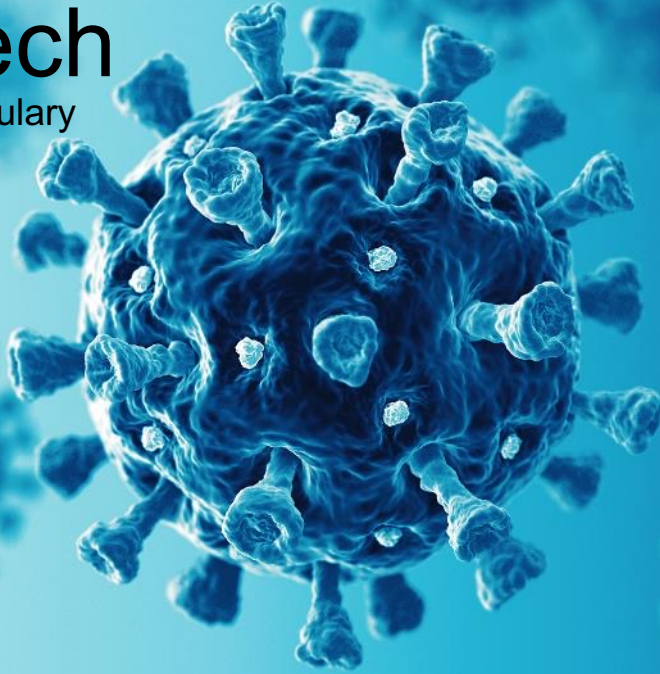


# New Competitive HOSA Event! Biotechnology

**The science behind the medicine**

Students have  
been exposed  
to a lot of **Biotech**  
vocabulary





PCR  
rtPCR

Antigen  
Antibodies

....

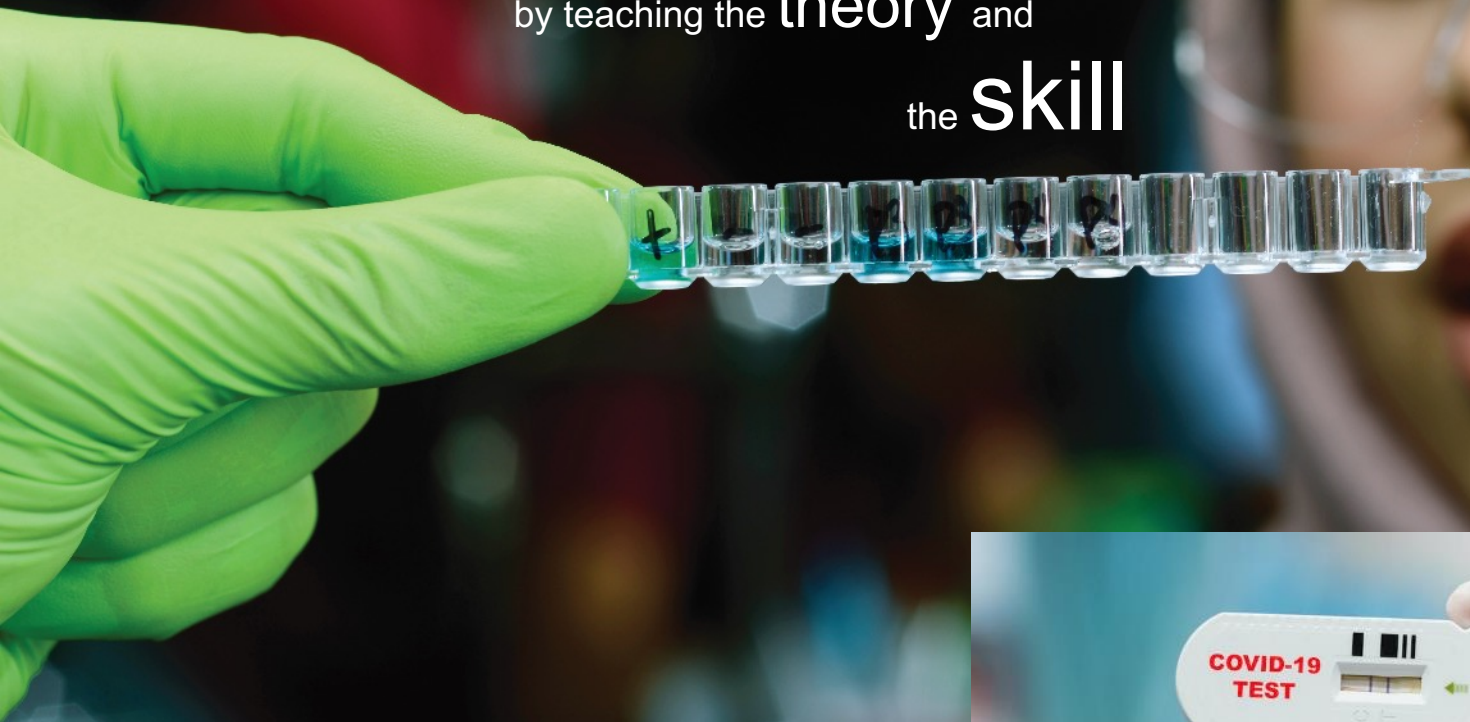


Build on the

# vocabulary

by teaching the **theory** and

the **skill**



### Health Professions Events

<b>NEW - Biotechnology</b>	<b>NEW - Clinical Laboratory Science</b>	<b>Clinical Nursing</b>	<b>Clinical Specialty</b>	<b>Dental Science</b>
<b>Family Medicine Physician</b>	<b>Home Health Aide</b>	<b>Medical Assisting</b>	<b>Nursing Assisting</b>	<b>Personal Care*</b> <small>IDEA qualified event</small>
<b>Pharmacy Science</b>	<b>Physical Therapy</b>	<b>Sports Medicine</b>	<b>Veterinary Science</b>	

- What is biotechnology?
- New for 2022-23: Competitive event in Biotechnology
- Resources





Biotech origins  
are ancient





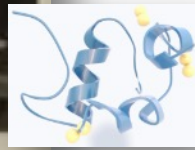




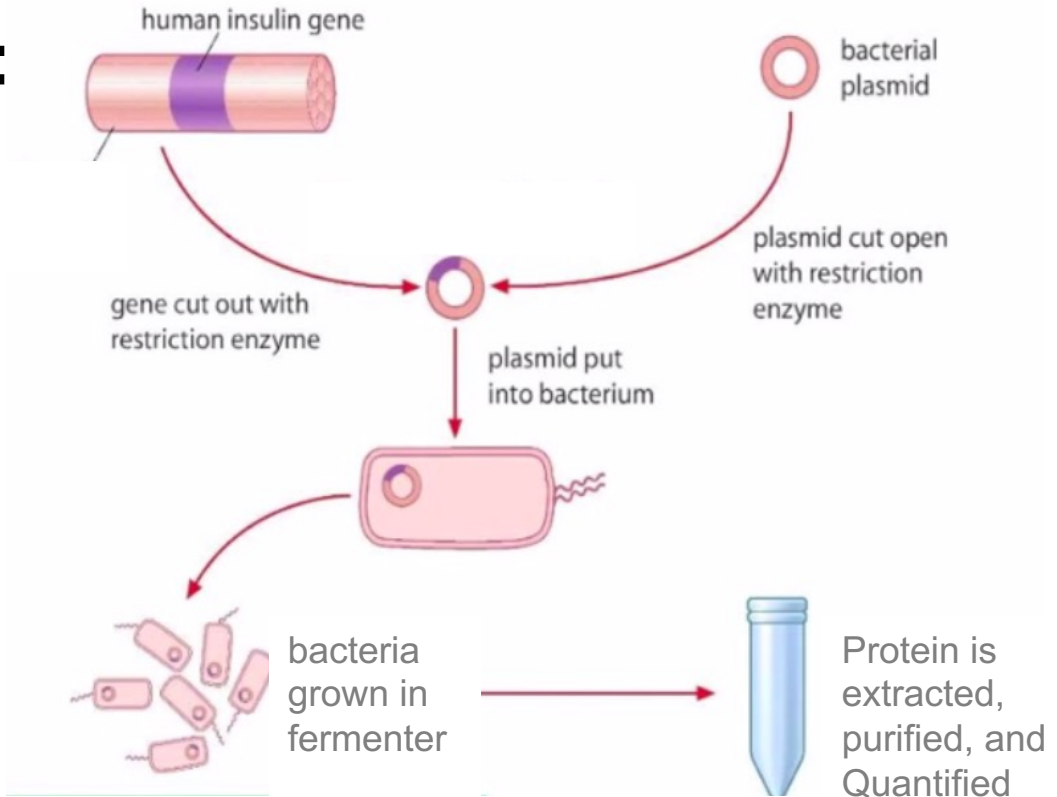
# Insulin

A case study of  
modern biotechnology  
in medicine





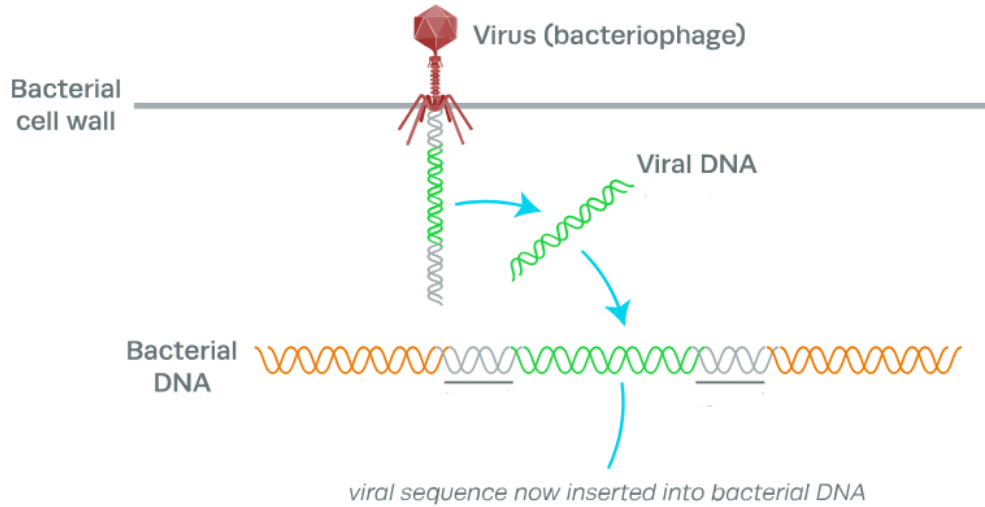
# Insulin Production: Modern Biotech



# Emerging Futures



## Gene Therapies are no longer the Future



They are HERE

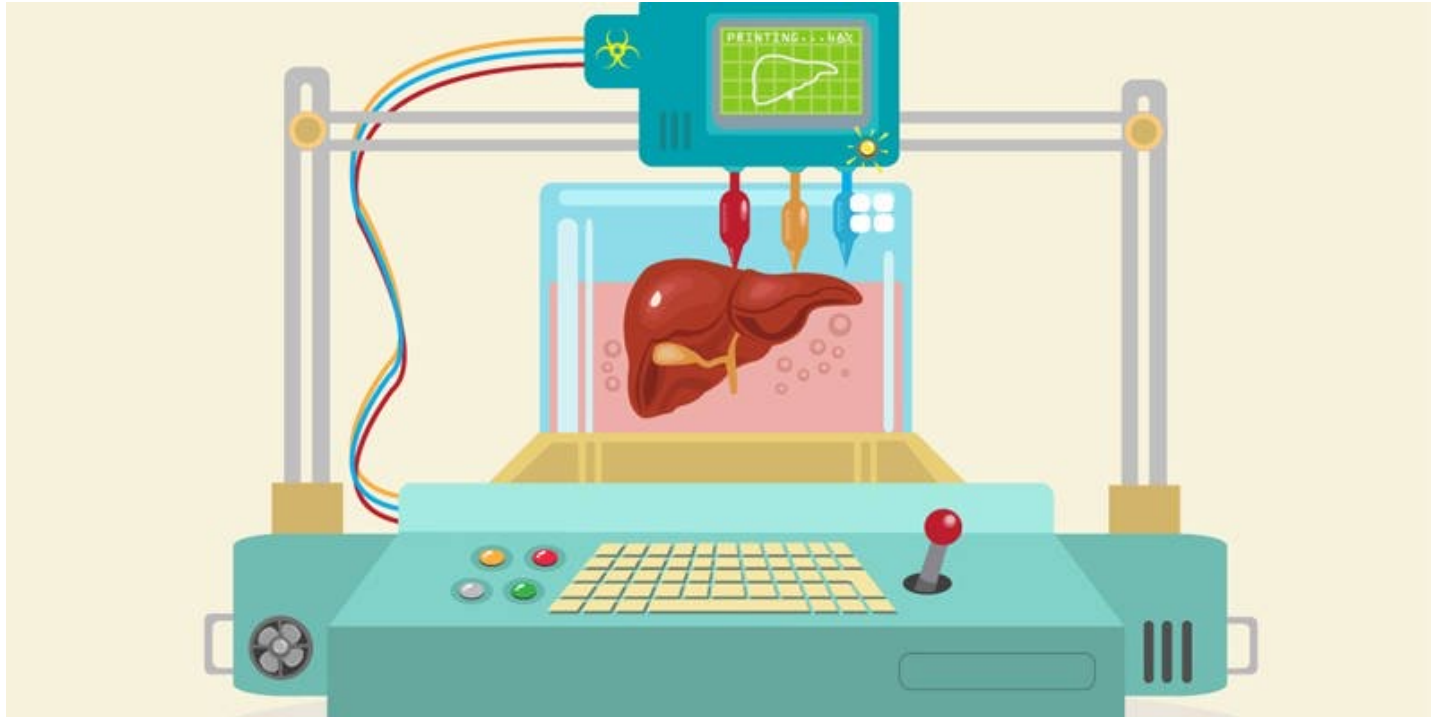
Victoria Gray

Sickle cell  
patient

First to be  
treated with  
CRISPR gene  
editing

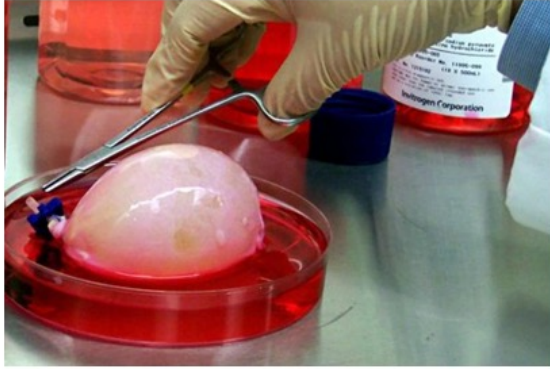


# Organ Printing

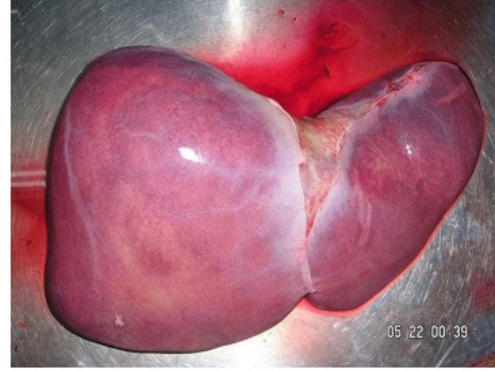




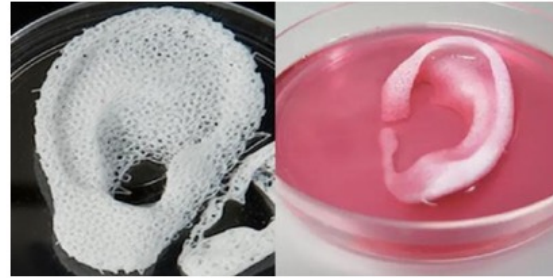
2001



2011\*



2013\*

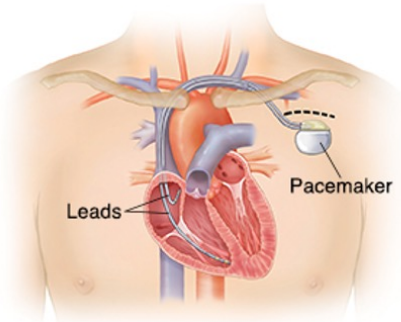


2017

# Cyborgs



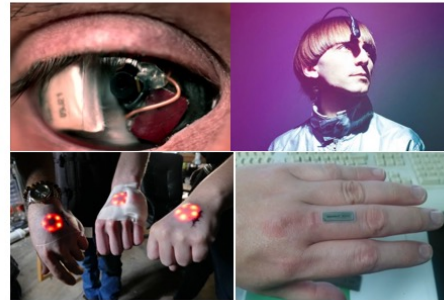
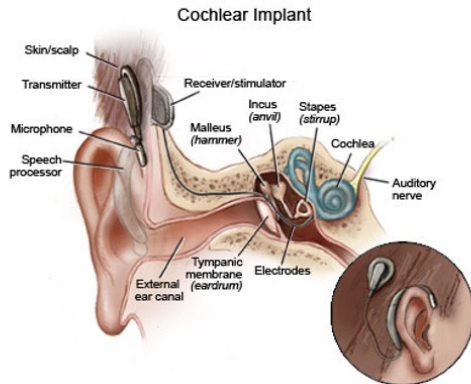
1958



2014

APL replaces double amputee arms, able to control with brain

1982



2018...





### Benefits for patient care

Enhance communication and inform decision-making

- Mechanism of disease
- How diagnostics and treatments work



### Career opportunities in:

- Medical research
- Diagnostics development
- Therapeutics, vaccines, etc.
- Clinical/medical lab science



Administration

BRIEFING ROOM

# Executive Order on Advancing Biotechnology and Biomanufacturing Innovation for a Sustainable, Safe, and Secure American Bioeconomy

SEPTEMBER 12, 2022 • PRESIDENTIAL ACTIONS

## Texas Medical Center's new 500-acre biomanufacturing center to bring 100,000 jobs to Houston



Evan MacDonald, Staff Writer

Sep. 21, 2022 | Updated: Sep. 21, 2022 6:35 p.m.



● ABOUT ● CONTACT ● MAPS ● COVID-19

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Admissions

Paying for College

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» NEWS »

### Dallas College Lands Historic Federal Grant To Grow Biotech Workforce in North Texas

- **Train a Diverse Skilled Workforce:** The United States is facing a shortage of relevant talent spanning all levels, from community college to graduate school. The initiative will expand training and education opportunities for all Americans in biotechnology and biomanufacturing, with a focus on advancing racial and gender equity and support for talent development in underserved communities.

# New HOSA competitive event in biotechnology

(and who is Bio-Rad, anyway?)

**NEW -  
Biotechnology**

## Our Locations

Headquartered in Hercules, California, Bio-Rad has offices and employees throughout the world.

**7,900**  
employees

**140+**  
locations

**35**  
countries

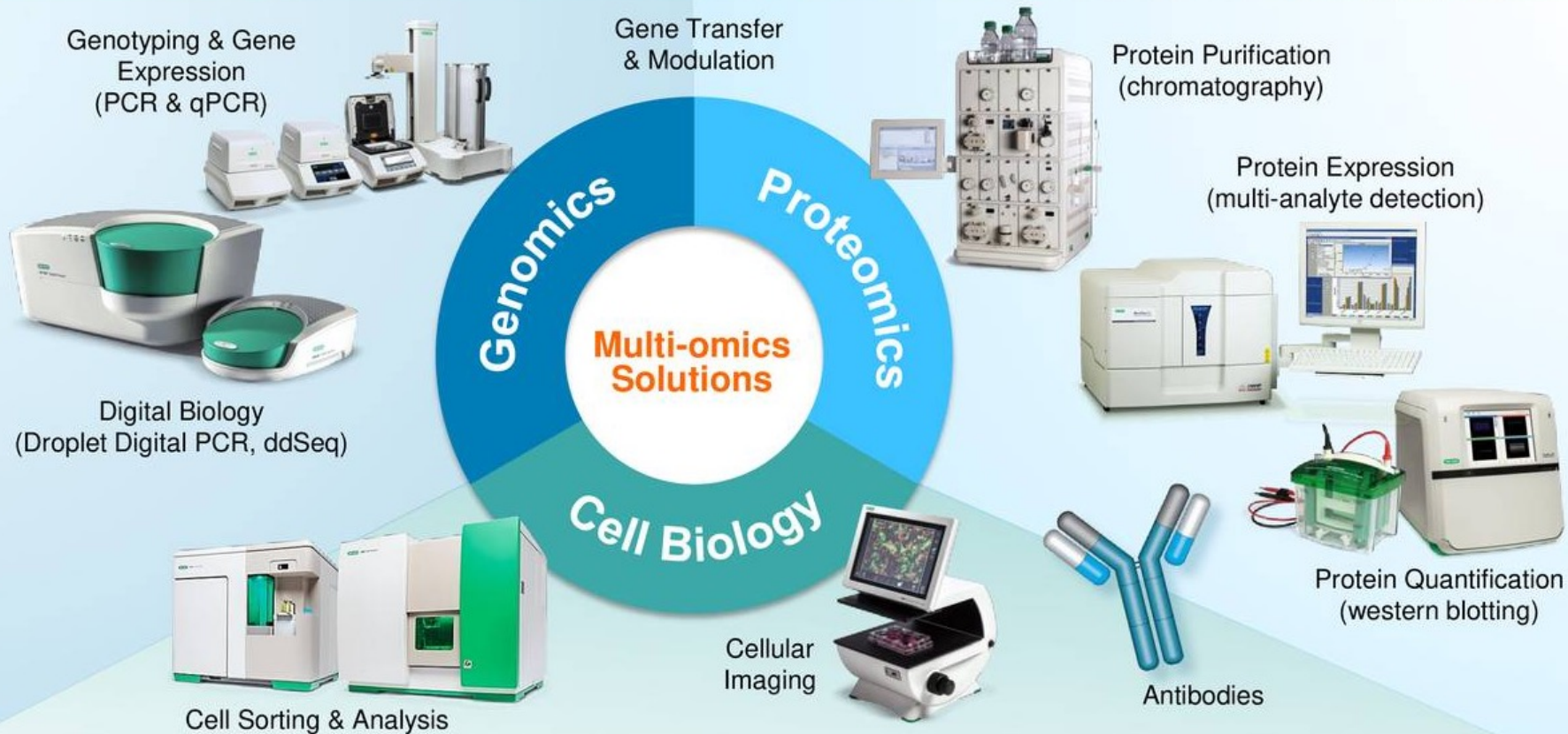
See [Appendix C](#) for full employee demographics

## Our Mission

To provide useful, high-quality products and services that advance scientific discovery and improve healthcare.







## Diagnostic Testing and Monitoring



- Diabetes
- Infectious Disease
- Autoimmune
- Transfusion Compatibility

## Protecting the Blood Supply

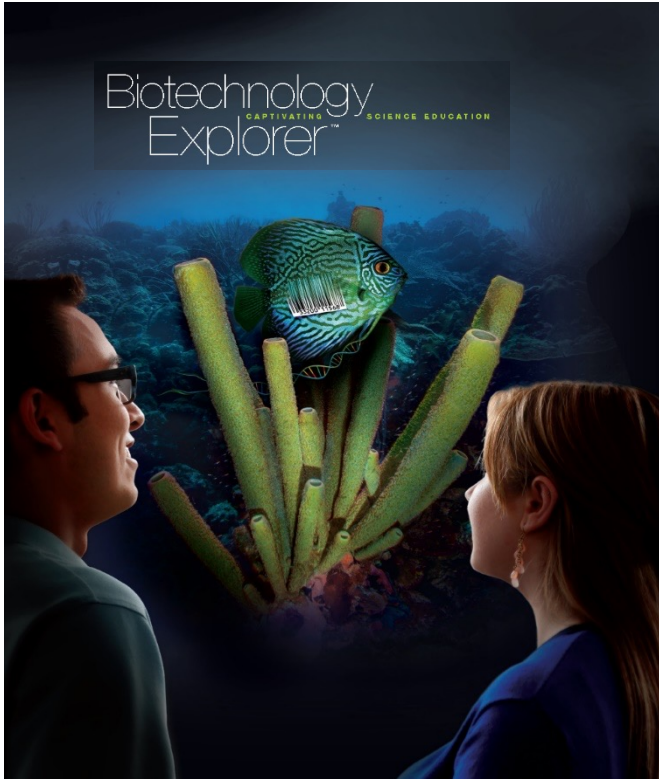


- Blood Typing
- Blood Virus Screening
- HIV Confirmation Testing

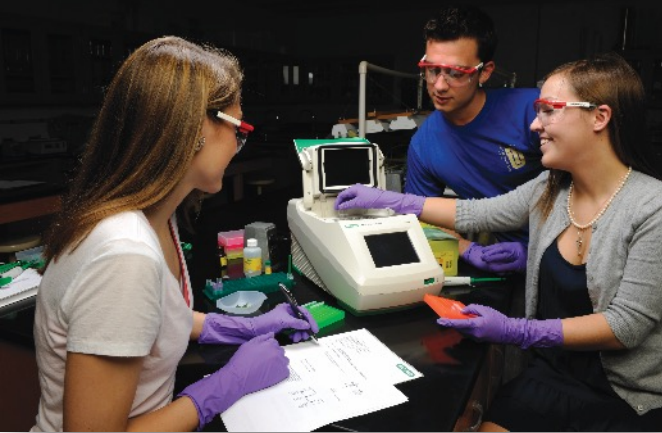
## Quality Assurance



- Quality Controls
- Quality Assessments
- Data Management



Founded in 1996 by Ron Mardigian  
Former High School Teacher



## Commitment to science education

**25 Years**

**>1 million students** in approximately 75 countries perform Bio-Rad Explorer activities each year

**Curriculum training specialists** train **over 2,000 teachers** every year in free, hands-on, in-person, and online workshops





About ▾

MyHOSA ▾

Partners ▾

Competition ▾

Conferences ▾

Resources ▾

## Health Professions Events

**NEW -  
Biotechnology**

**NEW - Clinical  
Laboratory  
Science**

**Clinical Nursing**

**Clinical  
Specialty**

**Dental Science**

**Family  
Medicine  
Physician**

**Home Health  
Aide**

**Medical  
Assisting**

**Nursing  
Assisting**

**Personal Care\***

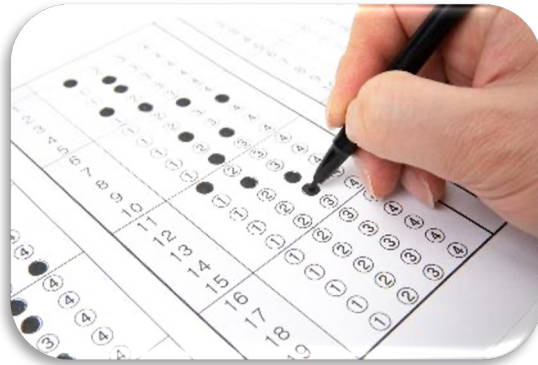
IDEA qualified event

**Pharmacy  
Science**

**Physical  
Therapy**

**Sports Medicine**

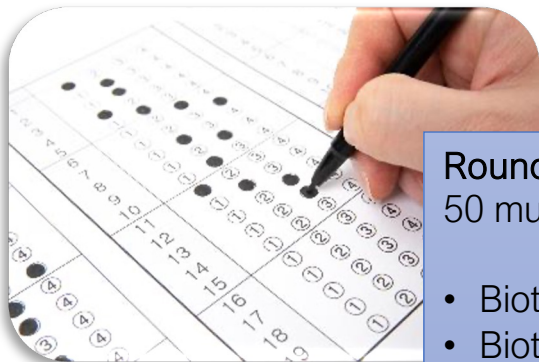
**Veterinary  
Science**



Round 1: Written test



Round 2: Hands-on skills



### Round One: Written Test

50 multiple choice items in a maximum of 60 minutes:

- Biotechnology industry practices and careers
- Biotechnology in health
- Governmental regulation of biotechnology
- Basic laboratory skills: PPE, preparing solutions, and pipetting
- Microbiology and cell culture
- DNA structure and analysis
- Bacterial transformation
- Polymerase chain reaction (PCR)
- Protein structure, function, and analysis
- Immunological applications (ELISA, western blotting)

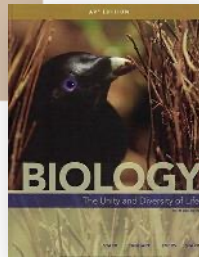
Top-scoring competitors advance to Round Two.



## Biotechnology: A Laboratory Textbook

- Student edition – for students
- Teacher supplement – for Advisors

Biology



**Biology: The Unity and Diversity of Life,  
AP® Edition**



**biotech-careers.org**



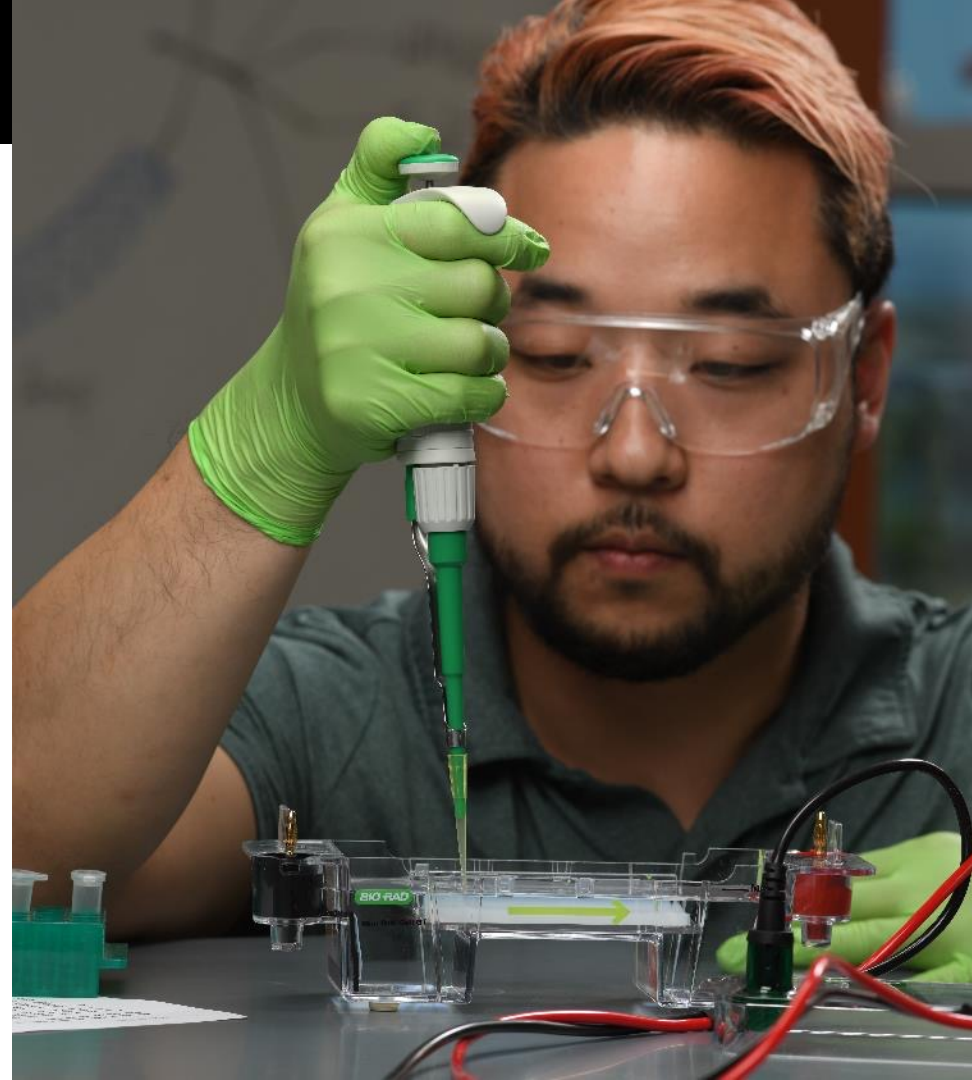
- Students exposed to many of these topics in other courses
- Biotechnology event enables a **deeper dive** and **career exploration**
- Biotechnology textbook offers focused content
- AP Biology textbook offers support



## Round Two: Hands-On Skills

Selection criteria:

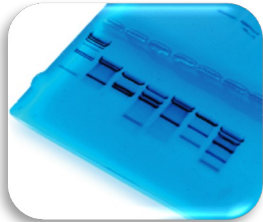
- Minimal equipment
- No hazardous chemicals or components
- Skill can be completed in <20 minutes
- Skill reflects techniques common to biology classroom laboratories
- Interesting, relevant, “real-life” scenarios and skills
- Supported by published protocols and videos



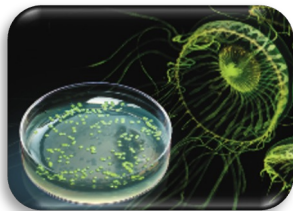
# Round Two: Hands-On Skills



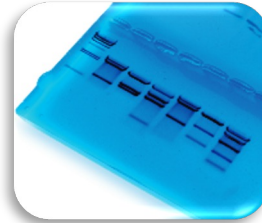
Using micropipets and transfer pipets



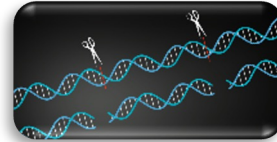
DNA gel electrophoresis



Bacterial transformation  
Calculation of transformation efficiency



DNA gel interpretation



Restriction digestion



Bradford protein quantitation assay

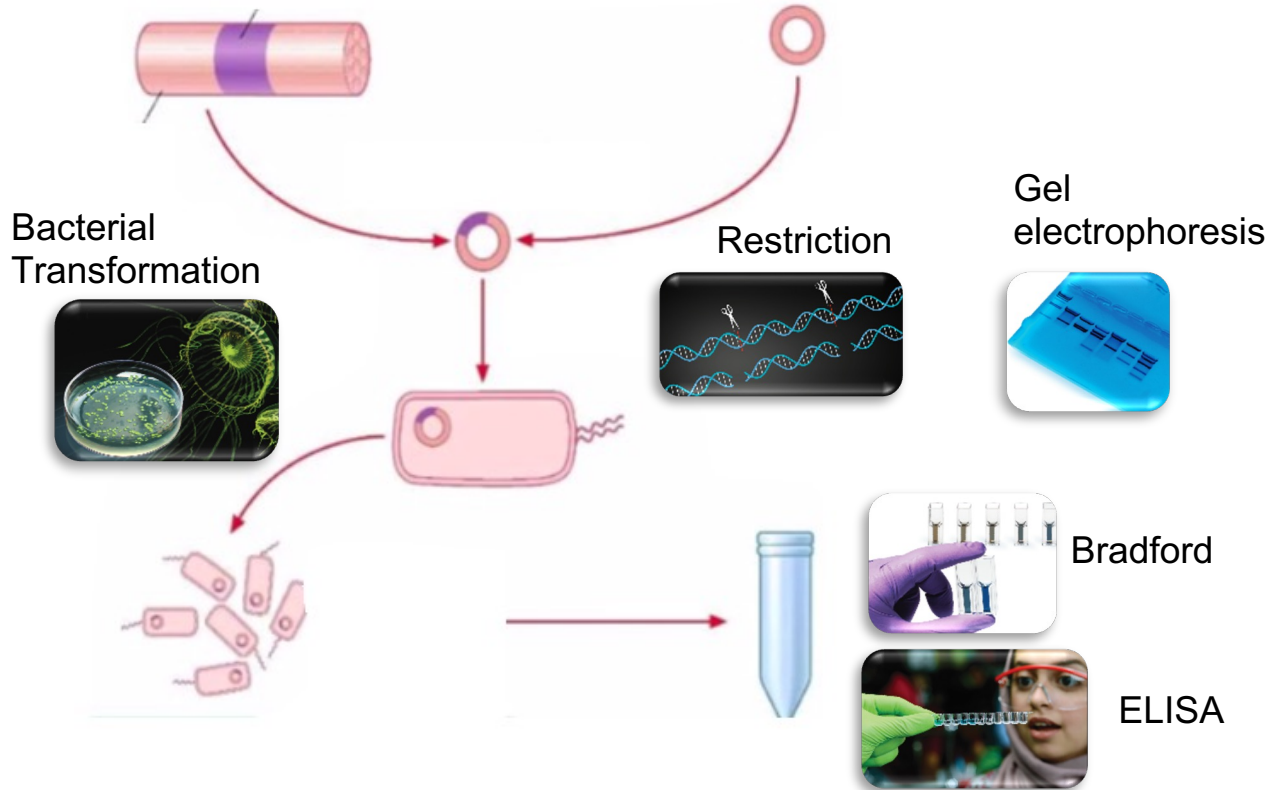


Qualitative ELISA

# Hands on Skills Mapped to Insulin production



Micropipettes used  
at every step



# Students have been exposed to many of these techniques! Biology, AP Biology, and other courses

**Biotechnology**

Section # \_\_\_\_\_ Division \_\_\_\_\_ SS \_\_\_\_\_ PS/C \_\_\_\_\_  
 Competitor # \_\_\_\_\_ Judge's Signature \_\_\_\_\_

*\*For all Judge verification steps, full points are only awarded if all components are accurate*

Skill I: Using 20-200 µl and 100-1,000 µl Micropipets and Transfer Pipets (Time: 15 minutes)	Possible	Awarded
1. Donned proper PPE, goggles/safety glasses/goggles, gloves, and lab coat (optional).	2	0
2. Labeled 3 microcentrifuge tubes: p200, p1000, and TP. Weighed each tube and recorded its mass. <i>Judge verified competitor cleared the balance before weighing each tube.</i>	4	0
3. Set a 20-200 µl micropipet to deliver 250 µl. Transferred 250 µl colored water to the tube labeled p200. <i>Judge verified competitor (i) selected 20-200 µl micropipet, (ii) set it to 250 µl, and (iii) used a clean pipet tip for the sample.</i>	4	0
4. Pipetted another 250 µl of colored water to the tube labeled p200.	2	0
5. Pipetted 100 µl of colored water to the tube labeled p200. Closed the tube labeled p200 tightly. <i>Judge verified competitor (i) selected 20-200 µl micropipet, (ii) set it to 100 µl, and (iii) used a clean pipet tip for the sample.</i>	4	0
6. Set a 100-1,000 µl micropipet to deliver 500 µl and transferred 500 µl colored water to the tube labeled p1000. Closed the tube tightly.	4	0
7. Used a transfer pipet to transfer 500 µl colored water to the tube labeled TP. Closed the tube tightly. <i>Judge verified competitor (i) selected 100-1,000 µl micropipet, (ii) set it to 500 µl, and (iii) used a clean pipet tip for the sample.</i>	4	0
8. Weighed all three microcentrifuge tubes and recorded mass of each. <i>Judge verified competitor (i) cleared the balance before weighing each tube and (ii) mass of liquid was similar across all tubes (±0.5 g).</i>	4	0
9. Cleaned work area: a. Disposed of pipet tips, microcentrifuge tubes, and transfer pipet in waste container. b. Cleaned work area with surface disinfectant. c. Removed PPE. d. Washed hands or used alcohol-based hand rub for hand hygiene.	2	0
	2	0
	2	0
	2	0
<b>TOTAL POINTS - SKILL I = 25.2</b>	<b>36</b>	

HOSA Biotechnology Event Guidelines (September 2022) Page 5 of 16



**Biotechnology: A  
Laboratory Textbook**

**YouTube Playlist**

**HOSA Guidelines**

## Round Two Skills

15. Round Two is the performance of a selected skill(s). The Round Two skills approved for this event are:

	<b>Textbook (Bio-Rad)</b>	<b>Time Allocated</b>	<b>Video Resource(s)</b>
Skill I: Using Micropipets and Transfer Pipets	pp. 50-53 (Part 3)	15 min	Videos <a href="#">1</a> and <a href="#">2</a>
Skill II: Set up Restriction Digestion Reaction	Page 140 (Part 1)	15 min	none
Skill III: DNA Gel Electrophoresis	pp. 140-141(Part 2)	20 min	<a href="#">Video</a>
Skill IV: DNA Gel Interpretation	pp. 136-138, 142	15 min	none
Skill V: Bradford Protein Quantitation Assay	pp. 254-255 (through step 10)	20 min	<a href="#">Video</a>
Skill VI: Bacterial Transformation	pp. 167-171	20 min	<a href="#">Video</a>
Skill VII: Calculation of Transformation Efficiency	pp. 155-156	10 min	none
Skill VIII: Qualitative ELISA	pp. 314-316	20 min	<a href="#">Video</a>

Skills should not be combined

Well  
Defined  
Rubrics

<b>Skill III: DNA Gel Electrophoresis – Digested Samples (Time: 20 minutes)</b>		<b>Possible</b>	<b>Awarded</b>
1.	Donned proper PPE: glasses/safety glasses/goggles, gloves, and lab coat (optional).	2	0
2.	Obtained rack containing 6 reaction samples and DNA size standard. Collected the liquid to the bottom of the tubes by either placing tubes into microcentrifuge or mini centrifuge and pulse-spinning for 5–10 seconds or tapped the tubes gently on the table.  <i>Judge verified competitor balanced the tubes in the microcentrifuge or tapped them on the table.</i>	4	0
3.	Pipetted 5 $\mu$ l of sample loading buffer (SLB) into each tube. Pipetted up and down or flicking the tubes to mix.  <i>Judge verified competitor (i) selected 2-20 <math>\mu</math>l micropipet and set it to deliver 5 <math>\mu</math>l to all 7 tubes and (ii) used a fresh pipet tip for each sample.</i>	4	0
4.	Placed the precast agarose gel into the electrophoresis chamber.  <i>Judge verified competitor placed the wells of the agarose gel near the black (-) electrode or cathode.</i>	4	0
5.	Filled the electrophoresis chamber with sufficient 1x TAE buffer to cover the gel by approximately 2 mm.	2	0
6.	Loaded 20 $\mu$ l each sample and 10 $\mu$ l standard into separate wells into the gel.  <i>Judge verified competitor (i) selected 20<math>\mu</math>l micropipet and set it to deliver correct amount, (ii) used a fresh pipet tip for each sample, and (iii) loaded sample into the gel with no gel breakage or sample overflow into nearby wells.</i>	4	0
7.	Recorded the order of sample loading in laboratory notebook.	2	0
8.	Placed the lid on the electrophoresis chamber.	1	0
9.	Connected the electrical leads to the power supply.  <i>Judge verified competitor connected red to red and black to black.</i>	4	0

## Biotechnology–Sample Skill Scenario

### Competitor Scenario 1:

It's your first day as a lab technician at the HOSA Laboratory. Your employer wants to test the accuracy of your pipetting skills. Please prepare three 500  $\mu\text{l}$  samples:

- Sample 1: in three increments (200  $\mu\text{l}$  + 200  $\mu\text{l}$  + 100  $\mu\text{l}$ )
- Sample 2: 500  $\mu\text{l}$  using a single micropipet
- Sample 3: Using a transfer pipet

Please record the mass of each sample here:

- Sample 1:
- Sample 2:
- Sample 3:

Skill to be performed:

- Skill I: Using 20-200  $\mu\text{l}$  and 100-1,000  $\mu\text{l}$  Micropipets and Transfer Pipets
- Time – 15 minutes

Students will need to **learn the steps** of each protocol

Students will need to have **proper technique** (check guidelines and rubrics)

Students will **not** have to memorize amounts of reagents to use



## Explore the Power and Promise of Biotechnology



NEW!

### HOSA Competitive Event in Biotechnology

Bio-Rad Laboratories, a global leader in the biotechnology industry, is excited to partner with HOSA to bring a new competitive event in biotechnology.

#### Why Biotechnology?

Biotechnology encompasses "the science behind the medicine," the tools and techniques used in medical research in the development of diagnostics, therapeutics, vaccines, and more. Today's students hold the promise of tomorrow's disease interventions and cures in their hands. Biotechnology will provide them with the tools they will need.

Career opportunities in biotechnology extend from laboratory-based research to clinical diagnostics, biomanufacturing, as well as regulatory and legal affairs. The Biotechnology Competitive Event provides HOSA members with the opportunity to gain knowledge and skills required in a laboratory setting. It aims to inspire members to learn more about biotechnology careers.

HOSA Advisors, how may we help?



Contact a Specialist

#### Event Summary

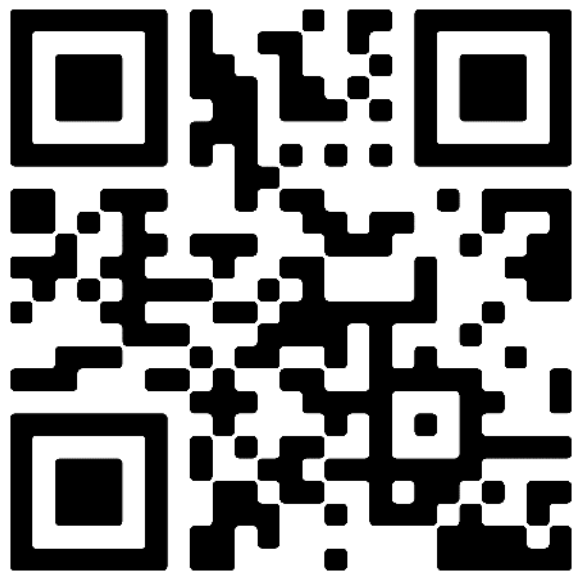
For complete rules and guidelines, and for sample questions, scenarios and grading rubrics, please visit the [HOSA Competition site](#).

Round One: Written Test

Round Two: Hands-On Skills Assessment

This written test will consist of 50 multiple choice items in a maximum of 60 minutes.

Round Two involves a hands-on skills assessment of



[bio-rad.com/HOSA](http://bio-rad.com/HOSA)

## The new competitive event in Biotechnology:

- Appeals to students given the last 3 years...
- Subject matter will likely already be familiar
- May help with recruitment!

Aligned with industry-recognized certification

Plenty of resources!



**NEW -  
Biotechnology**



Already doing HOSA Biotech Competitive event?  
You are almost ready then for the BACE!

Textbook aligned to the BACE and helps fill in manufacturing knowledge that other curriculums miss