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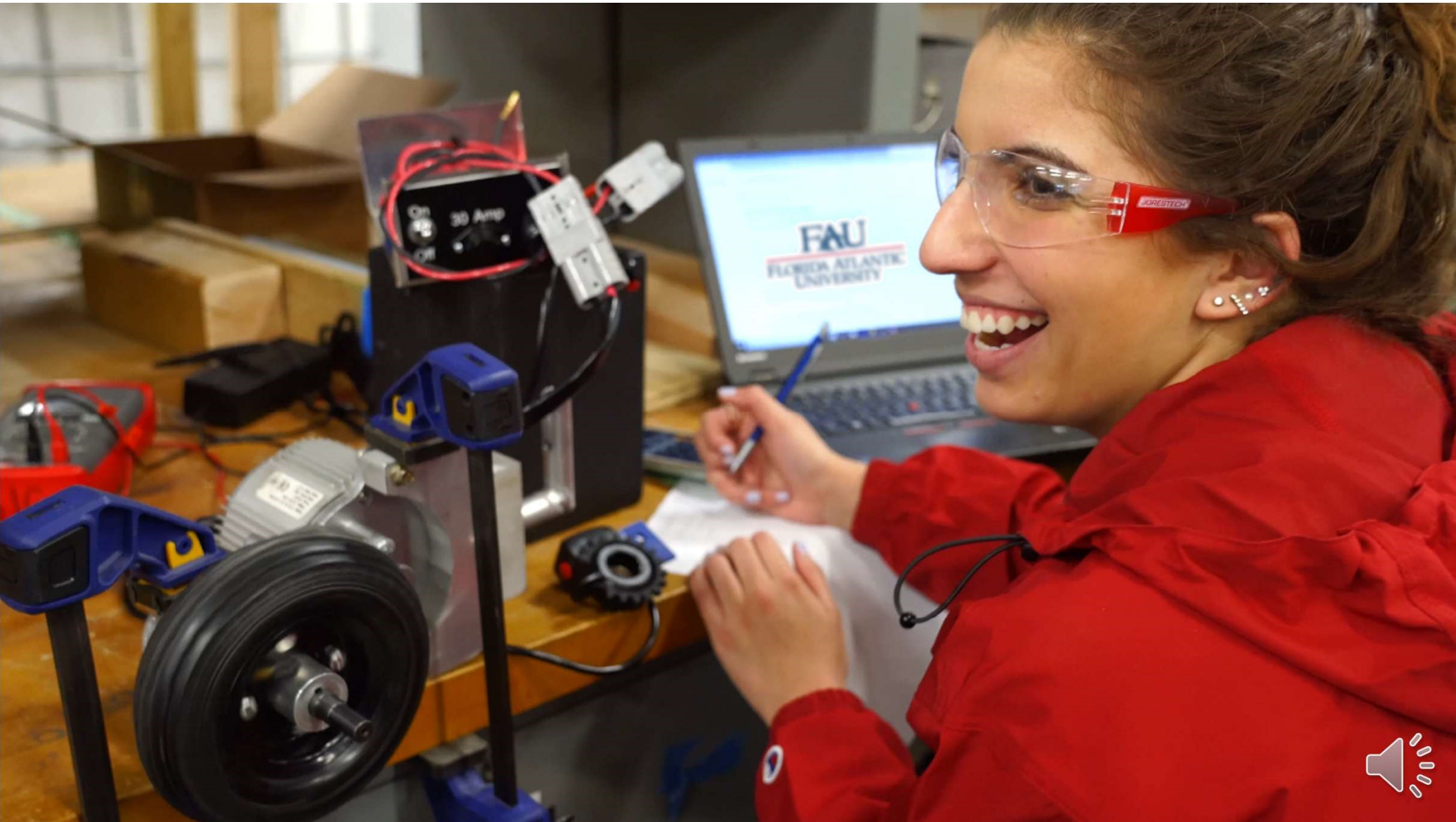
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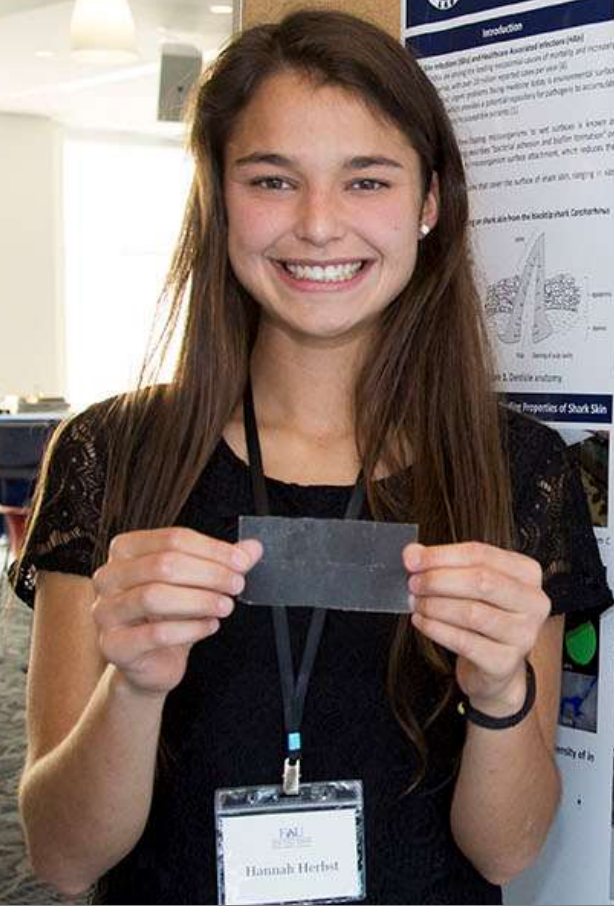






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Sharks take a Bite out of Infection!

Antibacterial Engineered Microtopography Development to Reduce the Spread of Pathogens in Medical Facilities

Hannah Herbst^{1,2} and Marianne Porter^{1,2}, ¹Department of Biological Sciences, Florida Atlantic University; ²Florida Atlantic University High School

Introduction

Shark skin (SK) and medicine-associated infections (MAI) are among the leading microbial causes of morbidity and increasing mortality in the United States, especially in long-term care facilities (LTCFs). MAI represent a global health burden, with an estimated 2.8 million cases annually, resulting in 1.2 million deaths. MAI are caused by a variety of pathogens, including bacteria, fungi, and viruses. The most common MAI-causing organisms are *S. aureus*, *P. aeruginosa*, and *C. difficile*. MAI are often associated with medical devices, such as catheters, ventilators, and prosthetics. The development of antibacterial surfaces that can reduce the spread of pathogens is a critical need in medical facilities.

Method 2: Antibacterial Reusable Bandage Synthesis

Autoclaved in-house control, Control: Commercial Bandage, Control: Flat PDMS

Results 1: Determination of the fouling Properties of Shark Skin

Comparative Fouling Surfaces: Petri Control vs. in vitro Shark Skin (C. imbetus)

Graph 2. There is considerably less contamination present on the petri dish control (equal compared to the in vitro shark skin). This was verified through a T-test, where $P = 1.58E-04$, verifying significant difference between contamination on surfaces.

Results 2: Antibacterial Reusable Bandage Testing

Qualitative Analysis of *S. aureus* Migration

Figure 5. Qualitative results of *S. aureus* simulated wound migration experiment. Sterile Contamination: Quantified Growth of *S. aureus*

Graph 3. Sterile contamination tests were conducted without the presence of nutrients or moisture characteristic to in vivo wounds, and were purposed to determine if PDMS bandage would contain spread of bacteria from initial point of contamination. The hypothesis was confirmed due to the observed positive correlation between high ERI and low bacteria % (see Graph 5 for ERI regression).

Simulated Wound Contamination: Quantified Growth of *S. aureus*

Engineered Roughness Index (ERI)

ERI combines λ , Wenzel's Roughness Factor (or $r = 1 + (df/d\lambda) + (df/d\lambda)^2$), and df , degree of freedom for movement.

- Consistently quantified as 2 throughout literature within most shark skin.

Engineered Roughness Index and Wenzel's Roughness Factor for Studied Topographical Surfaces:

| Surface | Calculated ERI | Wenzel's Roughness Factor | Wenzel's Roughness Factor (2) Value for Studied Topography | Engineered Roughness Index |
|----------------------------|----------------|---------------------------|--|----------------------------|
| <i>S. aureus</i> Denticles | 1.95, 1.93 | 343, 342 | 0.408 | 2.823 |
| PDMS Impression Mold | 1.94, 808 | 329, 490 | 0.413 | 2.857 |
| 20% | 22, 635 | 93, 294 | 0.336 | 1.540 |
| 30% | 38, 722 | 187, 214 | 0.338 | 2.279 |
| 70% | 134, 325 | 293, 629 | 0.353 | 2.438 |
| 100% | 332, 403 | 357, 435 | 0.435 | 3.758 |
| 125% | 205, 452 | 488, 449 | 0.436 | 3.761 |

Conclusions

Quantification of Fouling on Shark Skin

- After 72 h, control petri dishes had 98% biofilm cover, while shark skin had <3% after the entire 120 h experimental period (Figure 5).

Shark skin inspired surfaces

- Higher ERI is positively correlated to lower CFU count across all surfaces tested.
- Engineered PDMS microtopography had less total CFU counts than each of the other variables tested with *S. aureus* (Figures 7-10).
- The dermal denticle micro pattern of shark skin can be applied to inhibit biofilm development key to fouling and the development of SSIs and HAIs in medical facilities.

Future Steps

- Wound colonization is typically polymicrobial, therefore testing with multiple types of bacteria is necessary.

(A) Nanoscale Smooth Surface ($df = 2$) (B) Nanoscale Rough Surface ($df = 2$)

Acknowledgements and Selected References

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The Next QEP

**Multiple Academic Credentials
for
Workforce Competencies**

Focus:

Career Readiness Across and Beyond the Curriculum

What Employers Say...

- 80% say it is difficult to find recent graduates who are qualified without retraining skills that were supposed to be learned in school¹
- *Only 11% of business leaders and only 14% of the public think that university graduates have the skills to succeed in the workplace²*

¹Florida Council of 100 (2018). <https://www.fc100.org/>

²The Gallup-Purdue Index (2016) <https://www.gallup.com/services/176768/2014-gallup-purdue-index-report.aspx>

FAU Surveys

| Competency | Employer Rating* | Faculty Rating* | FAU Graduates Achievement* |
|-----------------------------------|------------------|-----------------|----------------------------|
| Critical Thinking/Problem Solving | 1.06 | 1.29 | 1.70 |
| Oral/Written Communications | 1.09 | 1.33 | 1.68 |
| Teamwork/Collaboration | 1.05 | 1.64 | 1.47 |
| Digital Technology | 1.32 | 1.51 | 1.65 |
| Leadership | 1.46 | 1.93 | 1.92 |
| Professionalism/Work Ethic | 1.04 | 1.36 | 1.52 |
| Career Management | 1.00 | 1.35 | 1.73 |
| Global/Intercultural Fluency | 1.27 | 1.45 | 1.58 |

**Rating of 1 = "Very important" on a 4-point Likert scale*



NACE Career Readiness Competencies

Seamless Alignment with SACSCOC Objectives

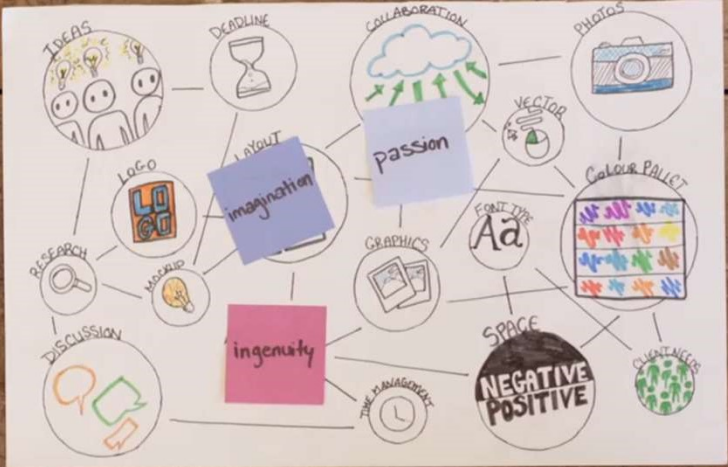
- **Content/Discipline Knowledge**
- **Communication Skills**
- **Critical Thinking Skills**
- **Diversity, Equity & Inclusion**

Race to Excellence

- Cultivating discovery, diversity and distinction
- Culture of student success
 - *Undergraduate Research*
 - *Graduate Placement*
 - *Non-degree seeking students*
 - *Non-traditional students*
 - *Transfer students*

**Imagine FAU graduates being
the most sought after talent
for our growing community and beyond**





Plan of Action



The Next QEP

Focus: *Career Readiness Across and Beyond the Curriculum*



CAREER CENTER



**Professional
Development**



**Curricular
Frameworks**



**Community
Engagement**



Professional Development



- **Faculty/Staff Learning Communities**

- Inclusive instruction
- Student development theory
- Diversity, equity & inclusion

- **Engagement at all levels**

- Faculty/staff
- Instructors, Adjuncts, Guest lecturers, Industry experts/employers, TA's and SI leaders





Community Engagement



- **Guest lecturer/project mentor clearinghouse**
 - Recruit a pool of diverse alumni, community leaders/employers
 - Create program-specific external advisory councils
 - Expose students/faculty to employers that look like them
- **Create learning communities dedicated to interacting with this group for curriculum enrichment**



Curricular Frameworks



- **Career Champions Network**
 - Faculty liaisons from each college
 - A&L, BUS, EDU, ENG, GRAD, HON, MED, NUR, COS, SW&CJ, UG, Library
 - Academic Support Services representation
 - Career Center, Advising, International Programs, Community Engagement, OURI, eLearning, Continuing Ed, Residence Life, Center for Teaching and Learning, Student Athlete Success Center, Council of Student Organizations, Alumni Association
- **Curriculum Enhancement Grants: 1st year and transfer cornerstone sequence**
- **Mini-Credentials: Targeted cross-college certificate programs**

Curriculum Enhancements

- **The capstone** is the culminating course experience that ties the major together
- **The keystone** is the gatekeeper course where performance indicates likelihood of degree completion
- **The cornerstone** is a multi-semester sequence that lays the foundation for career readiness exploration and student success (that also counts toward the major)



Career in the Curriculum

- *IFP Thematic Clusters*
- *First year bridge programs*
- *FTIC*
- *Transfer students*
- *First generation*
- *New graduate students*
- *Non-degree seekers*
- *Non-traditional students*



Micro-Credentials

- Accumulate career readiness micro-credentials to give graduates a competitive advantage
 - *University-wide certificates*
 - *Exploratory: IFP Thematic Clusters*
 - *Skill-Building: Keystone*
 - *Intensive: Designated courses or capstones*



Transcripts

- Stack micro-credentials on transcripts and CV
- *Future-proof resumes with skills employers want*



CAREER CENTER

- Infuse more faculty interaction via the Career Champions Network
- Provide artificial intelligence tools to expand access
- Enhance data mining from multiple sources to provide critical insights
- Enhance student internships program
- Establish a peer consultants program

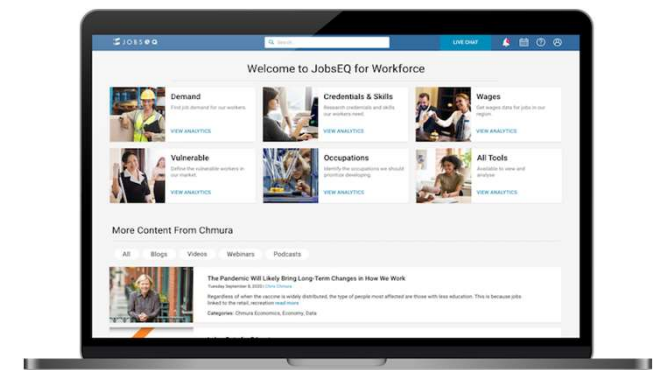
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Jordan

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Expand

Getting started

Save Progress



Question 1

Tell me about yourself.

Previous Question

Next Question

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Washington (53)

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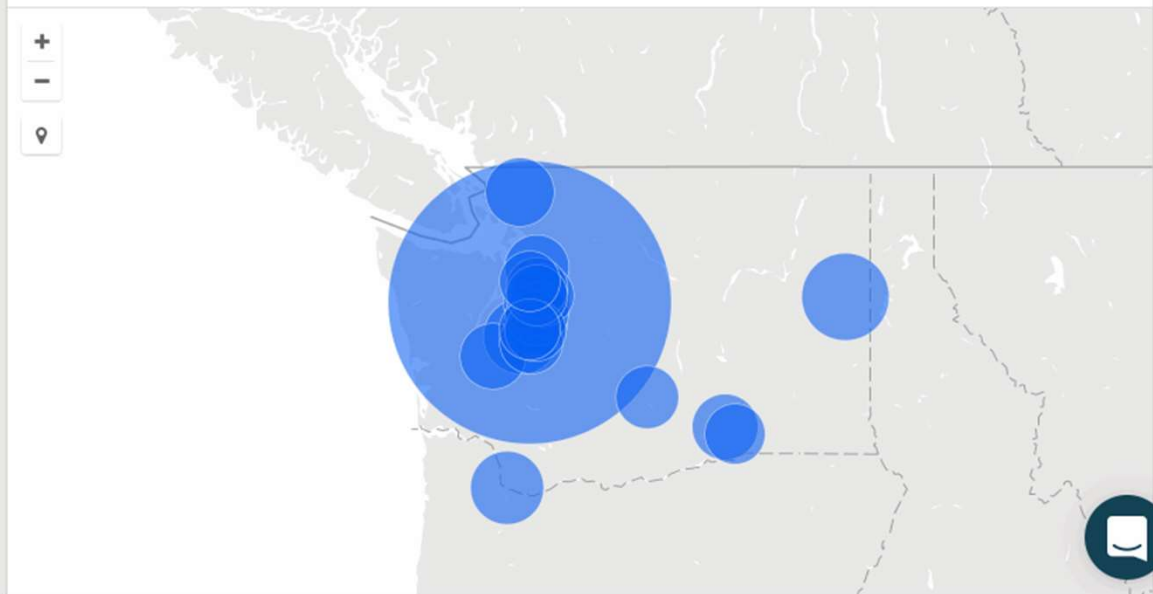


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CAREER READY TAKEOVER



"Who wants a job?"



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YOUR
FUTURE
DREAM JOB
AWAITS.



Go 
OWLS



The Next QEP

Multiple Academic Credentials for Workforce Competencies

Focus:

Career Readiness Across and Beyond the Curriculum

