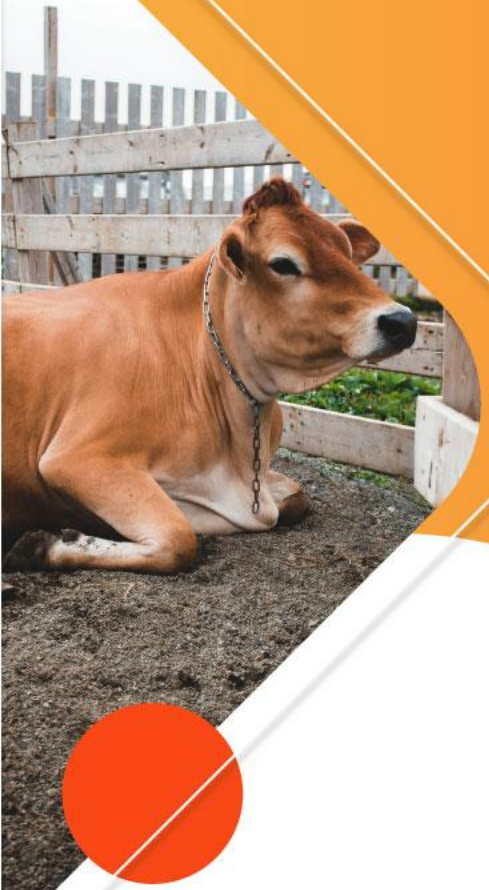
World Organisation for Animal Health

Regional Training Seminar for WOAH National Focal Points for Veterinary Laboratories (cycle III)

8 - 10 July 2025, Gaborone, Botswana



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CyberBiosecurity

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What networked devices/equipment do you have in your organization?

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Does your organization have any of these?

- Incident response plan
- Bring your own device policy (BYOD)
- Laboratory Information Management System (LIMS)

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Ever heard of (or use) any of these?

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Outline

- Case studies
- What is CyberBiosecurity?
- Foundations of CyberBiosecurity
- Threat Landscape
- CyberBiosecurity vulnerabilities in the laboratory
- CyberBiosecurity Risks to Materials, Data, Lab Workers, Animals & the Environment
- Developing Cybersecurity Training Programs & Fostering Awareness

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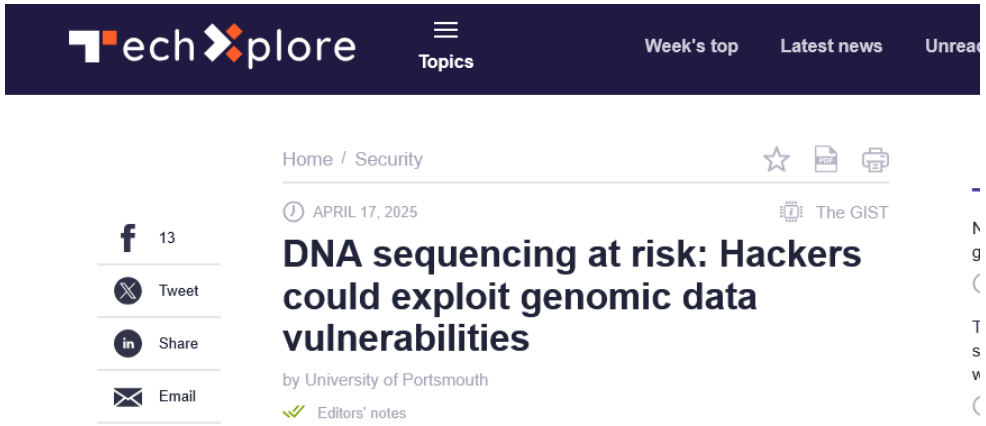
Case studies

SCIENCE

These Scientists Took Over a Computer by Encoding Malware in DNA

There's no immediate threat, but as sequencing becomes more commonplace, researchers face security risks.



Ransomware attack hits German pharmaceutical wholesaler, disrupts medicine supplies

AEP, a German pharmaceutical wholesaler based in Bavaria, said it was hit by a ransomware attack that could disrupt the supply of medicine to thousands of pharmacies.

Cyberattack on UK's CVS Group disrupts veterinary operations

By Bill Toulas

April 8, 2024 10:45 AM 0

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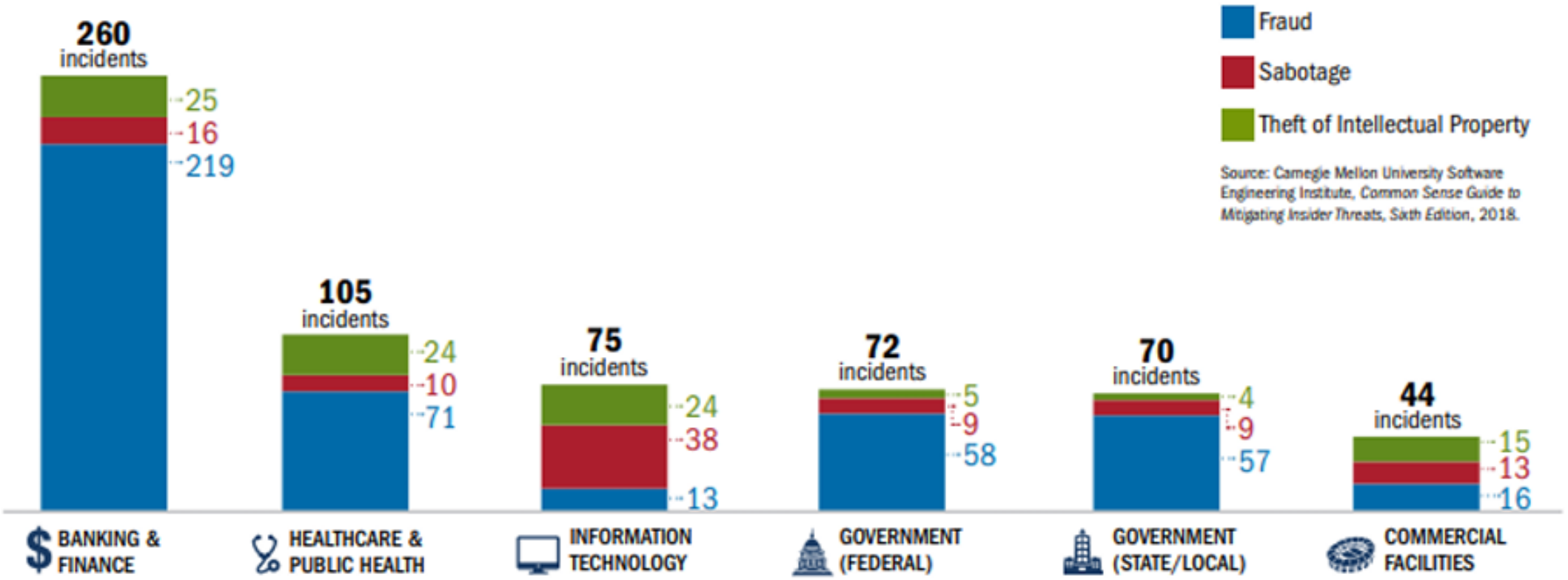
What Sectors are targeted?



Carnegie Mellon University Software Engineering Institute, *Common Sense Guide to Mitigating Insider Threats*, Sixth Edition.

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What is CyberBiosecurity?

"It is Nexus between Biology and Cybersecurity"

- *Computers can be compromised by encoding malware in DNA sequences*
- **Biological threats** can be **synthesized** using publicly **available data**
- **Trust within the biotechnology** community creates vulnerabilities at the interface between cyberspace and biology
- **Awareness is a prerequisite to managing these risks**

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Foundations of CyberBiosecurity

- Multidisciplinary
- Associated with potentially significant impacts to the bioeconomy
- Addresses the *malicious destruction, misuse, or exploitation of valuable information, processes, and material*
- Requires an **understanding of both life science and the digital worlds**

"[…] emerging hybridized discipline at the interface of cybersecurity, cyber-physical security and biosecurity."

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Threat Landscape

Cyberbiosecurity by the Numbers

- Ransomware attacks succeed every **40 seconds**, with an attempt every **11 seconds** (DataProt).
- **53%** of connected healthcare devices at risk of a cybersecurity attack (Cynerio).
  - Most vulnerable are IV pumps and VOIP systems

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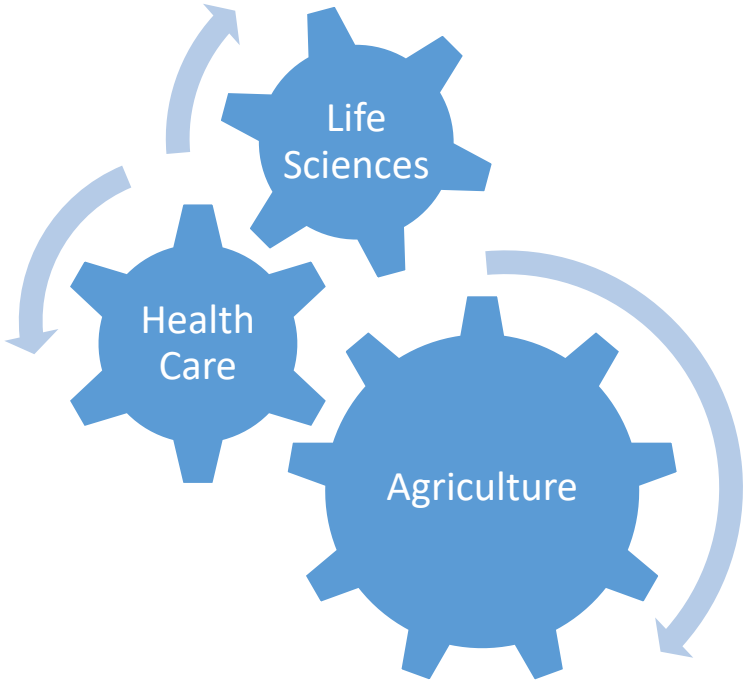
CyberBiosecurity – Risks to the Bioeconomy

Threats to the Bioeconomy

- Disrupted growth and innovation
- Theft, loss, or disruption of IP and data
- Misuse of products and organizations



Impacts from Realized Risk

- Employment
- Supply chain
- Transportation
- Trade
- Security
- Cybersecurity

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Sectors of concern

- Life sciences
  - Research
    - Sequencing
    - Laboratory Information Management Systems (LIMS)
  - Diagnostics
    - Patient information
    - Epidemiologic data
  - Non-traditional laboratory environments
- Biomanufacturing
- Biomedical sciences
- Biotechnology
- Synthetic biology

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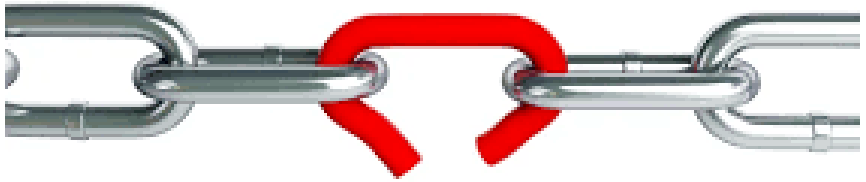
CyberBiosecurity vulnerabilities in the laboratory

- *"A weakness in system security procedures, system design, implementation, internal controls, etc., that could be exploited to violate the system security policy."*



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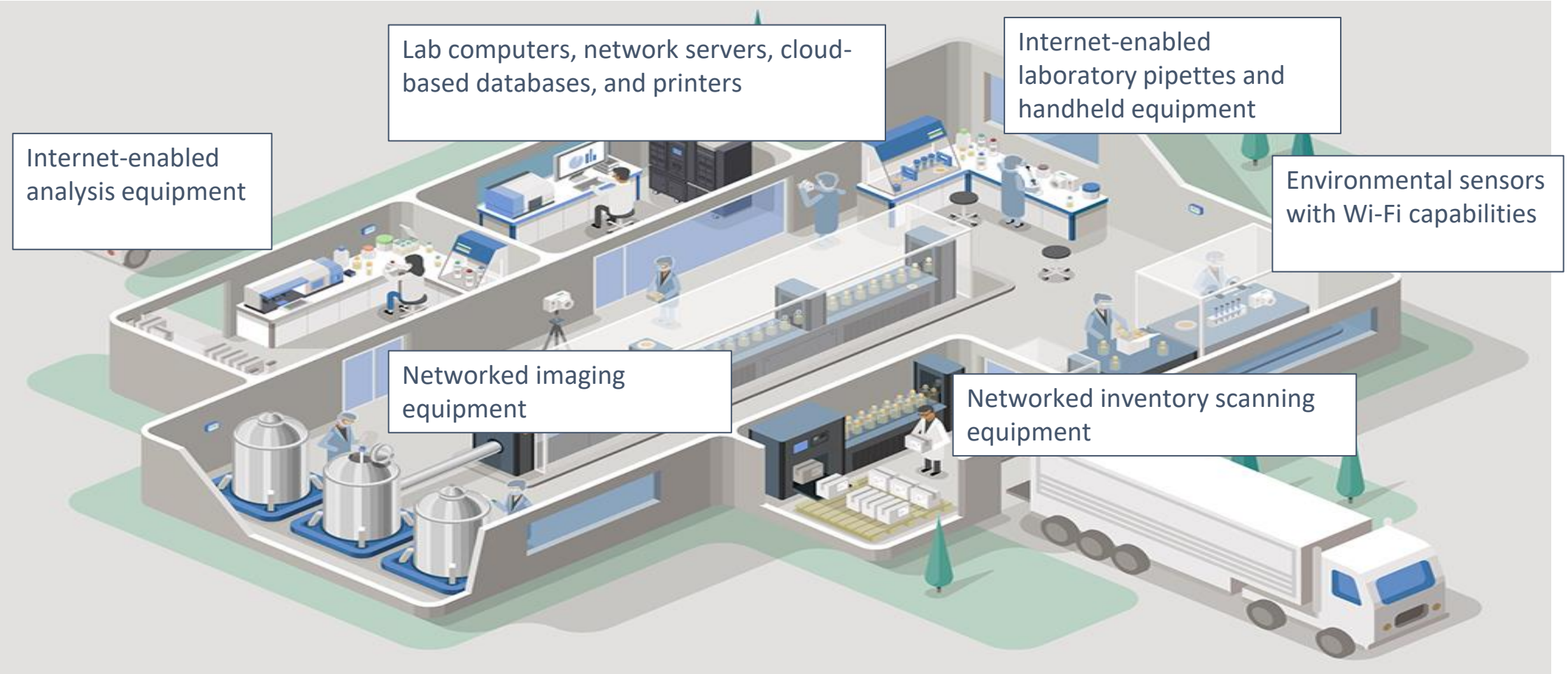
Where are the vulnerable points?



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Common equipment as attack vectors

All-in-one networked printers

Cameras and Surveillance

Freezer/Refrigerator Temperature Monitors

VoIP Phones

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Interconnected equipment and the IOT

Lab equipment as new vectors for cyberbiosecurity attacks

- **Interconnected devices** and sensors can be targeted by adversaries
- “Smart” technology, thermal cyclers, incubators, freezers, environmental sensors…

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Cyber-Physical vulnerabilities

- Access control systems
- Cameras and surveillance equipment
- Air handling / differential pressure systems
- Animal cage controls and containment systems

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Cyber-Material vulnerabilities

- Schedules/patterns for operations
- Digital maintenance order requests and schedules
- Biological waste streams and schedules
- Environmental monitors
- Inventory management systems and acquisition management

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Cyber-Transport vulnerabilities

- Record-keeping systems
- Chain-of-custody
- Transit control procedures
- Transport information and incident response planning

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Cyber-Personnel vulnerabilities

- Personnel access to data/ systems
- Training and competency
- Personal devices

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CyberBiosecurity Risks to Materials, Data, Lab Workers, Animals & the Environment

What is a Biological Risk?

- *"The **probability** that a particular adverse event [e.g., accidental infection or unauthorized access, loss, theft, misuse, diversion or intentional release], possibly leading to harm, will occur."*

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CyberBiosecurity Risks

- Integrity of materials
- Integrity of data and patient information
- Worker safety
- **Laboratory animals**

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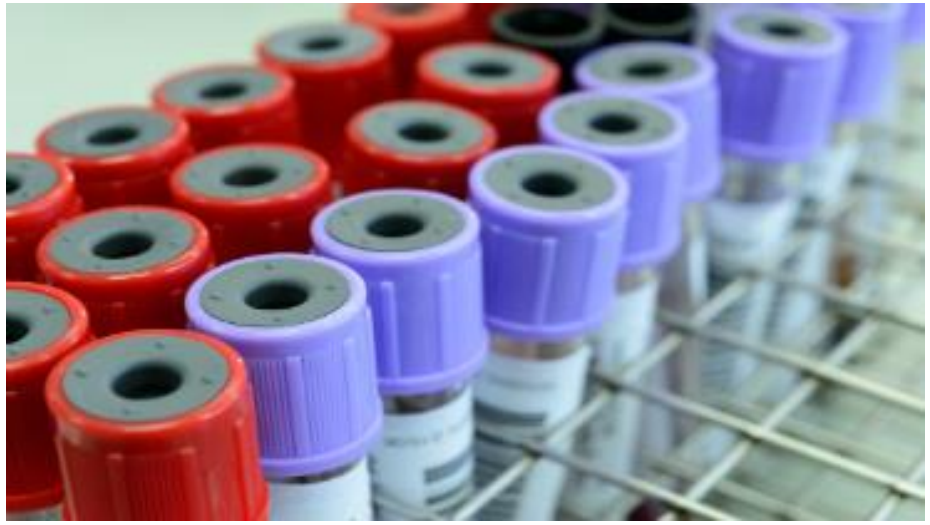
Risk to integrity of materials

- Altering DNA/RNA sequences
- Disrupting material storage conditions
- Altering reaction parameters
- Decreasing integrity of resultant work and publications



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Risk to integrity of data

- Altering, deleting, withholding, or generating uncontrolled data
- Releasing confidential data
- Creating malicious data that damages equipment or networks
- Data theft, misuse, violation of intellectual property
- Alteration of epidemiologic information
- Patient data and medical history

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Risk to Laboratory workers

- Compromised lab containment
  - Reversing containment airflow
  - Compromising intrusion detection measures
- Theft or ransom of medical information
- Compromising laboratory equipment to create operational hazards

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Risk to laboratory animals

- Disruption of **digitized monitoring equipment** (e.g., compromised animal cages or physical containment system)
- Alteration of animal housing conditions
  - Temperature
  - Air quality
  - Noise levels
- Adulteration or interruption of supply chain for animal feed, bedding, supplies, e.t.c

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CyberBiosecurity Risk and Threat Assessment

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Framework of Risk and Threat assessment

Ground-up laboratory assessment

- What equipment do I have, and which of it is IoT-enabled?
- What are my assets?
- Which of my assets are valuable to adversaries, and how are they protected?
- What are my lab's threats, vulnerabilities, and potential risks?
- What can I do to mitigate risks?
- How can I measure the effectiveness of my mitigation strategy?
- How do I respond in the event of a successful or unsuccessful attack?
- How often should I revisit my mitigation protocols?

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Defining Risks, Threats and Vulnerabilities

Risk is the potential for loss, harm, or damage.

Threat is an activity, deliberate or unintentional, with the potential for causing harm.

Vulnerability is a weakness in a system.

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Defining Risks, Threats and vulnerabilities

Threat + Vulnerability = Risk

Threat	Vulnerability	Risk
Negligent insider	Poor cybersecurity practices	Data breach

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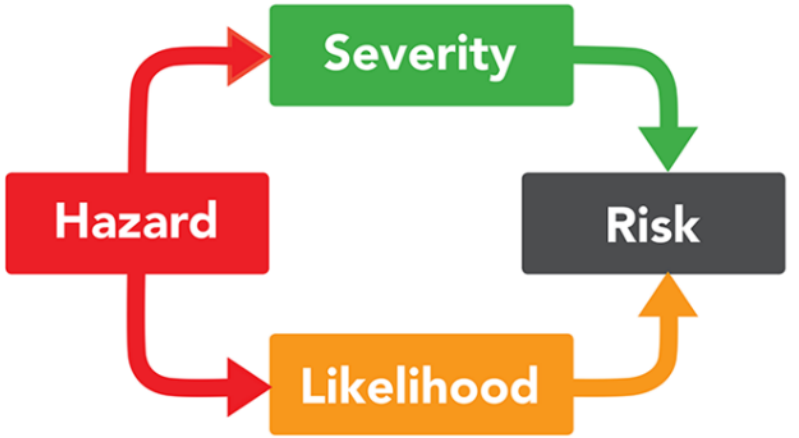
Conducting Assessment

1. Identify and prioritize biological materials
2. Identify and prioritize the threat
3. Analyze the risk with biosecurity scenarios
4. Develop a Risk Management Program/Plan
5. Re-evaluate regularly



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Developing Cybersecurity Training Programs & Fostering Awareness

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Communication mechanisms

Know your incident response communication mechanisms…

- Phone
- Email
- Teams / Instant Messaging
- Hotlines or Call Numbers
- Alternate systems

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Training program development

- Identify user groups
- Perform cybersecurity risk assessments
- Assess vulnerabilities and define mitigation strategies
- Competency testing and evaluation
- Iterate as necessary

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Awareness raising

- Culture of security
- Engagement of leadership
  - Impact on the organization
  - Impact on clients and public appearance
  - Impact on reputation

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Best practices for individuals

- Proper device hygiene
- Stewardship of your digital footprint
- Approval processes for new devices
- Supervised integration of new equipment
- Thorough and frequent communication among personnel
- Protect company information and intellectual property

- Use strong, unique passwords
- Regularly update software and systems
- Implement two-factor authentication (2FA)
- Backup important data frequently

https://haveibeenpwned.com/

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For organizations/Institutions

- Ensure regular pentest services
- Have BYOD policy
- Have a robust incident response plan
- Ensure compliance with cybersecurity framework(s) (NIST 2.0, ISO 27001 & ISO 27002 Frameworks, SOC2 Framework, NERC-CIP Framework, HIPAA Framework, GDPR Framework, FISMA Framework)
- Cybersecurity training programs

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Key Takeaways

✓ **Technology presents significant security vulnerabilities** to the life science enterprise and public health space

✓ **Cybersecurity** and **global health security converge** with increasing digitization of health data and information

✓ **Vulnerabilities pose a threat** to individual organizations' **reputation**, **integrity** and **quality of research data**, intellectual property, and **biological products**

✓ **Exploitation of these vulnerabilities** could easily **compromise public health** and health security

✓ There is an **urgent need to prevent threats** to bioeconomy through integrated efforts

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“Security of Biological Data and Infrastructure is a Shared Responsibility”

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Thank You!

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