OBLXC4JZ2RFAO001V0-S403/335664731#overlay

Conclusions/action items:

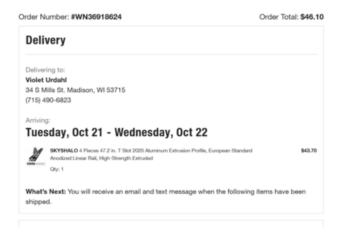
AUBRIANNA YOUNKER - Oct 30, 2025, 1:33 PM CDT



Download

The_Home_Depot_-_Order_Confirmation.pdf (240 kB) Home Depot Order Confirmation

AUBRIANNA YOUNKER - Oct 30, 2025, 1:33 PM CDT



Download

Screenshot_2025-10-17_143921.png (76.2 kB)

AUBRIANNA YOUNKER - Oct 30, 2025, 1:33 PM CDT



Download

IMG_2181.jpg (280 kB) Amazon Connecter Set Order Confirmation



Second Round Material Order - Aubrianna Younker

Title: Second Round Material Order

Date: 10/30/25

Content by: Aubrianna Younker

Present: Aubrianna Younker

Goals: The goal of this entry is to document the second round of material ordering. This way, the exact information and confirmations are all in one place to reference.

Content:

The team decided to use extruded aluminum for the foundation of the handle component since we had extra left over after constructing the base, and since it is easy to assemble. I we got, and there is still one more rod we have to connect to complete that part. This means that for both the completion of the base and the foundation of the handle, we need more 10-piece set we got the first time. It fit well with our aluminum, so it made sense to use the same ones again. The link to these can be found below with an image.

connector set link - https://www.amazon.com/Aluminum-Extrusion-Connectors-Hardware-Accessories/dp/B0FF9TCTJR?th=1

Since it was decided that the handle's foundation would also be extruded aluminum, we were able to find long aluminum handles that slide and secure right onto our rods. We orde below.

4 pack of handles link: https://www.amazon.com/uxcell-Rectangular-Aluminium-Cabinets-Garages/dp/B0DK1XT91N/ref=sr_1_1_sspa?crid=2ZORFAAJGU1BP&dib=eyJ2IjoiMSJ9.r_DJzHjYtlx 4td8y5ovBkyojYq0SNSQilsjgKCWyGxWC04eHlYtnAfylDas0FdERwbCP6dZNVgM0rhiEECvJMdJtP1EuRqFvz6igqKA7TLodbeq__ozs6QoLmHz7AtmMVNEZ8M8ApHkAX6iTC6MVozoUM0NyYt __6W8jXroGb5ETjL3xTCBMpjYaZuLFOQgFzyf0OlRnl.fEYbrgBgZQYKtHyxkhj5nYy0UBzHDEPy8OuRkeZEngs&dib_tag=se&keywords=uxcell%2B4%2Bpack%2Bhandles&qid=1761838072&s=1-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9hdGY&th=1

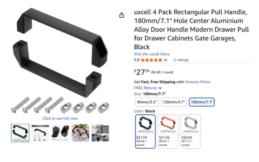
Going along with those aluminum handles, we decided to order a pack of grip tape to wrap the handles with. This will add additional grip for the users, as well as comfort and a way below.

Pack of multicolor grip tape link: https://www.amazon.com/ORBEIN-Tennis-Grip-Tape-Pickleball/dp/B0CDGVTRJ9/ref=sr_1_4?
crid=10F3Q5EZ3LREK&dib=eyJ2ljoiMSJ9.SiTgNuclo8V2qxkVxZBDTAYZo8AAhNQlxHGU4aXQsGiAkyZt8QNKhaG1lzXChMRl3ZhU2wZu8vfNKL5BH06CJFxNWX5UpvMveiyRbKnO_l0bpb0dhQzwjFcOnWHuE7HKaV8LDpU0RArTA9iht0KLucbu14G96lvt03bOyE2wFxSmXVa6yj5SF2WKK4Fi1HiJ2Yanlv5PVD6yOap_BpVsNSwXMuugVGmnXJNV9s4_xmoS69FNYidqVeNUl-qrHJbsRf8NA.SVSNvA1_xxx6wGW4uHkHqsc6txZS0rJM870ORF0EGp8&dib_tag=se&keywords=orbeez%2Bgrip%2Btennis%2Btape&qid=1761846396&sprefix=orbeez%2Bgrip%2Btennis%2B

This order came to a total of \$53.35, bringing our total budget used \$110.37. The order confirmation will be attached below for reimbursement purposes.

Conclusions/action items: This is all that was ordered in this second round of ordering. These items will help us complete the next stage of fabrication and one step closer to completion. Action the knee rest components.

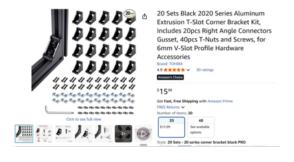
AUBRIANNA YOUNKER - Oct 30, 2025, 1:33 PM CDT



Download

 ${\bf Screenshot_2025\text{-}10\text{-}30_132357.png} \; \textbf{(404 kB)} \; \textbf{Handle Product Image}$

AUBRIANNA YOUNKER - Oct 30, 2025, 1:33 PM CDT



Download

Screenshot_2025-10-30_125941.png (583 kB) Image of Connector Set

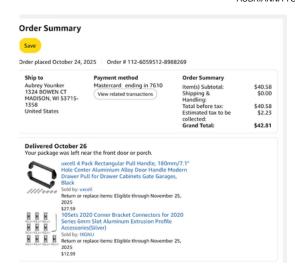
AUBRIANNA YOUNKER - Oct 30, 2025, 1:34 PM CDT



Download

Screenshot_2025-10-30_132500.png (629 kB) Grip Tape Product Image

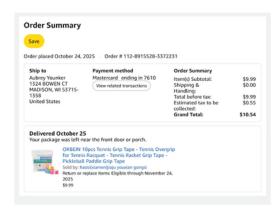
AUBRIANNA YOUNKER - Oct 30, 2025, 1:34 PM CDT



Download

IMG_2261.jpg (398 kB) Order Confirmation

AUBRIANNA YOUNKER - Oct 30, 2025, 1:34 PM CDT



Download

IMG_2262.jpg (309 kB) Order Confirmation

How long should patients be kept non-weight bearing after ankle fracture fixation?

Tess FITZGERALD - Sep 16, 2025, 12:18 PM CDT

Title: How long should patients be kept non-weight bearing after ankle fracture fixation?

Date: 9/16/2025

Content by: Tess Fitzgerald

Present: N/A

Goals: Get some background information on non-weight bearing injuries and the recovery process for patients that may be using the team's device.

Citation: Swart, Eric, et al. "How Long Should Patients Be Kept Non-Weight Bearing after Ankle Fracture Fixation? A Survey of OTA and AOFAS Members." *Injury*, vol. 46, no. 6, Jun. 2015, pp. 1127–30. *ScienceDirect*, https://doi.org/10.1016/j.injury.2015.03.029.

Link: How long should patients be kept non-weight bearing after ankle fracture fixation? A survey of OTA and AOFAS members - ScienceDirect

Content:

Older patients (age 60-70) with medical comorbidities reported an average time of non-weight bearing recovery to be 7.6 weeks. This was significantly different than for young, healthy patients (4.9 weeks).

The ideal time of non-weight bearing for various injuries has not been objectively established.

Patients in this survey were described as having one of three injuries: supination external rotation type 4, bimalleolar ankle fracture, or trimalleolar ankle fracture.

The factors that played a role in surgeons' decision regarding length for patient non-weight bearing:

- 1. Bone quality (79%)
- 2. Medical comorbidities (77%)
- 3. Type of fracture (64%)
- 4. Presence of osteoporosis (50%)
- 5. Age of patient (43%)

Conclusions/action items: When brainstorming the device, the team should consider the demographic of users. Given the age of patients being older, the team should expect the device to provide assistance for longer periods of time, and provide significant stability to ensure users won't have to rely on self-stabilizing.

Tess FITZGERALD - Oct 08, 2025, 11:36 AM CDT

Title: Human Leg Dimensions

Date: 10/8/2025

Content by: Tess Fitzgerald

Present: N/A

Goals: Finalize device dimensions based on human anthropometric data.

Citation: Ergonomics Resources and Tools - The Ergonomics Center. 11 Mar. 2021,

https://ergocenter.ncsu.edu/resources-and-tools-hub/.

Link: Anthropometry-Summary-Table-2020.pdf

Content:

The 50th percentile measurement from below the knee to the foot, the dimension of the leg that will be assisted, is 16.93inches for men and 15.24inches for women. The client requires that the device depth come below that length.

Conclusions/action items: Depth of device is an important consideration in utilization. This anthropometric data should be reference when determining the dimensions.



Tess FITZGERALD - Sep 15, 2025, 10:30 PM CDT

Title: iWalk Crutch

Date: 9/15/2025

Content by: Tess Fitzgerald

Present: N/A

Goals:

Citation: "iWALK Crutch Introduction." *iWALKFree*, https://iwalk-free.com/product-

introduction/. Accessed 15 Sep. 2025.

Link: The Best Crutch Substitute: Introducing the iWALK Crutch

Content:



Assistive device used for walking and climbing stairs. This device implements an adjustable height feature, allowing for users of various age and height. It also uses an adjustable thigh support feature, where users can strap the device onto their legs for optimal security. However, this is not ideal for the client's use, as his patients are looking for a quicker, less complex method for ascending/descending stairs. The iWalk additionally features a disk foot that provides stability for the user as weight is applied.

iWalk is intended for single user, under 126kg with need for single lower limb unloading during walking in normal indoor and outdoor environments between 0-40 degrees celsius.

This device is a very successful product for users recovering from a leg injury. It provides ample security with multiple strap-in features, allowing for users to walk confidently. The team should implement many of iWalks characteristics, including the stabilizing foot and cushioned knee pad. However, the team's device must be suitable for quick accessibility and be user friendly for elderly patients (60+ years old), so the iWalk does not make a good fit. Its functionality is too complex and is not designed to be put on and taken off in short periods of time.

Conclusions/action items: This competing design was a valuable design to look at. It possesses many of the features outlined in the team's PDS, and provides a good starting point for some basic specs including weight, height adjustability, and stabilizing features. The team should reference this design in choosing an appropriate operating environment and weight bearing capacity.



Assistive devices for elderly mobility and rehabilitation

Tess FITZGERALD - Sep 16, 2025, 12:41 PM CDT

Title: Assistive devices for elderly mobility and rehabilitation

Date: 9/16/2025

Content by: Tess Fitzgerald

Present: N/a

Goals: Learn some background information regarding assistive devices used for elderly patients to become more knowledgeable on what the team's demographic has access to currently.

Citation:

Goher, K. M., and S. O. Fadlallah. "11 - Assistive Devices for Elderly Mobility and Rehabilitation: Review and Reflection." *Assistive Technology for the Elderly*, edited by Nagender Kumar Suryadevara and Subhas Chandra Mukhopadhyay, Academic Press, 2020, pp. 305–41. *ScienceDirect*, https://doi.org/10.1016/B978-0-12-818546-9.00016-6.

Link: Assistive devices for elderly mobility and rehabilitation: review and reflection - ScienceDirect

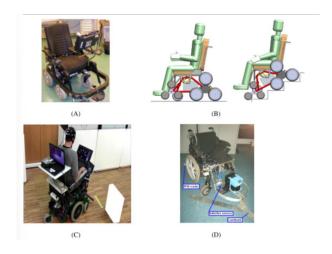
Content:

More than 30% of older adults aged 65 and above experience fall every year.

As people age, their ability in maintaining balance reduces, causing an increase in the incidence of fall.

Canes are the simplest and most common assistive device to help people with balance disorders. 42% of assistive devices' users use canes. Presents light support. Made of strong woods such as oak and walnut; metals such as titanium and aluminum; plastics; and fiberglass. Height adjustable canes are typically made with aluminum. Canes have either a single rubber tip bottom, a four-rubber tip bottom, or may use wheels on the bottom.

Wheelchairs are another common mobility device; however, these provide the ability for patients suffering severe mobility disorders to sit and transport indoors and outdoors. They include manual and motorized. Some wheelchairs have been developed to allow for climbing stairs.



Conclusions/action items: There seems to be significant access to devices that can either provide ultimate assistance (wheelchair) or very minimal assistance (cane). There doesn't seem to be a device that can provide the means for sufficient mobility without relying on user stability. It is important that the team considers both mobility and stability as the users will need to ascend and descend stairs but won't have the strength needed for something like a cane or walker.

Tess FITZGERALD - Sep 23, 2025, 2:33 PM CDT

Title: Design Idea - The Frankenstein

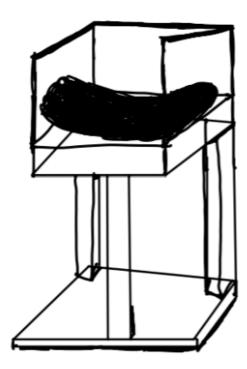
Date: 9/23/2025

Content by: Tess Fitzgerald

Present: N/a

Goals: Sketch a final design for the matrix following the team meeting where possible design ideas were shared.

Content:



this is the final design. It incorporates a flat base with rubber (anti-slip) bottom, three legs for able lateral and medial support, a concaved platform and cushion for the leg to rest on and be supported by. The design also uses two side hand rests as well as a front hand rest for ease of use when lifting the support up/down the stairs.

Conclusions/action items: The team will add this design to the final matrix, weight the three possible designs, and begin writing explanations for each criteria as well as design description paragraphs.

Tess FITZGERALD - Nov 19, 2025, 6:34 PM CST

Title: SolidWorks Knee Rest Component file

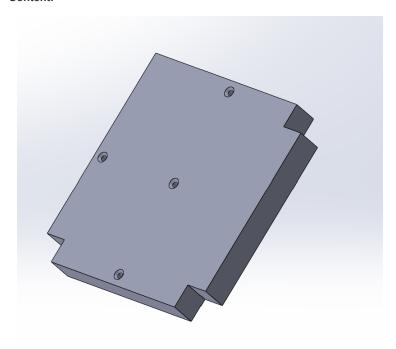
Date: 11/19/2025

Content by: Tess Fitzgerald

Present: na

Goals: document the solidworks file for the knee rest to be stored for 3D printing

Content:



Conclusions/action items: see attached file for access to solidworks file.

Tess FITZGERALD - Nov 19, 2025, 6:34 PM CST



Download

knee_crutch_1_in_block.SLDPRT (113 kB)



Human Subject Research Training (Citi program)

Tess FITZGERALD - Oct 23, 2025, 12:19 PM CDT

Title: Human Subjects Research Training

Date: 10/23/2025

Content by: Tess Fitzgerald

Present: n/a

Goals: Get trained on human subjects research

Content:

See attached file for documentation of completed training.

Conclusions/action items: Implement these principles when conducting the teams human subject research on the prototype.

Tess FITZGERALD - Oct 23, 2025, 12:19 PM CDT



Download

Human_Subjects_Research_Training_CITI_Program_.pdf (78.6 kB)

Tess FITZGERALD - Sep 10, 2025, 2:05 PM CDT

Title: Lecture 1: 9/10/2025

Date: 9/10/2025

Content by: Tess Fitzgerald

Present: BME 300

Goals: Learn about BME career prep and resources

Content:

- · Keep track of what you do
- · Do not use websites like indeed or google jobs to apply
 - · Go through the direct company application
 - Handshake
 - Linkedin
- Connect with a person in-person so that your application online becomes more valuable and you have the ability to follow up
- Apply even if the position isn't a "perfect" role for your goals
 - Getting experience is the most important thing
- Resume should be high-level (not super detailed)
 - Tailor your resume to the position quick changes
 - Create balance show a full picture of your experience
 - Always review and update your resume
- You are responsible for the why
 - What makes you a good candidate
 - · Be confident and articulate
- · Industries in Handshake
 - Healthcare, government (intelligence), manufacturing, management consulting, research, scientific and technical consulting

Conclusions/action items:

With the career fair next week, I will begin researching companies that will be attending. I will update my resume to make sure its clear and confident. I will also prepare what I want to say to each company, to ensure I am articulate and can confidently demostrate my pitch.

Tess FITZGERALD - Sep 17, 2025, 2:03 PM CDT

Title: Lecture 2: Exploring your Leadership Style

Date: 9/17/2025

Content by: Tess Fitzgerald

Present: BME 300

Goals: Learn how to be good leader for the BME 200s

Content:

It's important for a leader to be supportive and open to new ideas, but also confident and communicative with decision making in the ideas that should be chosen.

- -Personal (self-awareness and management)
- -Interpersonal (Recognizing and responding to others' needs, active listening, building trust, engaging in difficult conversations)
- -Team (Facilitate team interactions, support others' development, empower others)
- -Organization (Collaborate beyond individual teams)

Use CliftonStrengths to get better information on individual skills/style one might lead

Three Leadership Styles:

Power model - being in control is the most important thing; only certain people are bord to lead

Servant model - being of service to others, sharing power, listening/understanding, empowering

Authentic model - building self-esteem, transparency, genuineness, honesty, creating authentic relationships

-Discussed experiences with each leadership model; Being lead through the authentic model is usually a good experience for all parties. The power model does not usually make a very enjoyable environment. There is often tension between the team members and leader because it feels like there is a wider gap between them (less fostering of a collaborative environment).

I think the best fit for my strengths is the process-oriented leader. I am a very organized person, and I enjoy planning/maintaining and clear schedule.

- -Leadership doesn't require a particular job title (leading others starts with leading yourself!)
 - -Self-assess (what do you enjoy, what are you good at, what motivates you, where do you show up well)
 - -Seek out feedback (others may be able to identify strengths and areas for improvement)

Goal Setting:

1. I want to become more personable within my team by building a stronger relationship with each member. I plan to do achieve this goal by attending team meetings with a positive attitude and asking members open-ended questions to allow for positive discuss and sharing of ideas. I hope to make the team feel comfortable in collaboration.

Conclusions/action items: After this lecture, I think it's important to reflect on how I can be a leader for my team despite not holding the official team leader title. I want to empower my team to be creative and collaborative with each other so we can be as successful as possible. I also want to implement some process-oriented leadership qualities. I hope to keep my team very organized so everyone has a vital role and we all know the task we must do individually to be successful as a whole.

Tess FITZGERALD - Sep 24, 2025, 2:07 PM CDT

Title: Lecture 3: 9/24/2025

Date: 9/24/2025

Content by: Tess Fitzgerald

Present: BME 300

Goals: Learn how to be a good mentor to my BME 200s.

Content:

Why are we mentoring BME 200 students?

It's a good way to guide BME 200s with a design project. They have no context, and we have the experience of being a BME 200 to help them through it. Its also a good way for us to learn how to lead and be a confident and supportive leader. Additionally, it can be a way to show BME 200s what is ahead in their academic career in general, they can ask questions about classes, and we can give advice on our experience as a BME student. Lastly, it gives a good introduction in how real-life careers work. There will be people above you and below you and its important to learn how to navigate those dynamics in a professional way.

General benefits of mentoring

- -Increased self-esteem/confidence
- -Increased patience
- -Build positive habits because you are the role model
- -Foster personal growth
- -Help identify gaps in your knowledge
- -Feel accomplished

What does it mean to be a good mentor?

Be communicative, patient, and open to helping in different ways (not just BME 200/300 related).

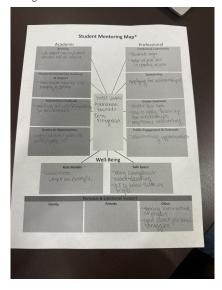
Building trust and making clear that they can share things with you without fear. Be reliable and have enthusiasm. Humanize their challenges (acknowledge things can be changeling and their feelings are valid and also there are solutions).

During meetings - get rid of distractions, be engaged with them, get the main idea, and ask questions. React to ideas, not to the person.

What did you wish you knew in BME 200?

- -How to use LabArchives
- -How to use the online library/database
- -How to cite things properly
- -Deadlines/personal expectations

The teams mentor map:



Conclusions/action items: After this lecture, the other BME 300s and I will implement the skills and advice suggested to be good mentors for our BME 200s.

Tess FITZGERALD - Oct 01, 2025, 1:59 PM CDT

Title: Lecture 4: 10/1/2025

Date: 10/1/2025

Content by: Tess Fitzgerald

Present: BME 300

Goals: Learn how to apply sustainability to BME

Content:

Presenter: Andrea Hicks (Sustainability in design)

- -Glass is not very economically valuable to recycle
- -Circular economy: how economically valuable it is to recycle a material. What is the environmental impact? How do they compare?
- -Sometimes environmental and economic assessments go hand in hand (beneficial to both).

Need to consider what goes into upkeeping a reusable device (cleaning supplies, labor, etc.) vs materials use for a disposable device. Another consideration is the frequency of use when deciding between a reusable or disposable device. Availability is another consideration (is the disposable device readily available?).

Infection is another factor that has to be considered within sustainability. How well does it need to be cleaned? What supplies will need to be cleaned?

How do we use these tools to engineer a more sustainable world?

- -Always have to weigh environmental factors, economic factors, and supply restrains when making decisions on design fabrication, materials, usability, etc.
- -Target audience is also going to affect how each factor is weighed (who finds what more important)

Conclusions/action items: When making decisions for design prototype, the team has to consider the environmental factors that come from material choices and fabrication procedures. We should consider how our target audience and client are going to alter the importance of economic factors vs sustainability factors vs supply restraints. Disposable vs reusable debate should also be considered (does the device need to be sanitized?). Lifetime of the device should also be considered (what materials are going to be more durable? What materials are going to be more cost efficient?).

Tess FITZGERALD - Oct 08, 2025, 2:08 PM CDT

Title: Lecture 5: Patents and licensing with WARF

Date: 10/8/2025

Content by: Tess Fitzgerald

Present: BME 300

Goals: Learn about IPs

Content:

Speakers - Jeanine Burmania and Justin Anderson

Four common types of IP:

- 1. patents
- 2. copyrights
- 3. trademarks
- 4. trade secrets

Other, WARF IP:

- -Biomaterials
- -Techniques and know how
- -Data

Overview of non-patent IP

Copyrights:

- -Protection for creative works that are expressed in a tangible medium
- -A wide range of subject matter, including software code

Trademarks:

- -Protection for names, marks, logos
- -Requires use in commerce
- -Source-identifying function

Trade Secrets:

-Can be used to protect anything of value

Patent - a property right, granted by a government agency. Patent holder has right to exclude others from making, using, selling, or importing the claimed invention.

Three types of U.S patents:

- 1. Design (15 yr term)
- 2. Plant (new variety)
- 3. Utility

Utility (non-provisional) patents:

- Issued for the invention of a new and useful process, machine, manufacture, or composition of matter
- -Applicant gets a time limited monopoly on your invention (20 years from filing)
- -Often takes 2-5 years to issue after filing (patent examination)
- -Cost, on average, \$30K mostly attorneys' fees
- ~90% of patents issued by USPTO are non-provisional utility patents

Requirements for patenting

- 101 Eligible; cannot be a product of nature
- 102 Novel; it must be new
- 103 Non-obvious; it cannot be simple modification or combination of existing concepts
- 112 Enabled and described; must provide enough detail to teach others how to make or use the invention

WARF receives approx. 400 new innovation disclosures each year

Disclosing:

- -Describe the innovation
- -Identify its advantages and potential applications
- -Name contributors
- -Provide funding and public disclosure details

Meeting with WARF:

- -Discuss the innovation in more detail
- -Ask questions about WARF and patenting processes
- -Discuss next steps

Decision on accepting an innovation in their profile based on

- -IP Considerations
- -Licensing Considerations

Value of licensing:

Benefits to the company - reduced R&D costs, improved time to market, opportunity to enter new markets and expand company quickly, provide additional revenue opportunities

Determining the Value - technology application, key selling points, technology trends, market size, industry standards

AI and IP:

Patents - can Al invent (no); limited to US only (no); can Al assist in inventing (likely yes under Pannu Factors)

Copyright - original works of human authorship

Conclusions/action items: Think about what patenting would look like for the teams' design - is it a possibility? what resources/time/contacts would be needed?

Tess FITZGERALD - Oct 15, 2025, 2:15 PM CDT

Title: Bioengineer it, Protect it

Date: 10/15/2025

Content by: Andrea Arndt

Present: BME 300

Goals: Learn about the legal side of engineering

Content:

- IP protection allows research to safely transfer into products, processes, and/or systems

medical device -> patent filing -> marketplace

- IP enables investment, partnerships, and ethical competition

Legal career paths for engineers in IP:

- -technical advisor (no law degree or patent bar needed)
- -patent agent (patent bar needed)
- -patent examiner (patent bar eventually)
- -patent attorney (law degree + patent bar)
- -patent litigator (law degree)
- -tech transfer manager (stem degree preferred)
- -engineer (stem degree, work with IP lawyers to protect your inventions)

How do engineers influence law and innovation?

- -research
- -analytical reasoning
- -communication
- -creativity (problem solving)
- -collaboration (cooperate with colleagues and external professionals)

University: disclose before publishing; university owns IP

Company: employer typically owns inventions, trademarks, copyright

Timing & Publication

- -disclose internally first
- -publishing before filing and offer for sale = lost patent rights abroad and possible loss of rights in the $\overline{\mathsf{US}}$
- -first to file system (not first to invent)

What makes an invention patentable?
-novelty: must be new
-non-obvious: more than a routine change
-utility: must work (don't need a physical prototype)
-enablty: be able to explain how to make it
What is a patent?
-stops other from making, using, selling, or importing the invention
-Two main types:
1. Utility: protect how a product works or is made (20yrs)
2. Design: protect the unique visual appearance of a product (15yrs)
-patents are especially critical in BME, where innovation drives competitive advantage
Parts of a patent:
- front page
- drawings
- specification (written explanation how to make and use invention)
-claims (the more claims, the smaller the fence)
-abstracts
Counterfeit in medical field:
-counterfeits threaten patient safety, reputation, etc
Conclusions/action items: This presentation was super informative and taught me that you must protect your innovation if it makes

Conclusions/action items: This presentation was super informative and taught me that you must protect your innovation if it makes sense to do so economically. Also I had always wondered how genaric brands were making money off medicine like advil with but now I know the patent only lasts for 20years.

Tess FITZGERALD - Oct 22, 2025, 2:01 PM CDT

Title: Lecture 7: Advising day II - Post-graduate Planning

Date: 10/22/2025

Content by: Dr. John Puccinelli

Present: BME 300

Goals: Get some tips and info on post graduate planning

Content:

- -Use undergraduate experience as a way to "build a story" (it's easier to do this in school. ex: research, volunteering, tutoring, etc.)
- -Research what does your ideal career look like? What programs have the opportunities you are looking for?

Graduate school options

- Masters: stepping stone / change directions / gain depth / expand credentials for future; generally, ONE YEAR; industry focused
- Doctoral, PhD: Desire to be an independent researcher; write research grants; work in academia

Three MS options within BME - 24 credits

- Research (1.5 to 2 years)
 - o for those continuing on for a PhD here
 - Can be funded RA/TA/PA
 - Thesis required (Must have PI identified)
- Accelerated Programs (1 year)
 - Funding stipend only (no tuition remission)
 - No co-op allowed
- Biomedical Innovation, Design, and Entrepreneurship
 - Project based project required
 - · Partnership with business school

Find people/places that are doing what you like!!!

Research - demonstrates skills outside classroom

- · Convince them you can make the jump from textbooks to the real-world
- · Utilize BME design projects
- · Build skillset to get into lab
- · Get published

Conclusions/action items: Based on this lecture, it's really important to get research experience to demonstrate my ability to consolidate my work, even if I plan to go to industry. It's crucial to be able to write/tell my story in a cohesive way that puts my best foot forward.

Tess FITZGERALD - Oct 29, 2025, 2:12 PM CDT

Title: Lecture 8: To Regulate, or Not to Regulate...That is the Question

Date: 10/29/2025

Content by: Tess Fitzgerald

Present: BME 300

Goals: Understand the benefits and drawbacks of regulation and FDA approval

Content:

Three major centers of FDA: CDRA, CBUR, CDUR

- -Regulatory Pathway: Do the benefits outweigh the risks.
- -FDA does not approve materials; titanium is approved for hip replacement, not approved for contact lens
- -Class I: don't really need FDA approval (not enough risk involved)
- -Class II (moderate risk): need a 510k
- -Class III (High risk): need a PMA (reasonable assurance of safety and efficacy)

510k De Novo - no predicate device to compare to

Can be approved by FDA but still need post market requirement (need to do a study that is bigger and confirm that expanding to larger scale won't cause significant failure)

-sometimes it takes years to identify a failure from a device/drug/etc.

FDA did not regulate medical devices before 1976

Regulation come about from events (they don't just come out of nowhere to make it more difficult to get on the market)

Failure mode and hazard analysis - what is every possible thing that could go wrong (high level), how to can it be minimized, then what failures could go wrong given failure modes at every component

Conclusions/action items: There is a lot of components and areas for failure when getting FDA approval (from supply chain, to clinician use, animal studies, etc.). Very interesting lecture!

Tess FITZGERALD - Nov 05, 2025, 2:10 PM CST

Title: Lecture 9: Regulatory Strategy - The Framework Guiding Advanced Therapeutic Product Development

Date: 11/5/2025

Content by: Cathy Rasmussen and William Murphy

Present: BME 300

Goals: Overall structure of FDA, including framework of laws, regulations, and guidances for advanced therapeutics

Content:

Speaker: Bill Murphy

- Device (CDRH)
 - PMA (premarket approval)
 - 510(k)
 - IDE (investigational device exemption)
- Drug (CDER)
 - NDA (new drug application)
 - IND (investigational new drug trial)
- · Biologic (CBER)
 - BLA (biologics license application)
 - IND (investigational new drug trial)

FDA Framework:

- U.S. Laws (made by Congress)
- Regulations CFR Title 31 (made by FDA based on laws)
- FDA Guidance (made by FDA with help from the public to help industry and the public interpret regulations)

Dramatic Implications: 351 vs 361

Human cells, tissues, and cellular and tissue-based products

- 1. Minimally manipulated?
- 2. Homologous use? (same function)
- 3. Combined with another article?
- 4. Systemic effect of dependent on metabolic activity of the cells

Answers for the requirements that distinguish 351 and 361:

361 (yes, yes, no, no)

351 (if any of those requirements answer different than 361)

***351 is considered a biologic so it requires FDA approval and will take a lot longer to reach market compared to 361!

***361 is not considered a biologic and therefore does not require FDA approval and is largely unregulated

Essentially each decision/point on the path is noted as an area for risk. It will get kicked to 351 if it does not "pass" that decision/point.

Target Product Profile (TPP)

- · Like a PDS for a therapeutic product
- · Start with what you know, add detail as you go
- Core Info
 - · Route of administration
 - What is the dose (daily, weekly, etc.)
 - What is the indication and target patient
 - Dose form
 - Safety
 - Efficacy
- · Clinical Development Planning
 - What is the clinical pathway
 - What is the regulatory pathway
 - Timeline
 - Cost
 - Risk
- CMC
 - Product attributes
 - Purity
 - Biocompatibility
 - Storage
 - Stability
 - Container
 - o Pharmacopeial compliance

Next you will share your TPP to get answers on:

- · Will patients and prescribers want it?
- · Will regulators accept it?
- Will payers reimburse for it?
- Is the cost and timeline reasonable?
- · What are the risks?

Considerations when developing a 351-Regulated CGT

- · Prove potency
- Prove good manufacturing practices/process

Quality Management System

- A system that documents policies, processes, internal rules, procedures, and other records to ensure consistent quality
- · Extremely important and tedious but required in essentially all therapeutic product development

Conclusions/action items: Understanding QMS documentation is extremely important and getting exposed to it early is going to give me a leg up because having and following a QMS is a requirement for any company that I may work for. I had never heard of a TPP but it's nice that I've been exposed to something similar with the PDS's that we make in all the design courses. I also just learned that the company I interned for this summer was producing a 351 CGT product, which I had not realized!

Tess FITZGERALD - Nov 07, 2025, 12:51 PM CST

Title: Tong Distinguished Entrepreneur Lecture

Date: 11/7/2025

Content by: Kristin Myers

Present: BME undergrads

Goals: Hear from a successful woman and how she got to where she is

Content:

Speaker: Kristin Myers

-Earned her BS in BME at UW-Madison and MBA at Harvard

-Spent her career trying to fix the healthcare system across different sectors of the industry

Some notes/takeaways from her:

-First chapter of her career focused on herself (getting experience, proving her worth in the industry, making herself known), second chapter focused on how to operate a team and make a bigger impact (having the IQ and EQ to run a team and navigate larger responsibility)

What does a great healthcare system look like?

- -Quadruple aim (improved provider experience, improved patient outcomes, lower cost of care, improved patient experience)
- -18% of GDP spent on healthcare in the United States (2X more than other countries)

Primary care doctors are not making nearly as much money as specialty doctors, which is an issue because preventative primary healthcare is really important and also it's an issue if people aren't choosing to become a primary care doctor because of the pay

Final Takeaways:

- 1. Work Hard and Build Range (take on the hard projects, classes, and experiences)
- 2. Seek Diverse Exposure (she lived in Boston, Minneapolis, San Diego, Silicone Valley, etc. with completely different positions doing different things and it helped her learned what she likes/doesn't like and was able to progress forward in a way that made life super rewarding and fulfilling)
- 3. Chose You People Wisely (surround yourself with curious, driven, high-integrity people. They will shape who you become)
- 4. Know Your Values & Protect Them (define what matters most family/friends, health, career/impact, values and make decisions that align)
- 5. Embrace Challenge & Keep Growing (run towards hard problems. growth lives on the edge of discomfort where big impact starts)

You get to choose how you want to embrace every moment in your life and career - you can make decisions with fear, or you can make them with curiosity (we have made it further than most people in this country will ever have access to. that is so powerful!!!! be proud of yourself)

Conclusions/action items: Having a schedule and prioritizing your energy and peace will take you far. Be ok with letting things go that are not your priority. She was very inspiring, and I appreciate her authentic, confident, and driven energy.

Tess FITZGERALD - Nov 12, 2025, 2:02 PM CST

Title: Lecture 10: An Introduction to Research and the IRB

Date: 11/12/2025

Content by: Stephanie Metzger

Present: BME 300

Goals: Learn how to navigate the Institutional Review Board

Content:

Speaker: Stephanie Metzger who is an IRB analyst at UW-Madison

Historical problematic research:

-US Public Health Service Untreated Syphilis Study at Tuskegee

-Willowbrook State School hepatitis experiments

Participates were not given consent, and it was often dangerous

Ethical Research Frameworks:

-Implemented voluntary consent for participants

Belmont Report:

- Respect for Persons/Autonomy
 - "The principle of respect for persons thus divides into two separate moral requirements: the requirement to acknowledge autonomy and the requirement to protect those with diminished autonomy."
- Beneficence
 - Maximize possible benefits and minimize possible harms
- Justice
 - "Who ought to receive the benefits of research and bear its burdens?"

Applying the Belmont principles

- 1991 Department of Health and Human Services (DHHS) 45 CFR 46
 - Common Rule
 - Criteria for approving research
 - Protections for vulnerable groups
 - Requirements for IRB operations
- 2018 Revised Common Rule
 - Modifications to reduce administration burden

IRB Composition

- · Diversity of membership required
 - o Race, gender, cultural backgrounds
 - Scientific expertise
 - MD, PHD, MPH
 - Faculty, clinicians
 - Non-scientists
 - Community members
 - IRB staff

IRB Purpose

- · Protect rights and welfare of people enrolled in research
 - Participants/subjects

IRB Review Requirements

 UW-Madison requires IRB review of all research involving human subjects, including exempt human subjects research

Common Rule Criteria

- Risks must be reasonable in comparison to the risks (does not mean there won't be risk)
- Equitable selection of subjects
- · Informed consent
- · Privacy & confidentiality

Human subject defined under the Common Rule as:

• "a living individual about whom an investigator conducting research: (1) obtains information or biospecimens through intervention or interaction with the individual; or (2) obtains, uses, studies, analyzes, or generates identifiable private information or identifiable biospecimens"

Not Considered Research:

· QI/PE projects do not meet the definition of research

De-identifying Data

- · Directly Identifiable
 - · Identifier included with data
- Coded/Indirectly Identifiable
 - o Identifiers removed from data but linked via study ID code
- · Anonymized/Deidentified
 - All identifiers removed

- Prostheses
- · Contact lenses
- Magnetic resonance imaging hardware and software
- · Diagnostic software
- · Assay for detecting antibodies in blood
- · Bandage adhesive
- Olive oil (used to remove drugs)

How to submit a study

- · create a study in ARROW
- · amend an existing study if possible

IRB Review Process

- administrative review (checks for required training)
- IRB pre-review (checks for consistency, clarity, completeness)
- Committee or Non-Committee Review (determines if criteria for approval are met)

After approval....begin your study!

- if you want to change protocol must have approval of change before implementing the change
- · if something unexpected happens must report it
- Annual progress reports must be submitted for some non-exempt studies

Conclusions/action items: The team considered submitting an IRB for testing the device, however, the team spoke with the client and determined it would not be necessary. This lecture was very informative and was a good review from the human subjects training that was completed last week.

Tess FITZGERALD - Nov 19, 2025, 2:06 PM CST

Title: Lecture 11: "How Medical Product R&D works in the industry"

Date: 11/19/2025

Content by: Dr. Russ Johnson

Present: BME 300

Goals: Learn the processes for project selection of R&D of a medical product

Content:

Speaker: Dr. Russ Johnson

Selecting and prioritizing projects

- Define how the business will sustain itself over the next 3-5yrs
- Define which product categories to develop, to sustain, and to eliminate
- Select and prioritize projects to support over next 1-3 yrs
- · Allocate budget and resources based on project prioritization

NPD (new product development) in the medical device industry is:

- -highly regulated
- -expensive
- -resource intense
- -competitive

Typical NPD Team Members

- Product Development Engineer
- Marketing
- Project Manager
- · Quality Assurance
- Clinical/Regulatory Assurance
- · Manufacturing Engineer
- · Packaging Engineer
- Legal
- Finance
- Sales Reps

Managing NPD: Stage-Gate Process

- · Stage 0: Ideation
- Stage 1: Exploration
- Stage 2: Concept Development
- Stage 3: Design Development

- Stage 4: Design Confirmation
- Stage 5: Design Transfer & Commercialization
- Post-Market Surveillance

Case Study

Stage 0: Ideation

Typical Activities:

- · Chose area of opportunity
- · Review market trends and/or competitive threats
- Conduct primary and secondary market research
- · Identify customer unmet needs
- Create high-level, "back of the napkin" ideas

In the speaker's case, they identified that the area for opportunity was improving the enzymatic cleaning process and fluid collecting process

Stage 1: Exploration

Typical Activities:

- Define problems to be solved and customer requirements
- · Review, refine, and screen list of ideas from Stage 0 for exploration
- Create concepts for 8-10 ideas
- Develop high-level business case
- Conduct preliminary technical scouting and intellectual property landscaping

In the case study, there arrive with 8 preliminary ideas that address the identified areas for opportunity in stage 0

Stage 2: Concept Definition

Typical Activities:

- Down-select from 8 to 1 leading concept
- Develop robust business case including market opportunity, initial forecast, and projected expenses
- Conduct comprehensive IP examination
- Next Gate Review is "go/no go" business decision

In the case study, they arrived at a final leading concept and evaluated the business opportunity before beginning development

Stage 3: Design Development

Typical Activities:

- Move to functional prototype
- · Continue iterative design process including initial testing and reviews with customers
- · Confirm regulatory pathway

• Begin formal Design Control documentation

Case study, they created a functional prototype and tested it

Stage 4: Design Confirmation

- Conduct extensive verification and validation testing
- · Finalize product and component drawings/models
- Accelerate manufacturing process development along with plans for quality control (make vs. buy)
- "Freeze" design at the end of this stage
- Submit Regulatory documentation (ex: FDA 510(k)

Stage 5: Design Transfer & Commercialization

Typical Activities

- · Complete any remaining testing
- · Make final design changes
- · Build molds, assembly/test equipment
- · Create Instructions for Use (IFU) and user manuals
- · Develop service plan and resrouces
- Finalize go-to-market strategy and start limited release (if applicable)

Post Market Surveillance

Typical Activities

- Regulatory agencies expect that companies are monitoring and documenting customer complaints and field issues post launch
- Companies continuously track customer and salesforce feedback via interviews and surveys
- On a 4-6month cadence, project teams report out to stakeholders:
 - Account sales
 - Business and regulatory issues observed
 - Complaints
 - Product and process improvement opportunities

Summary

- Medical device development is an expensive, complex, and high-collaborative effort
- Having limited resources, most businesses have instituted processes like Stage-Gate to reduce risk and increase probability of success
- Good product design and development is necessary for commercial success but not sufficient!

Conclusions/action items: Overall, the product development process for medical devices is an especially tedious and challenging industry given the intensive regulation and cost strains. Being able to accurately evaluate the profitability of project idea and chose the ideas that will be most successful is crucial to the survival to a company.

Lauren Anderson - Sep 19, 2025, 12:04 PM CDT

Title: Lower Limb Stress Injuries

Date: 9/17/25

Content by: Lauren Anderson

Present: Lauren Anderson

Goals: Understand what biological concerns may require a patient to need a knee crutch

Content:

- 90% of stress injuries occur in the lower limb areas
- displacement stress fractures can have a higher degree of issues
- there is a clear different between low risk and high risk fractures
- can see low risk injuries on a radiograph alone
- high risk fractures have an increased risk of fracture propagation, delayed union, or non-union
- high risk fractures usually occur on tension side of the bone
- grade 4 injuries require casting for around 6 weeks

Conclusions/action items:

- there are high risk injuries that need the patient to be non weight bearing
- though these are important biological factors these athletes that the study looks at could probably use regular crutches
- look at how the foot is placed in the prototype in order to lessen contact and pain
- Continue to look at how these high risk injuries present themselves in an older demographic

Location of use	Generic	Generic	Navicular	5 th Metatarsal Base
Grade 1	STIR signal change	periosteal edema - bone marrow normal	Dorsal cortex involved	Acute fracture line, no intramedullary sclerosis or periosteal reaction
Grade 2	STIR and T2 change	periosteal and bone marrow edema - T2 change only	Dorsal cortex and body involved	Widened fracture line with intramedullary sclerosis and periosteal reaction
Grade 3	STIR, T1 and T2 change - no fracture line present	periosteal and bone marrow edema - T1 and T2 change - no fracture line	Dorsal and Volar cortices involved	Widened fracture line with complete intramedullary sclerosis and periosteal reaction
Grade 4	STIR, T1 and T2 change - fracture line present	periosteal and bone marrow edema - STIR, T1 and T2 change - fracture line	-	- Feedback

Robertson, Greg A J, and Alexander M Wood. "Lower Limb Stress Fractures in Sport: Optimising Their Management and Outcome." *World Journal of Orthopedics*, vol. 8, no. 3, Mar. 2017, pp. 242–55. *PubMed Central*, https://doi.org/10.5312/wjo.v8.i3.242



Lower limb stress fractures in sport: Optimising their management and outcome

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Injury Risk Factors in an Older Demographic

Lauren Anderson - Sep 19, 2025, 12:37 PM CDT

Title: Injury Risk Factors in an Older Demographic

Date: 9/19/25

Content by: Lauren Anderson

Present: Lauren Anderson

Goals:

- Understand what injuries may affect an older demographic

- Look at stability issues in an older demographic to better understand the requirements for our product
- Understand what safety and stability factors should be implemented into our project

Content:

- over 33% of community-dwelling people aged over 65 years fall at least once a year, and of those 50% will have recurrent falls
- previous study reported a decrease in passive ROM of the hip and gastrocnemius flexibility increased a change of injury
- women are more likely to fall than mean because of decreasing bone mass, usually post menopause
- older adults who use assistive devices are more exposed to falls
- there is a correlation between assistive devices that protected the older adults against falls
- one leg stance also led to instability

Variable	Percentage (%)	History of falls,	History of falls, n (%)		
	(n = 100)	No (n = 58)	Yes (n = 42)		
Sex					
Female	50	24 (48)	26 (52)		
Male	50	34 (68)	16 (32)		
Age group, years					
65-69	61	45 (73.8)	16 (26.2)		
70-74	17	8 (47.1)	9 (52.9)		
≥75	22	5 (22.7)	17 (77.3)		
Nationality					
Emirati	75	36 (48)	39 (52)		
Non-Emirati	25	22 (88)	3 (12)		
Body mass index, kg/m ²					
Normal weight (18-24.99)	30	20 (66.7)	10 (33.3)		
Overweight (25-29.99)	39	22 (56.4)	17 (43.6)		
Obese (≥30)	31	16 (51.6)	15 (48.4)		
Dominant side					
Right	94	55 (58.5)	39 (41.5)		
Left	6	3 (50)	3 (50)		
Exercise status					
No	56	22 (39.3)	34 (60.7)		
Yes	44	20 (58.8)	8 (18.2)		
Smoking status					
No	66	38 (57.6)	28 (42.4)		
Yes	34	20 (58.8)	14 (41.2)		
Diabetes status					
No	51	32 (62.7)	19 (37.3)		
Yes	49	26 (53.1)	23 (46.9)		
Using assistive device					
No	77	55 (71.4)	22 (28.6)		
Yes	23	3 (13)	20 (87)		

Variables	Mean	SD	Univariate analysis		Multivariable analysis	
			Odds ratio (OR) with 95% CI	Р	Adjusted OR with 95% CI	p
Numbers of fall (year)	0.70	0.99				
Gender						
Male			1			
Female			2.30 (1.02, 5.19)	0.044	2.13 (0.55,8.23)	0.27
Age Group						
65-69 years			1			
70-74 years			3.16 (1.04, 9.60)	0.042	0.45 (0.07, 2.93)	0.40
≥75 years			9.56 (3.03, 30.16)	< 0.001	1.26 (0.20, 8.03)	0.80
Exercise Status						
No			1			
Yes			0.14 (0.06, 0.37)	< 0.001	0.34 (0.08, 1.47)	0.14
Assistive Devices						
No			1			
Yes			0.06 (0.02, 0.22)	< 0.001	6.89 (0.96, 49.39)	0.05
VAS	3.49	2.58	1.08 (0.93, 1.26)	0.329		
Rt SLS test (s)	18.74	27.51	0.88 (0.83, 0.95)	< 0.001	1 (0.96, 1.04)	0.96
Lt SLS test (s)	15.53	7.07	0.87 (0.81, 0.93)	< 0.001		
PTSST (a)	13.25	2.97	1.27 (1.08, 1.50)	0.004	0.97 (0.71, 1.32)	0.83
TUGT normal (s)	10.77	3.01	1.31 (1.10, 1.55)	0.002	0.85 (0.34, 2.14)	0.72
TUGT dual (s)	11.29	3.28	1.24 (1.07, 1.43)	0.005	0.61 (0.24, 1.54)	0.29
TUGT cognitive (s)	12.31	3.37	1.35 (1.16, 1.58)	< 0.001	1.88 (0.84, 4.20)	0.12
DGI	19.92	3.98	0.66 (0.54, 0.81)	< 0.001	0.81 (0.57, 1.17)	0.26
Lower limb active ROM						
Percentage normal Rt Hip ROM - all planes combined	80.14	13.28	0.91 (0.87, 0.95)	< 0.001	0.79 (0.48, 1.30)	0.35
Percentage Normal Rt Knee ROM	72.70	14.46	1.01 (0.98, 1.04)	0.41	0.82 (0.43,1.57)	0.55
Percentage Normal Rt Ankle ROM	87.67	12.83	0.92 (0.88, 0.96)	< 0.001	0.84 (0.45, 1.60)	0.59
Percentage Average Rt 11. ROM all joints	80.17	8.90	0.89 (0.84, 0.94)	< 0.001	1.70 (0.25, 11.67)	0.59
Percentage normal Lt Hip ROM - all planes combined	43.71	6.72	0.76 (0.68, 0.86)	< 0.001		
Percentage Normal Lt Knee ROM	73.17	14.46	1.01 (0.98, 1.04)	0.39		
Percentage Normal Lt Ankle ROM	88.61	12.02	0.91 (0.86, 0.95)	< 0.001		
Percentage Average ROM of all joints - Lt I.L.	98.93	6.11	0.92 (0.86, 0.97)	0.022		
ÓOF						
WHOQOL Domain 1	67.01	18.27	0.95 (0.93, 0.98)	< 0.001	1.07 (0.97, 1.17)	0.17
WHOQOL Domain 2	73.26	15.44	0.95 (0.92, 0.98)	0.001	0.999 (0.91, 1.09)	0.99

Conclusions/action items:

Though this article wasn't clear on the potential injuries that would lead to a need for a knee crutch. However, this information is important factors to consider when we begin to design. Specifically, this article said that assistive devices are more exposed to falls. This is important to us because we must focus on the stability of our device. Communicate the importance of stability with my team.

Lauren Anderson - Sep 19, 2025, 12:35 PM CDT



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Lauren Anderson - Sep 26, 2025, 1:45 PM CDT

Title: Safety Concerns in Mobility-Assistive Products in an Older Demographic

Date: 9/26/25

Content by: Lauren Anderson

Present: Lauren Anderson

Goals: Understand the safety concerns associated with an older demographic using a mobility-assistive device. Use the knowledge to update out design to have increased safety features.

Content:

- 14.6 million emergency department cases associated with older adults using consumer products 2/3 due to falls
- 10% of community-living adults aged > 65 years adopting them each year to help with their mobility limitations

Table 2.

Mobility-assistive device by injury type per 10,000 reviews.

Mobility-assistive device	Major injury, n (%)	Minor injury, n (%)	Potential future injury, n (%)
Cane (n=672)	2 (0.3)	56 (8.3)	614 (91.4)
Gait or transfer belt (n=393)	6 (1.5)	43 (10.9)	344 (87.5)
Ramp (n=484)	0 (0)	22 (4.5)	462 (95.5)
Walker or rollator (n=479)	10 (2.1)	44 (9.2)	425 (88.7)
Wheelchair or transport chair (n=530)	0 (0)	57 (10.8)	473 (89.2)

Open in a new tab

- in the walker a main issue was the metal breaking and the legs gave out, issue with welding and the sockets that are attached on the walker

Injury pathway	Cane, n	Gait or	Ramp, n	Walker or	Wheelchair or
	(%)	transfer belt,	(%)	rollator, n	transport chair, n
		n (%)		(%)	(%)
Critical component	240	123 (14.4)	129	141 (16.5)	222 (26)
breakage or decoupling	(28.1)		(15.1)		0.0 to
(n=855)					Back to Top
Unintended movement	30 (6.9)	184 (42.4)	31 (7.1)	101 (23.3)	88 (20.3)
(n=434)					
Instability (n=457)	180	0 (0)	129	99 (21.7)	49 (10.7)
	(39.4)		(28.2)		
Poor, uneven surface	3 (4)	0 (0)	0 (0)	26 (34.7)	46 (61.3)
handling (n=75)					
Trip hazards (n=41)	15 (36.6)	0 (0)	9 (22)	15 (36.6)	2 (4.9) 123 (17.6)
Design failure (n=699)	205	86 (12.3)	187	98 (14)	
	(29.3)		(26.8)		

- A major thing to look at is the uneven surfaces, how will the knee crutch be able to perform on wood, or carpet stairs
- Canes had a high rate of instability and design failure
- some injuries may be avoided through caregivers evaluating new and exsisting equipment for potential future injuries
- wobbly or bending
- cane issues did come from poor self-standing capabilities

Conclusions/action items:

- Look at specifically the stability and the overall weight capacity of our design
- incorporate safety features to create a better design
- important to rank stability and safety as higher in our dsign matrix to ensure prevention of any additional injuries source -

Mali, Namrata, et al. "Safety Concerns in Mobility-Assistive Products for Older Adults: Content Analysis of Online Reviews." *Journal of Medical Internet Research*, vol. 25, Mar. 2023, p. e42231. *PubMed Central*, https://doi.org/10.2196/42231.

link - https://www.jmir.org/2023/1/e42231 no download available



Force-displacement relations to obtain actuation parameters

Lauren Anderson - Oct 17, 2025, 12:35 PM CDT

Title: Using force-displacement relations to obtain actuation parameters from artificial muscles

Date: 10/17/2025

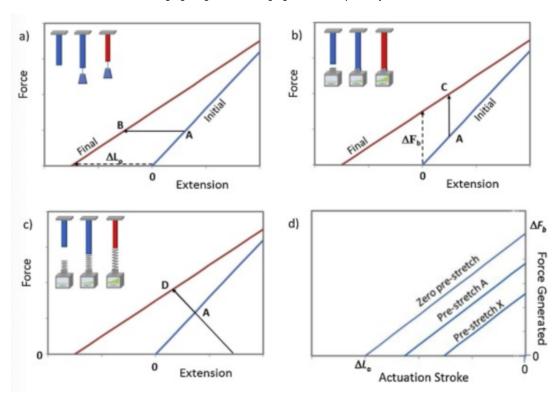
Content by: Lauren Anderson

Present: Lauren Anderson

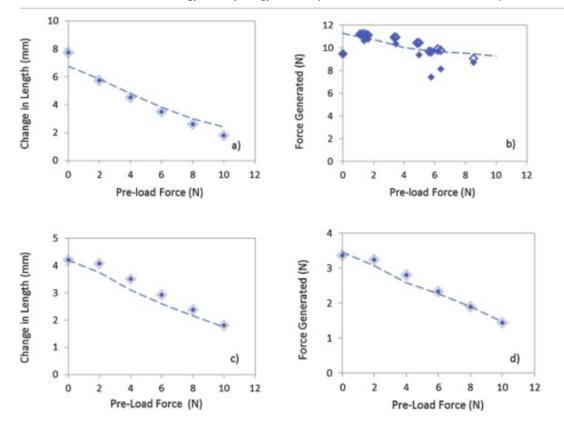
Goals: Understand how to test medical devices using force-displacement

Content:

- three variables looked at changing length and changing the load separately.



- graphical method of analysis can be applied to any external loading condition by identifying the equilibrium starting and finishing load and displacement to the actuator.
- load and unloading at the same point and see how that changes multiple
- look at the activator and nonactivated
- calculate maximal strain and the maximum force



Conclusions/action items:

- This study relates more to force testing utilizing force constants from a loaded spring
- During the testing portion this researcher did two variables changing both the load and the length which applies to our testing method
- Creating graphs to visualize the changes in the force and what the displacement looks like
- we should calculate the maximum force during out tests

IEEE citation -

Spinks, Geoffrey M., et al. "Using Force-Displacement Relations to Obtain Actuation Parameters from Artificial Muscles." *Sensors and Actuators A: Physical*, vol. 290, May 2019, pp. 90–96. *ScienceDirect*, https://doi.org/10.1016/j.sna.2019.03.012.

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SensorsandActuators.pdf (1.72 MB)



Clinical tests and Biomechanical measures

Lauren Anderson - Oct 17, 2025, 1:20 PM CDT

Title: Are clinical tests and biomechanical measures of gait stability able to differentiate fallers from non-fallers in hereditary spastic paraplegia

Date: 10/17/25

Content by: Lauren Anderson

Present: Lauren

Goals: Understand what testing and gait stability should be tested and how to best test those variables

Content:

Used method:

- six-item Activities-specific Balance Confidence scale
- mini-balance evaluation systems test
- gait capacity
- included gait variability
- mediolateral margin of stability
- foot placement deviation
- local divergence exponents of truck and pelvis
- fear-of-falling also increased the patients chances of falling
- fall risk the Activities-specific Balance Confidence Scale (ABC)
- used randomized selection of people
- logged falls for 15 weeks to have a control
- performed a 10-meter WalkTest performed at both comfortable gait speed and a maximum gait speed
- gait analysis was performed on an instrumented treadmill
- varied based on step length, step time, and step width
- used two force plates sampling at a rate of 2000Hz
- data was also collected using a 10-camera 3-dimensional motion capture system at a sampling rate of 100 Hz
- all walking trials were start no hand on a handrail
- tested the level of significance using p values using a series of independent t-tests
- calculated the average speeds across trials for more biomechanical measurements

Equations of interest -

Spatiotemporal gait variability -

coefficient of Variation

$$Coefficient\ of\ Variation = rac{Standard\ deviation}{Mean}*100\%$$

stability -

Medio-lateral margin of

$$MoS = BoS - XCoM$$

Base of support (BoS) - defined as the position of the mediolateral center of pressure (CoP) using the force plate recordings Foot placement deviation -

$$egin{aligned} Predicted \ foot \ placement = & eta_{position} * CoM + \ eta_{velocity} * CoM ' + arepsilon \end{aligned}$$

where the $\beta_{position}$ and $\beta_{velocity}$ are defined as the regression coefficients, and ε as the model error.

data -

Table 1. Differences between participants with HSP and healthy controls regarding clinical and biomechanical measures at comfortable treadmill velocity.

	HSP (n=33)	HC (n=15)	P-value
Clinical assessment			
Activities-specific Balance Confidence scale – six-item	56 ± 23	92 ± 78	< 0.001
Mini-BEST	19.5 ± 4.5	27.0 ± 1.0	< 0.001
Ten-meter walk test – comfortable (ms^{-1})	1.3 ± 0.3	1.6 ± 0.2	< 0.001
Ten-meter walk test – fast (ms ⁻¹)	1.7 ± 0.3	2.4 ± 0.4	< 0.001
Biomechanical assessment			
Step width (mm)	125 ± 44	94 ± 33	0.021
Coefficient of variation			
· Step length (%)	7.3 ± 5	2.4 ± 0.6	< 0.001
· Step time (%)	4.9 ± 3	2.1 ± 0.5	< 0.001
· Step width (%)	27.5 ± 13	27.1 ± 13.4	0.973
Mediolateral Margin of Stability (MoS) (mm)	45.8 ± 17	47.6 ± 10.6	0.696
Variability of MoS (mm)	13.4 ± 8	14.3 ± 6.8	0.368

Mediolateral Foot Placement Deviation (cm)	1.0 ± 0.3	0.7 ± 0.2	< 0.001	
Local Divergence Exponents				
· Trunk - mediolateral	1.5 ± 0.3	1.8 ± 0.2	< 0.001	
· Trunk - anteroposterior	1.7 ± 0.3	1.6 ± 0.2	0.019	
· Trunk - vertical	1.4 ± 0.2	1.3 ± 0.1	0.013	
· Pelvis - mediolateral	1.3 ± 0.2	1.1 ± 0.2	0.064	
· Pelvis - anteroposterior	1.5 ± 0.3	1.3 ± 0.2	0.008	
· Pelvis - vertical	1.3 ± 0.2	1.2 ± 0.1	0.008	- found that HSP, ABC-6

and Mini-BEST are the best in order to differentiate potential fallers from non-fallers

IEEE Citation -

van de Venis, Lotte, et al. "Are Clinical Tests and Biomechanical Measures of Gait Stability Able to Differentiate Fallers from Non-Fallers in Hereditary Spastic Paraplegia?" *Gait & Posture*, vol. 114, Oct. 2024, pp. 270–76. *ScienceDirect*, https://doi.org/10.1016/j.gaitpost.2024.10.017.

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- Utilize statistics testing in order to determine significance of our results t-tests
- understanding the increased potential to fall
- varying speed and length of steps are important for understanding biomechanics factors on our study
- Take advantage of the current math strategies in order to do mathematical analysis.

Lauren Anderson - Sep 14, 2025, 11:15 AM CDT

Title: Lower Limb Injury Devices

Date: 9/9/25

Content by: Lauren Anderson

Present: Lauren Anderson

Goals:

- Understand what devices are currently on the market
- Understand how these devices work to conceptualize the criteria for the current project

Content:

- Must think about both legs and if this device itself will be one size fits all (is there a certain age demographic?)
- many exoskeletons use rigid frame and actuated joints
- some can be made adjustable for different environments or people adjustable crutches
- IWalk, Long Beach CA but is bulky and restricts movement at the knee to a 90 degree angle [1]
- Intrepid Dynamic Exoskeletal Orthosis stiff foot plate, hard on uneven terrain
- there is an opening in the market for uneven terrain
- use springs or force dampeners in order to redistribute forces
- titanium and aluminum are good metal choices for heavy loads

Conclusions/action items:

- there is a hold in the market for exoskeletons that are able to navigate uneven terrain such as stairs
- there are a few different products on the market, but have drawbacks making them unusable to our client
- look at what is currently being used and understand the exact criteria
- continue researching how force loading can effect exoskeletons on uneven terrain

[1] W. B. Johnson *et al.*, "Exoskeletal solutions to enable mobility with a lower leg fracture in austere environments," *Wearable Technologies*, vol. 4, p. e5, Feb. 28, 2023, doi: 10.1017/wtc.2022.26.

Lauren Anderson - Sep 12, 2025, 1:44 PM CDT



L Introduction

Whether they are adventuring in the wildermose, navigating a dissoure soon, or fighting in a wantows, people excusator associated with the second characterised by regarded or masses tenta and promotion of the contractions of the second contraction of the second contraction of the classics and the release of these diseases and the release of these diseases and the release of the classics and the release of the classics of the classics and the release of the classics of the c

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Lauren Anderson - Sep 14, 2025, 11:33 AM CDT

Title: Cost of Competing Medical Devices

Date: 9/14/25

Content by: Lauren Anderson

Present: Lauren Anderson

Goals: Understand the average costs of medical devices such as crutches and use that information to develop an appropriate estimate for our knee crutch.

Content:

Conten

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Factor	Description	Ref.
Tensile Strength (C1)	Tensile strength is crucial for crutches, ensuring they support the user's weight without deformation or failure.	[18]
Density (C2)	Density indicates how much mass is packed into a given volume of material, with lower densities being lighter and thus reducing user fatigue.	[19]
Weight (C3)	Weight refers to the material's heaviness, and lighter materials are preferable for crutches to minimize user strain, especially during extended use.	[20]
Cost (C4)	Cost denotes the monetary expense associated with obtaining and using the material, a crucial consideration for budget-conscious users and healthcare systems.	[21]
Adjustability (C5)	Adjustability relates to how easily the material can be customized to fit the user's needs, such as adjusting crutch height or angle.	[22]
Corrosion Resistance (C6)	Corrosion resistance measures the material's ability to withstand damage from chemical reactions like rusting, crucial for durability.	[23]
Durability (C7)	Durability indicates how well the material withstands wear and tear over time, affecting maintenance needs.	[24]
Comfort (C8)	Comfort considers factors like padding and ergonomic design, influencing user experience during prolonged crutch use.	[25]
Stiffness (C9)	Stiffness refers to the material's resistance to deformation under load, providing stability but potentially affecting comfort.	[26]
Safety (C10)	Safety encompasses features like slip resistance and impact absorption, critical for preventing injuries during crutch use.	[27]

Factor Information (Converted on Scale 1-10)

Alternative\Factor	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Aluminium (A1)	7	7	8	6	8	9	8	7	7	8
Mild Steel (A2)	8	4	4	6	4	7	9	6	8	7
Carbon fibre (A3)	10	9	10	3	3	8	9	8	9	9
Fiberglass (A4)	6	8	7	6	7	8	8	7	7	8
Titanium (A5)	9	5	9	2	4	10	9	8	9	9
Beech Wood (A6)	5	8	7	4	5	3	6	7	4	6
HDPE (A7)	4	5	8	5	6	6	7	7	5	7

[1]

- information on the different aspects of the crutches and how the researchers assessed what was deemed to be important safety aspects of their products
- There is a wide variety of materials that can be used in crutches and each have the pros and cons in a new design
- materials such as aluminum, mid steel, and fiberglass would be ranked lower in cost than other materials such as beech wood and titanium
- though some materials are more cost effective, that doesn't correlate to other safety factors that are also important
- utilizing matrices can help simplify the process of picking the material with the best balance of all required features

Conclusions/action items:

- materials such as HDPE and Fiberglass could be good materials to look into when constructing our design

- Crutches as of now are not extremely cost effective due to their need for many different safety needs
- Discuss possible material options with my team
- continue to research cost effect materials
- implement a similar research process to compare all factors of a material

[1] M. Joshi, "Assessing cost-effective materials for multi-functional crutches: an integrated MCDM framework," *Archives of Metallurgy and Materials*, pp. 227–233, Mar. 20, 2025, doi: 10.24425/amm.2025.152537.

Lauren Anderson - Sep 14, 2025, 11:33 AM CDT

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Assessing_Cost-Effective_Materials_for_Multi-Funct.pdf (6.18 MB)

Lauren Anderson - Sep 14, 2025, 11:48 AM CDT

Title: Cost of iWalk

Date: 9/14/25

Content by: Lauren Anderson

Present: Lauren Anderson

Goals: Understand the price of a competing device in order to predict our target product cost

Content:

- The iWalk retails for \$179 [1]
- They are able to guarantee 1-2 day delivery, helpful for unexpected injuries
- has the ability to be covered by. insurance
- easy to navigate website that shows cost and coverage options
- is adjustable which makes the buying and selling process more streamlined

Conclusions/action items:

- Update the PDS with the information about the cost of the iWalk
- discuss with my team how to make our product cost effective and competitive
- continue to look at the materials used and understand what features may be important to the consumer

[1] iWALKFree, "Clinical Research," iWALKFree. Accessed Sep. 14, 2025. [Online]. https://iwalk-free.com/clinical-research

Lauren Anderson - Sep 22, 2025, 5:27 PM CDT

Title: Potential Designs

Date: 9/22/25

Content by: Lauren Anderson

Present: Lauren Anderson

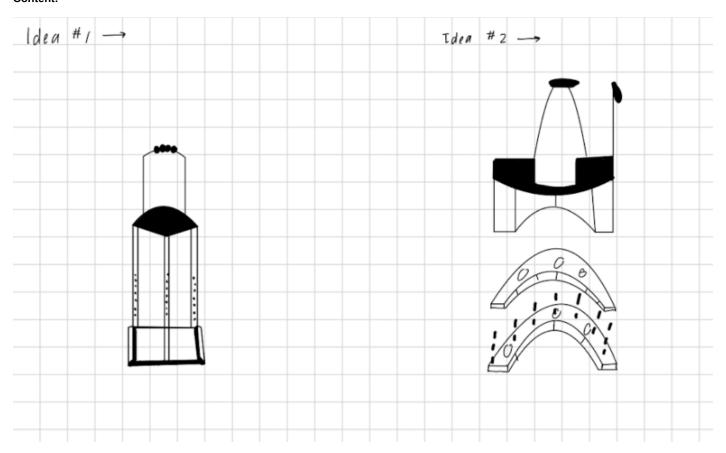
Goals:

- Come up with two clear designs

- Use different materials in the designs in order to explore options

- draw designs in a way to communicate ideas to my team

Content:



- #1 one would have steel legs
- #1 has a rectangular base
- #2 is made of plastic
- #2 has a horseshoe shaped bottom with space for the knee to fit into the curve
- both designs are are adjustable

- share all of these ideas with my team and continue to brainstorm solidified design ideas with my team
- look as a team at the dimensions of the current product in order to understand the exact dimensions that these designs would have to fit in

- finish the design matrix and decide on a design to continue with

Lauren Anderson - Oct 31, 2025, 5:15 PM CDT

Title: Intro To Machining

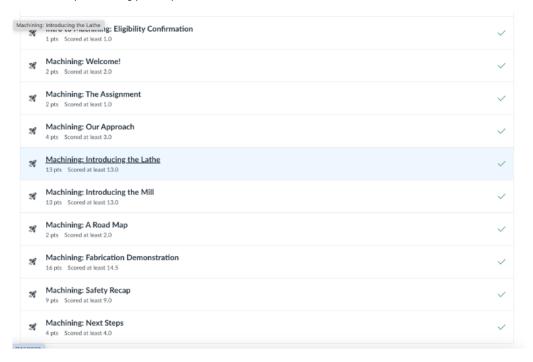
Date: 10/24/25
Content by: Lauren

Present: Lauren

Goals: Understand the Mill and Lathe in order to use them for future fabrication projects

Content

- finished the canvas course
- finished the in person training (10/21/25)





My Memberships				
Membership Type	Start Date	Expiry Date	Renew	Card Info
Machining	Tue, Aug 20 2024	Permanent	Not Renewable	N/A
Shop Tools	Tue, Aug 20 2024	Thu, Jan 2 3000	Not Renewable	N/A
Laser Cutter	Tue, Aug 20 2024	Thu, Jan 2 3000	Not Renewable	N/A
Lab Orientation	Tue, Aug 20 2024	Wed, Dec 31 3000	Not Renewable	N/A
Shop Tools - Training Eligible	Tue, Aug 20 2024	Wed, Dec 31 3000	Not Renewable	N/A
Laser Cutter - Training Eligible	Tue, Aug 20 2024	Wed, Dec 31 3000	Not Renewable	N/A

Profile

Program Registrations

Rookinge

- continue to utilize the ECB machines for fabrication
- learned how to use the mill and lathe
- Create a design consultation to determine how to fabricate out project



Lauren Anderson - Oct 31, 2025, 5:16 PM CDT

Title: Biosafety training

Date: 10/24/25

Content by: Lauren
Present: Lauren

Goals: Understand how to be safe in biological labs

Content:

See attached photos

- completed the canvas module for Biosafety

Biosafety Required Training Quiz 2024-2025

Assignments

Jul 15 at 9:09pm

13 / 15

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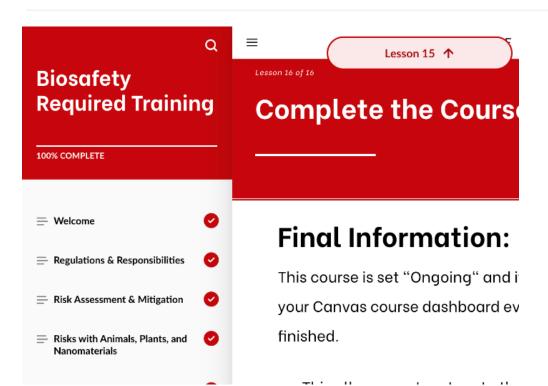
Assignments

86.67%

13.00 / 15.00

Total 86.67%

13.00 / 15.00



- put this learned items into practice
- continue to learn and ask questions about how to remain safe in the lab



Lauren Anderson - Oct 31, 2025, 5:16 PM CDT

Title: Chemical Safety Training

Date: 10/24/25

Content by: Lauren

Present: Lauren

Goals: Understand how to maintain safety standards in a chemical lab

Content:

- See attached certificate below

- completed the Chemical Safety Training canvas module

Conclusions/action items:

- put these ideas into practice
- continue to ask questions about how to maintain safety standards

Lauren Anderson - Oct 24, 2025, 12:22 PM CDT



Download

landerson_chem.pdf (114 kB)

Lauren Anderson - Nov 07, 2025, 12:35 PM CST

Title: Why Healthcare Needs More Engineers

Date: 11/7/25

Content by: Lauren Anderson

Present: Whole Group

Speaker: Kristin Myers, BME Class of 2002

Goals: Learn about the career of the guest speaker and take inspiration from a potential career path

Content:

- Pursue the tough challenges and develop skills that allow you to make an impact make the next best step for you
- Interned at Baird and Abiomed throughout college and worked in Medtronic for five years
- Moved to CA to purse venture capital
- First part was scoping a project and high achieving with a technical focus

Climb the growth curve --

- Transitioned into learning and Unified Women's Healthcare
- Worked as Chief of Staff to CEO at Aetna
- Also opened a cycling studio as a way to continue to pursue her passions
- Worked during the pandemic running a team of OBGYNs and struggled through PPE constraints and trying to keep mamy employees on the team

Build and Transform --

- Hopscotch Health - Founder and CEO that advances primary care for rural communities

Blue Cross Blue Shield Association - Chief Operating Officer that enables access, affordability, and experience for 1 in 3 Americans

What does great look like?

- Improved experience to the provider and patient, improved patient outcomes, lower cost

Measured through -

- US ranked last on equity, and access

Current Challenges

- Misaligned incentives
- Fragmented financing and regulation
- Data silos and legacy IT
- Inequities (10-15 year gap between zip codes) dictates longevity

Integrate system to enable health and wellness for all -

- Care delivered in the right place
- Having Primary places of care, shared support system, multi-sector community partnerships

Building a better system! -

- Systems and design thinking
- Care built around people

- Connected care delivery platforms

Integration is an Engineering problem

Tips -

- Work hard and build range take on the hardest projects, classes, and experiences. Effort and range are your foundation.
- Seek Diverse Exposure explore different sectors, teams and geographies. Gain perspective and learn how systems connect, not just how parts work

Kayla Christy - Sep 12, 2025, 1:55 PM CDT

Title: BSAC Meeting 1

Date: 09/12/2025

Content by: Kayla Christy

Present: Kayla, Lauren

Goals: First Meeting. Get a feel for what the first meeting is.

Content:

We had a small group discussion with other people at our table. We talked about:

- 1. The project draft and what we thought about it or what we think needs improvement
- 2. If we are ready for the trainings (for shop work and other things).
- 3. How meeting with our advisor was and if we have met our client yet.
- 4. If we had any questions about our projects or the class structure.

We had a discussion with the whole group about what our small groups discussed. Other ideas were brought up and Jose wrote them out and talked about moving those ideas along. Great ideas were brought up and lots of BME 300 and 400 students gave a lot of good advice to us BME 200 students.

Conclusions/action items:

I need to make sure I do the three trainings for BME 200. Those are good because they add to my resume and my job experience. Talk to my group about the situation with our advisor and that most other groups have already met with theirs or are meeting with them today. We need to come up with a game plan with our group, our current advisor, and possibly Puccinelli. I also need to understand what my requirements are for this class so I can get a good schedule.

Kayla Christy - Sep 26, 2025, 11:49 AM CDT

Title: BSAC Meeting 2

Date: 09/26/2025

Content by: Kayla Christy

Present: Kayla

Goals: Second Meeting. Discuss with groups about BME and questions or concerns we have

Content:

We met some of the Faculty and they did intros and talked about their research and classes they teach.

We had a small group discussion with other people at our table. We talked about:

- 1. How was the process of drafting a PDS
- 2. How has client communication been
- 3. At what stage of the project are you in
- 4. Are you and your advisor on the same page for lab archives expectations
- 5. Thoughts on a suggestion form for BME "Training throughout the curriculum?"
- 6. How to increase student awareness of BME advisor resources and links?

We think that our canvas pages should be more structured. We also discussed that we think our advisors should have a rubric for how they are grading LabArchives and things they are looking for. We also discussed that we think our advisor should recomend one more specialty training that they think will be helpful or corelate to our projects. We discussed our PDS and most groups sectioned off portions for everyone to complete.

Big group discussion

Discussed that there advisors have different expectations for LabArchives. Also discussed that there should be a set list of expectations for Labarchives so we dont have to guess what our advisors are looking for. More direction with what we should talk about with our advisor and what questions and things we should be asking them. An advisor talked about how we have goals in our progress reports and when we talk to them we can go over our notebooks the next week and discussed how we met those goals or if we didnt meet those goals. Said that use the notebook to guide the conversation and allows for them to provide feedback and make sure they are on track. Talked about how you should be putting everything into LabArchives even if you dont think it relates very well to your project. Being a 200 is just about learning from 300s and advisors about the design process and being a BME. Talked about how they like the suggestion form and that they might change the training chariculum google document to a google sheet.

Conclusions/action items:

I need to register and sign up for times to do my BME trainings throughout the curriculum. Most groups are starting to look into fabrication and buying materials for their projects. All groups have met with their clients, but sometimes have struggled to find a time to meet with them or their client was unhelpful/ unclear. Do more research on what my project is and what specialty my project falls into for BME and thinks I find interesting about my specialty. Add more sketches and do more research on materials for our crutch and prices. Find that document with the trainings and figure out the trainings I am required to do and ones that are for the future. Go back to my group and discuss what we talked about in BSAC and if they have any ideas or recomendations I can bring up to the next BSAC meeting. BME Advising Canvas page. Preliminary presentation Oct 3rd. Preliminary report due Oct. 8th.

Kayla Christy - Oct 10, 2025, 11:46 AM CDT

Title: BSAC Meeting 3

Date: 10/10/2025

Content by: Kayla Christy

Present: Kayla, Lauren

Goals: Third Meeting. Discuss with groups about BME and the questions or concerns we have

Content:

Started with a recap of ideas and other information that has been talked about with Dr. P.

- Lecture for BME 200 would add a credit to the curriculum (possibly online lectures)
- Trainings and having a spreadsheet of what or how each training relates to what specialties
- Mentor/Mentee

Small group discussion

How were the preliminary presentations?

- Some groups already have feedback from their presentations.
- Discussed how the questions asked after a presentation were a little weird.

How was the preliminary report?

- Some groups had it split up
- Some groups had 300s pretty much do the whole thing
- Some groups had their juniors edit their whole parts (Juniors need to tell us the edits they are making)

At what stage are you in your project? Prototypes?

- People have done CAD
- Some of us 200s have no idea how to CAD yet.
- Some of the groups have ordered materials

Are expectations clear for Show and Tell?

- People have no idea what it is
- Is it like poster presentations?
- People are meeting with their groups today to discuss these next steps.

Big group discussion

- Some groups had people go way over time during preliminary presentations. Have advisors be able to control the time and give warnings when
- Push the preliminary report to Friday. Timing with midterms and when groups usually have team meetings. Have a mixed timing with feedback fruits.
- Grey area on some portions of the preliminary report.
- Advisors have no grades put in for some groups. Inconsistency with advisors, grading, and providing feedback to groups.
- Advisor feedback fruits!!!!!
- be able to deviate from the normal design path and structures of assignments and deliverables. Take a real-world approach.

- Feedback fruit reflections
- Show and tell Oct. 31st
- Start canvas trainings

Kayla Christy - Oct 24, 2025, 11:46 AM CDT

Title: BSAC Meeting 4

Date: 10/24/2025

Content by: Kayla Christy

Present: Kayla, Lauren

Goals: Fourth Meeting. Discuss with groups about BME and the questions or concerns we have

Content:

Small group discussion

- We all discussed our projects and how prototyping is going. When we discussed our portion, the facility member at our table recommended that we start an IRB for testing. Get that done as soon as possible
- Talked a lot about our projects and how they are going. Discussed testing and prototyping.
- If we have any questions about registering for courses next semester. If the 300s have any recommendations on what courses to take to meet all prerequisites.

Big group discussion

- Talked about how some clients do not know how to order materials. Confusion about who is supposed to buy things, such as the client, the students, or the University. Should have client ship orders to the students or advisors. Make the client buy it for you. There should be a meeting or a clear plan in place for ordering, paying for, and shipping materials at the beginning of the semester.
- Talked about having a prototype for show and tell. Some groups are running into problems when fabricating and finding a problem, having to reevaluate what materials they will be using and falling behind when coming up with a prototype for show and tell. Recommended that you bring the failed prototype to show and tell, explain what the problem was and how your group is going to continue.
- Talked about testing. Rabbit UW Madison will have answers to general questions and link you to someone. WCNT. Make sure to think about statistics, very important to consider.

- Meet with the advisor and find a professor who can help with my schedule and doing the biomechanics path. Include study abroad.
- Finish Training Documentation folder in LabArchives



Kayla Christy - Nov 07, 2025, 11:33 AM CST

Title: BSAC Meeting 5

Date: 11/07/2025

Content by: Kayla Christy

Present: Kayla, Lauren

Goals: Fifth Meeting. Discuss with groups about BME and the questions or concerns we have

Content:

Small group discussion

Show and tell

- -All of the feedback was stuff that groups have already thought of.
- Interesting to see other people's projects and where they are in fabrication and the design process.

What is the focus for the week?

- A lot of groups are either still working on fabrication or looking to finish their prototypes

Terms of fabrication and testing?

- People are still unsure of what they are doing for testing.
- Lots of possible human testing
- Groups are in the middle/end of the fabrication process.

Big group discussion

Show and tell wasn't really useful for most groups. Most groups are still working on fabricating their prototype. A couple of groups have started testing on their projects. Reminder to have testing and a prototype built before Thanksgiving break. Be prepared for poster presentations. Make sure to have course enrollment figured out and make sure you are meeting all of the pre-recs.

Conclusions/action items:

Poster presentation on December 5th.



Tong Lecture: Building a Career of Impact

Kayla Christy - Nov 07, 2025, 12:54 PM CST

Title: Tong Lecture

Date: 11/07/2025

Content by: Kayla Christy

Present: Whole team

Goals: Listen and Learn from Kristin Myers

Content:

"Run towards the hard problems... they are the ones that change the world"

The first part of her career was learning and gaining experience

- · past experience in school.
- · She had 4 co-ops and internships.
- · Arboretum Ventures and Skyline Ventures.
- A lot of her major work was or aetna, which is with CVS. She was very proactive in aetna and tackled big problems that people were
 afraid to work on or fix. Became a standout employee.

The second part was about learning with teams.

- · How to make systematic change to healthcare.
- · Quadruple aim: improved provider experience, improved patient outcomes, lower cost of care, improved patient experience
- 50% of doctors would say that if they were given the chance to do it all over again
- We spend a lot of money on healthcare (government), but our outcomes are not ideal
- Healthcare is too expensive, and people will not get the care they need because it is to expensive.
- · We have misaligned values. Fee for service. Our system is not great.

"Every broken system is an invitation for someone brave to fix it."

How are engineers able to fix the system

- · Engineers are the people who could possibly fix the system (which should be multiple systems)
- · Care built around people, not processes intuitive, empathetic, seamless
- · Learners are going to run/lean towards the jobs that have the most money (primary care vs. specialists)

Five takeaways:

- 1. Work hard and build range (take on the hardest projects, classes, and experiences you can find. Effort and range are your foundation.)
- 2. Seek Diverse Exposure (explore different sectors, teams, and geographies. Gain perspective and learn how systems connect, not just how parts work.)
- 3. Choose Your People Wisely (Surround yourself with curious, driven, high-integrity people. They will shape who you become.)
- 4. Know your Values and Protect them (Define what matters most family/friends, **health**, career/impact, values and make decisions that align.)
- 5. Embrace Challenge and Keep Growing (Run towards hard problems. Growth lives on the edge of discomfort where big impacts start.)

Question: What is your advice on preventing burnout?

- We have times of day when we are built to do certain things. Get your schedule and find the prime time when you can get work done.
- Block your calendar and be on your time and not anyone else's. Otherwise, it becomes 7 pm and you haven't done what you have needed to do.
- · It's okay to say no to certain things that don't serve you.
- · Know when you have the most energy to be effective

Question: How can we fix the system of healthcare business-wise?

- The problem is when you have a ton of small players in the system, trying to achieve what the big businesses are doing
- We don't have all of our medical records/ comprehensive medical records of our own.
- · Data flow is not there
- primary care can deliver outcomes at a lower cost, releasing data, innovation directly to consumers

Kayla Christy - Oct 02, 2025, 11:31 AM CDT

Title: Motivation Slide Research

Date: 10/02/25

Content by: Kayla Christy

Present: Kayla Christy

Goals: Come up with a list of statistics for the motivation slide in the Preliminary Presentation Slide Show.

Content:

- Roughly 1 in 8 U.S. adults (12.2%) in the U.S. report significant difficulty with walking or stair climbing due to mobility limitations [1]
- A U.S. study found that half of adults over 65 had some form of disability, with nearly one-third (30.4%) reporting difficulty climbing a flight of stairs [2]
- Difficulty climbing stairs is a leading mobility limitation in older adults and a key predictor of functional decline and loss of independence. [3]
- Common home solutions like motorized stair glides/lifts are stationary, costly, and do not promote physical activity or independence, often requiring assistance or supervised use [4]
- Crutch users experience slower, less efficient movement and altered gait mechanics. These changes reduce stability and significantly increase the risk of falls especially in complex situations such as stair climbing [5]
- [1] CDC. "Disability Impacts All of Us Infographic." *Disability and Health*, 14 Apr. 2025, https://www.cdc.gov/disability-and-health/articles-documents/disability-impacts-all-of-us-infographic.html.
- [2] Kondo, Kyoko, et al. "Factors Associated with Functional Limitation in Stair Climbing in Female Japanese Patients with Knee Osteoarthritis." Journal of Epidemiology, vol. 16, no. 1, Dec. 2005, pp. 21–29. PubMed Central, https://doi.org/10.2188/jea.16.21.
- [3] Gagliano-Jucá, Thiago, et al. "The Stair Climb Power Test as an Efficacy Outcome in Randomized Trials of Function Promoting Therapies in Older Men." The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, vol. 75, no. 6, May 2020, pp. 1167–75. PubMed Central, https://doi.org/10.1093/gerona/glz167.
- [4] Clinical Evaluation Of A Novel Assistive Device For Safe Stair Negotiation. https://www.resna.org/sites/default/files/conference/2019/emerging_technology/Triolo.html. Accessed 2 Oct. 2025.
- [5] https://www.researchgate.net/publication/337252945_Walking_Assistance_Using_Crutches_A_State_of_the_Art_Review

Conclusions/action items:

Need to decide which bullet points to include in the presentation. I need to make the correct citations.



Client Questions and Initial Information (09/07/25)

Kayla Christy - Sep 15, 2025, 5:52 PM CDT

Title: Research and Questions #1

Date: 09/07/25

Content by: Kayla Christy

Present: Kayla Christy

Goals: Come up with questions about our project and try to do some research to answer those.

Content:

- 1. Can the patient bend their knees?
- 2. Can the patient put weight on their arms/ shoulder?
- 3. Who/ what type of patient is using this tool?
- 4. How is the balance of a typical patient?
- 5. Is it needed for both going up and down the stairs?
- 6. How many stairs?

According to the Fall 2024 Stair chair project, it sounds like the patients are temporarily needing this device to both go up and down the stairs. From their overview, the patient needs to go up and down 3-5 stairs. Their device was more of an alternative to an electric stair lift system. Right away, I was thinking about the knee crutch, I was thinking about something that is like a peg leg. If the patient can bend their knee, and put weight on it, there could be an option like figure 1. Another option or idea I was thinking of was life figure 2. Both of these options could be useful when designing our product. Having a few more questions answered can help us come up with a better design.

Conclusions/action items:

I think there are a couple more questions that we need to ask our client to be able to come up with preliminary designs.

Kayla Christy - Sep 17, 2025, 8:33 PM CDT

Title: Research on Freedom Leg

Date: 09/15/25

Content by: Kayla Christy

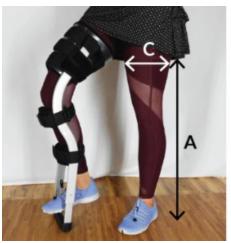
Present: Kayla Christy

Goals: Look at the Freedom Leg, which is a competing design.

Content:

The Freedom leg is a product intended to be used in place of crutches or knee walkers.





 Brace Size:
 Small
 Regular
 Tall

 A (Pants Inseam):
 21"- 28"
 27"- 34"
 31"- 38

Strap Length: Standard Long
C (Upper Thigh Circumference): 20"- 26" 23"-29"

They claim it is 100% Non-Weight bearing. Most of the weight will be on the back of the thigh, so all the weight is off of the knee and the foot. The device is hands free and able to safely climb stairs. They are a Class I Medical Device.

The side rails (aluminum) have a slightly bent knee position and the straps are there to stabilize and support the leg.

The freedom leg is for anyone. Foot, ankle, and knee surgery, Fractures of the foot and ankle, femoral condylar fracture, fusion of the foot or ankle more injuries/surgerys.



Conclusions/action items:

This is a great product because it is durable, customizable, and hands-free. After talking to our client and trying to understand what they want, this might be a great design/ idea to start our project. Our client wants something that is easy and quick to use. This product has a lot of straps which is something our client doesnt want.



Kayla Christy - Sep 19, 2025, 12:10 PM CDT

Title: Competing Design iWalk

Date: 09/07/25

Content by: Kayla Christy

Present: Kayla Christy

Goals: Competing Design research on the iWalk.

Content:

Our Client mentioned the iWalk as a competing design.



Figure 1 (Amazon.com) https://www.amazon.com/iWALK-Hands-Free-Crutch-Alternative/dp/B08WJRWR57?th=1

The iwalk is hands free device that patients kneel on. This device roughly costs around \$179. It has a peg that acts as the foot. Where the knee rests, it is padded and partially indented to provide stability. The patient straps the iwalk to their leg.

Conclusions/action items:

After talking to our client and understanding what they want, the iwalk provides some great structural ideas for our product. Our client does not want straps but the leg rest is a great design for stability and comfort.



What are Standards and Why do we Need Them.

Kayla Christy - Oct 17, 2025, 12:21 PM CDT

Title: Standards

Date: 09/21/25

Content by: Kayla Christy

Present: Kayla Christy

Goals: Understand what standards are. Know what to look for when I am trying to assign standards to my project

Content:

Standards are a used to define technical definitions, rules, guidelines, and procedures for a specific area of interest. They have multiple purposes:

Safety: To avoid accidents and ensure the design process and the operation of engineering systems is safe.

Consistency: They provide guidelines to make sure products and services are consistent in quality no matter who or who they were made by.

Efficiency: Providing guidelines and procedures to make sure that processes are speedy, safe, reduce waste, and lower costs.

Interchangeability: Allow components to be made by different manufacturers allowing for reducing the need for custom designs.

Standards allow for reliability, safety, and cost-effective results in engineering. Allows businesses to compete internationally.

Conclusions/action items:

Now that I understand a little more about standards for engineers, I can start to research more standards and protocols for our project. Understand what the standards are and how they correlate or relate to our project.

https://www.eit.edu.au/engineering-standards-what-is-it-and-why-it-matters/



What are Patents and the Process to get them

Kayla Christy - Nov 07, 2025, 12:07 PM CST

Title: Patents

Date: /25

Content by: Kayla Christy

Present: Kayla Christy

Goals: Understand what patents are. If we need or could get a patent, and how we get one

Content:

You can apply for patents online. There are many types of patents and applications.

Utility patents: for if someone invents or discovers a new or useful process, machine, article of manufacture, or composition of matter.

Design patents: anyone who has invented a new, original ornamental design for an article of manufacture.

Plant patents: anyone inventing or discovering and asexually reproducing any distinct or new variety of plant.

If we were to get a patent for our project, it would be a utiltiy patent.

Conclusions/action items:

We should search for patents or other publications to see if there is an invention similar to ours.

https://www.uspto.gov/patents/basics/apply

Kayla Christy - Sep 22, 2025, 6:21 PM CDT

Title: Preliminary Design Ideas

Date: 09/19/25

Content by: Kayla Christy

Present: Kayla Christy

Goals: Start coming up with ideas or structures we want in our design using ideas from competing designs and our client needs.

Content:

Our client is currently using a garden box to move from one step to the next. The patient places the box down on a step, kneels on it to go up the next step, then picks the box up to move to the next step. This process is time-consuming and not as efficient as it could be.

Our client wants something that can be knelt on, uses one hand crutch for stability, and has no straps.

Comfort

To make the device as comfortable as possible, we can add a couple of features. Our client mentioned that they want padding where the patient will be kneeling for comfort. We can also make the hand holder comfortable by making it grippy and adding indents where the fingers curl around.

Stability

The padding at the knee should be partially indented to provide support and stability for the knee area. We should be cautious of the material we use for the padding so that the cast doesn't stick or slide. The foot of the device should be made with rubber, or the same type of material used at the bottom of crutches, to make the device slip-resistant and grippy.

Conclusions/action items:

Keeping these requirements and ideas in mind, I feel confident in creating a preliminary design that meets our clients wants and needs. Using these ideas and partial structures from past projects, I can start making sketches.

Kayla Christy - Sep 22, 2025, 6:30 PM CDT

Title: Preliminary Design Sketch 1

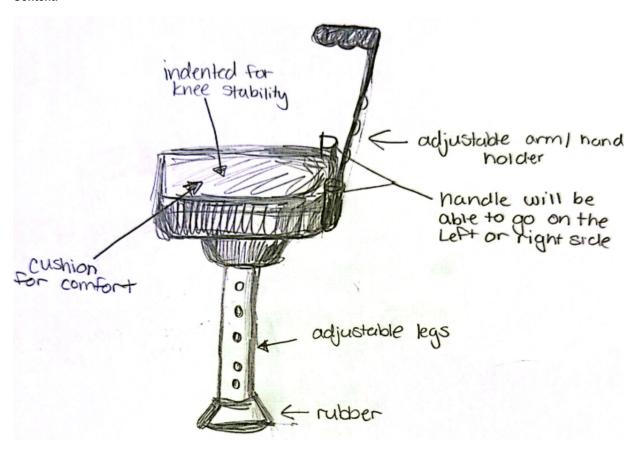
Date: 09/22/25

Content by: Kayla Christy

Present: Kayla Christy

Goals: Start sketching preliminary designs using structures and potential features from competing designs, past designs, and our clients needs.

Content:



Design Features

- Adjustable leg
- Adjustable arm/hand holder
- Rubber/ stable foot
- Cushion for knee rest
- Indents in cushion for stability
- slots on both sides of the device for the hand holder (for left or right side injury)
- comfortable hand holder
- leg in the middle of the knee rest

We will need to determine what materials we will be using and how much they weigh. We will need to determine if the weight distribution will be balanced if the leg is positioned in the middle of the knee rest. We will need to determine the heights of the leg and arm.

Kayla Christy - Sep 22, 2025, 6:31 PM CDT

Title: Preliminary Design Sketch 2

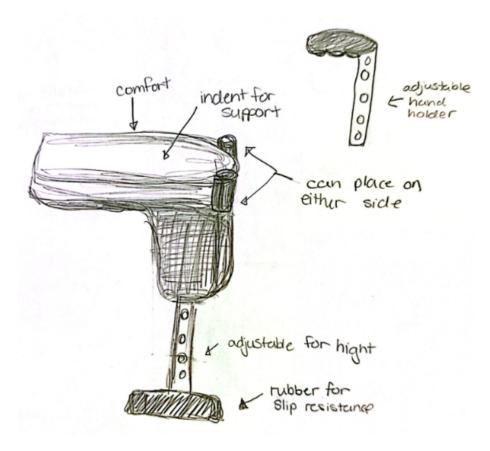
Date: 09/22/25

Content by: Kayla Christy

Present: Kayla Christy

Goals: Start sketching preliminary designs using structures and potential features from competing designs, past designs, and our clients needs.

Content:



Design Features

- Adjustable leg
- Adjustable arm/hand holder
- Rubber/ stable foot
- Cushion for knee rest
- Indents in cushion for stability
- slots on both sides of the device for the hand holder (for left or right side injury)
- comfortable hand holder
- leg in the front of the knee rest

We will need to determine what materials we will be using and how much they weigh. We will need to determine if the weight distribution will be balanced if the leg is positioned in the front of the knee rest. We will need to determine the heights of the leg and arm. We need to determine which design will be the easiest to use and carry.

Handle Design Research and Materials

Kayla Christy - Oct 19, 2025, 1:03 PM CDT

Title: Handle design

Date: 10/19/25

Content by: Kayla Christy

Present: Kayla Christy

Goals: Brainstorm Ideas for the Handle component of our project

Content:

What I know about the handle component so far:

- There will be a handle along 2 of the sides of our prototype. We tested out the prototype from the previous group and found that 3 handles will be very restricting and could cause instability for the patient. We have decided to make a square base so that when we use the two handles, the overall design will be able to accommodate patients with both left and right leg injuries.
- We plan to build up the handles using the same extruded aluminum as our base. This will allow us to attach the handle components more easily and more stably to the base component of our prototype. This allows us to ensure that the handle component is safely attached to the base component, and there will be no unknowns about the attachment.
- The previous group used wood as their material for the handle component of the prototype. After doing some tests and experimenting with their designs, I concluded that the handle is uncomfortable to grab onto and its shape might cause some grip instability, especially for patients with smaller hands
- -We plan to add a comfortable grip material around the extruded aluminum handle component to make it comfortable for patients to use. This material needs to be somewhat grippy so patients can have a firm hold while not having to worry that their hands slide or slip while they are lifting or putting pressure on the device. We plan to make this as comfortable as possible by making sure the handle conforms to the hand and is a comfortable texture.

- Need to do some research on possible materials for the hand grip component of our prototype
- Factors like cost, safety, and weight are factors that need to be considered when choosing materials.
- Include a drawing/ picture for this LabArchives entry to demonstrate the intended design for the base of our prototype.

Kayla Christy - Oct 24, 2025, 1:20 PM CDT

Title: Handle height

Date: 10/24/25

Content by: Kayla Christy

Present: Kayla Christy

Goals: Research on the height of the handle component.

Content:

We did some testing on the previous group's prototype. Me, being 6'0, and my team member, Aubrey, 5'3, both liked the height of the handle when testing the prototype. I found the previous group's final report and found the dimensions of their handle. We want the top of our handle. We want the top of the handle to be less than 30 inches from the ground. We will need to figure out how tall our base component will be and how the height of the handle impacts the stability of our device.

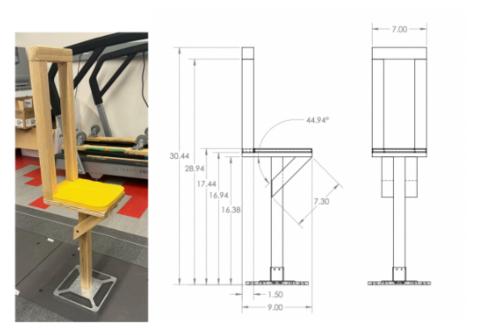


Figure 5. Prototype of the bench with the aluminum base. Dimensions in inches.



https://bmedesign.engr.wisc.edu/projects/f23/stair_assist_bench/file/view/1b995ced-f94c-4b4e-996f-46f22fee0e77/BME_Step_by_Step_Final_Report.pdf

Kayla Christy - Oct 29, 2025, 7:02 PM CDT

Title: New Prototype Drawing

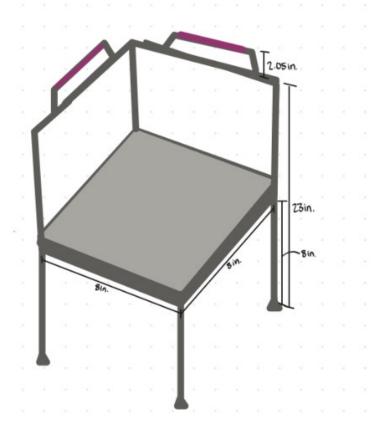
Date: 10/29/25

Content by: Kayla Christy

Present: Kayla Christy

Goals: Draw an updated prototype sketch

Content:



Conclusions/action items:

Upload to the Progress Report

Kayla Christy - Nov 13, 2025, 12:07 PM CST

Title: Updated prototype drawing

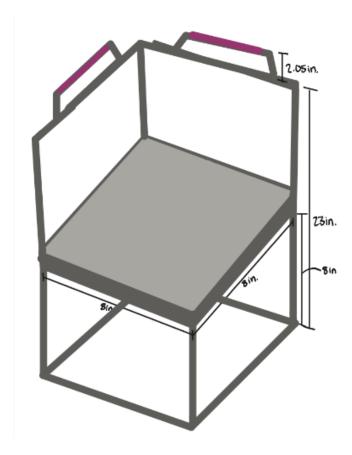
Date: 11/13/25

Content by: Kayla Christy

Present: Kayla Christy

Goals: Update the sketch of our prototype to reflect our fabrication plans

Content:



Kayla Christy - Nov 13, 2025, 12:21 PM CST

Title: Handle Connection to Base Component

Date: 11/13/25

Content by: Kayla Christy

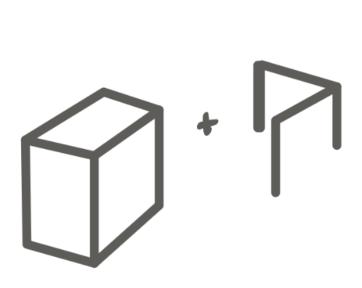
Present: Kayla Christy

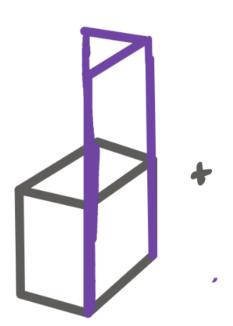
Goals: Ideas for Fabrication connecting the handle and base component

Content:

Currently, our plan has been to build the base first and then attach the handles as a separate component. To do this, we left space in the 3D-printed knee piece for connectors that would join the extruded-aluminum handle assembly to the base. However, using additional connectors introduces a few concerns. It adds unnecessary weight to the prototype, and the extra attachment point could create instability.

I think we should revise this approach. Instead of attaching a separate handle piece, the handles (which connect at three corners of the base), could be integrated directly into the structure. We can do this by replacing the shorter leg components with longer aluminum members that extend all the way up to the handle height. This would reduce connector usage, lower weight, and improve stability





Conclusions/action items:

Connect with the team to reevaluate our fabrication process.

Kayla Christy - Oct 24, 2025, 11:15 AM CDT

Title: Intro to Machining Training

Date: 10/14/25

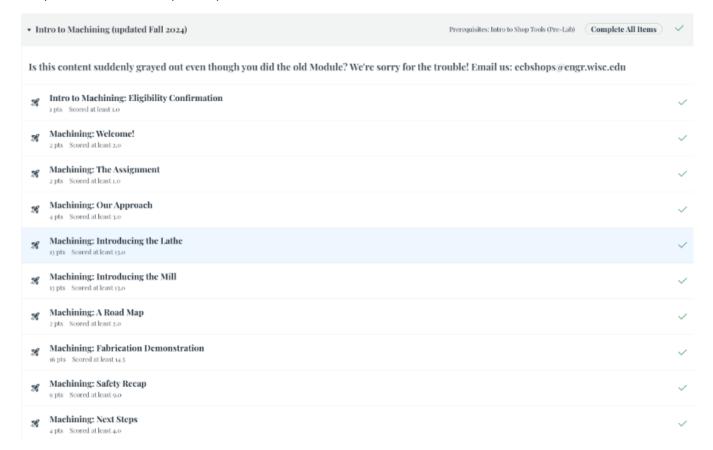
Content by: Kayla Christy

Present: Kayla Christy

Goals: Complete Intro to Machining Training

Content:

Completed the canvas course (10/14/25)



Conclusions/action items:

- 10/14/25 Schedule in person Lathe and Mill training



Kayla Christy - Nov 01, 2025, 1:33 AM CDT

Title: Machining Training

Date: 10/21/25

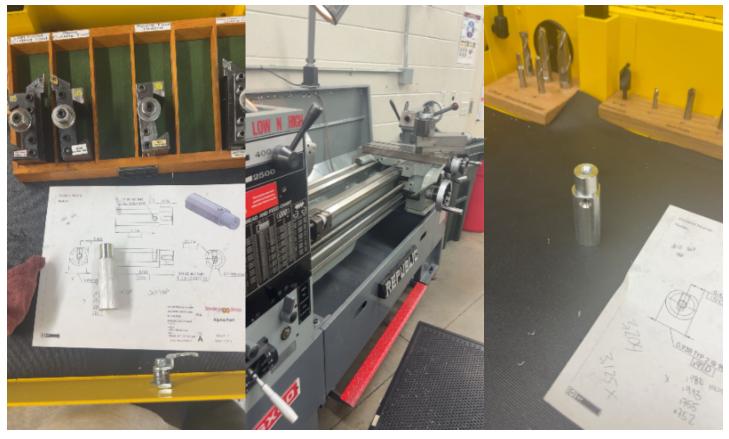
Content by: Kayla Christy

Present: Kayla Christy

Goals: Complete in-person Lathe and Mill Training

Content:

Completed the in-person training (10/21/25), five hours



irainger Engineering lesign Innovation Laboratory viversity of wisconsin-madison











Program Registrations

Bookings Memberships

Invoices

My Memberships				
Membership Type	Start Date	Expiry Date	Renew	Card Info
Machining	Wed, Aug 20 2025	Permanent	Not Renewable	N/A
Shop Tools	Tue, Aug 20 2024	Thu, Jan 2 3000	Not Renewable	N/A
Laser Cutter	Tue, Aug 20 2024	Thu, Jan 2 3000	Not Renewable	N/A
Lab Orientation	Tue, Aug 20 2024	Wed, Dec 31 3000	Not Renewable	N/A
Shop Tools - Training Eligible	Tue, Aug 20 2024	Wed, Dec 31 3000	Not Renewable	N/A
Laser Cutter - Training Eligible	Tue, Aug 20 2024	Wed, Dec 31 3000	Not Renewable	N/A

Find the certificate for the Lathe and Mill training.

Conclusions/action items:

Completed the in-person training. Finish the rest of the training for the semester.



Kayla Christy - Oct 19, 2025, 12:43 PM CDT

Title: Biosafety Training

Date: 10/19/25

Content by: Kayla Christy

Present: Kayla Christy

Goals: Complete the Biosafety Required Training Course

Content:

Completed the canvas course 2 hours (10/19/25)

Biosafety Required Training Quiz 2024-2025

Due No due date	Points 15	Questions 15	Available Mar 14 at 5:30pm - Dec 31 at 11:59pm
Time Limit None	Allowed Atte	mpts Unlimited	

Instructions

This quiz is valid for 2024 and 2025 users.

- · Quiz will update every 1-2 years for record-keeping purposes.
- · Complete this quiz if you are new or renewing this training
- Renewal is required at 5 years (you do not need to take each annual updated quiz just take the quiz every 5 years when you're due to renew).
- Questions about renewal? Email the Biosafety Trainer <u>biosafety@fpm.wisc.edu</u>

To pass this quiz & complete this training, you must score of 11 out of 15 questions correct or better (~75%).

You may take the quiz more than once in order to achieve a passing score.

After you submit the quiz with a passing score, click here to finish the course,

Take the Quiz Again

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	4 minutes	13.75 out of 15

Conclusions/action items:

I completed the required Biosafety Training Course.

Last Attempt Details:

Time:	4 minutes
Current Score:	13.75 out of 15
Kept Score:	13.75 out of 15

Unlimited Attempts

Take the Quiz Again

(Will keep the latest of all your

scores

Kayla Christy - Nov 01, 2025, 1:25 AM CDT

Title: Chemical Training

Date: 10/31/25

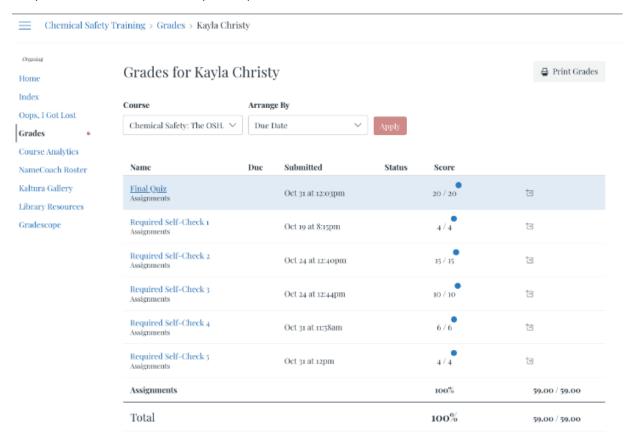
Content by: Kayla Christy

Present: Kayla Christy

Goals: Complete the Chemical Required Training Course

Content:

Completed the canvas course 2 hours (10/31/25)



Conclusions/action items:

I completed the required Chemical Training Course.

2014/11/03-Entry guidelines 298 of 299



John Puccinelli - Sep 05, 2016, 1:18 PM CDT

Use this as a guide for every entry

- Every text entry of your notebook should have the **bold titles** below.
- Every page/entry should be **named starting with the date** of the entry's first creation/activity, subsequent material from future dates can be added later.

You can create a copy of the blank template by first opening the desired folder, clicking on "New", selecting "Copy Existing Page...", and then select "2014/11/03-Template")

Title: Descriptive title (i.e. Client Meeting)

Date: 9/5/2016

Content by: The one person who wrote the content

Present: Names of those present if more than just you (not necessary for individual work)

Goals: Establish clear goals for all text entries (meetings, individual work, etc.).

Content:

Contains clear and organized notes (also includes any references used)

Conclusions/action items:

Recap only the most significant findings and/or action items resulting from the entry.

2014/11/03-Template 299 of 299

John Puccinelli - Nov 03, 2014, 3:20 PM CST

Title:	
Date:	
Content by:	
Present:	
Goals:	
Content:	
Conclusions/action items:	