

Cybersecurity to Solve the Mystery of the Kentucky Derby Disappearance!

FACILITATOR GUIDE | AGRICULTURAL CYBERBIOSECURITY ACTIVITY



<https://doi.org/10.21061/cyberbiosecurity>

Adapted by Kindred Grey from "Agricultural Cyberbiosecurity" by David Smilnak, Anne Brown, Joseph Simpson, Jaylan Day, and Hannah Scherer from <https://doi.org/10.21061/cyberbiosecurity>. CC BY-NC-SA 4.0. Includes picture by Monstera (2020), Pexels license, <https://www.pexels.com/photo/focused-little-girls-with-microscope-in-room-5063442/>; picture by NASA Goddard Space Flight Center (2018), CC BY 2.0, <https://flic.kr/p/NYokoi>; and picture by COD Newsroom (2017), CC BY 2.0, <https://flic.kr/p/Sz4zJK>.

Activity overview and background information:

In this activity, youth act as private investigators trying to figure out what happened to a prized Kentucky Derby racehorse that has gone missing. The facilitator provides them with the introductory scenario and as they work to figure out who was responsible, they continue to receive additional clues until they solve the mystery.

The scenario is set up to contain cybersecurity concerns with technologies commonly used in the livestock industry. Youth are introduced to technologies including GPS, RFID chips, and online databases that could be vulnerable to cyber attacks. This includes the Equine Microchip Lookup Tool™ (<https://equinemicrochiplookup.org/>) that was introduced in 2017 and is now common practice. Similar to RFID chips that are used for cats and dogs, horses are injected with a microchip that contains a unique identification number. The veterinarian verifies the animal when they put the chip in and register it in the database.

For background information on cyberbiosecurity concepts in this activity, please see the following Fact Sheets in the Cyberbiosecurity Education Resource Collection at <https://doi.org/10.21061/cyberbiosecurity>

- Cyberbiosecurity
- Data Literacy
- Sensors

SOLs and CTE competencies:

- CS 6.6: identify physical and digital security measures used to protect electronic information.
- CS 7.7: The student will identify existing cybersecurity concerns associated with Internet use and Internet-based systems and potential options to address these issues.
- Ag 8002: 45. Explain the economic significance of various plants and animals to the community.
- Ag 8003: 39. Describe the relationship of agriculture to other segments of society. 65. Describe new technologies in animal science.
- Ag 8004: 37. Explore new and emerging technologies in agriculture and agriscience.
- CTE Prof Comp: Demonstrate an understanding of information security. Includes: describing cybersecurity, identifying various information types/formats, and using technology ethically.

Learning objective:

Describe the importance of cybersecurity in ensuring accuracy, security, and storage of data in agricultural systems.

Time: 90 minutes
(total)

This activity can be done all at once or in four or five 15–20-minute sessions (e.g., as a warm-up activity).

Vocabulary:

1. **Microchipping:** implanting a microchip under the skin of an animal as a means of identification. Microchips store electronic information such as identification numbers.
2. **DNA testing:** use of DNA profiles to determine parental relationships. Commonly used in the livestock industry for documenting pedigree.
3. **Cybersecurity:** Protection of computer systems and networks from the theft of or damage to their hardware, software, or electronic data, as well as from the disruption or misdirection of the services they provide.
4. **Data security:** Protection of data from theft or manipulation.
5. **Data storage:** use of technology to keep data using computers or other devices.
6. **Data:** information gathered by the observation of people, things, or objects and can measure quantities, traits, or characteristics

Materials, supplies, and activity prep:

Participants need a copy of the Youth Activity Guide to work through. This can be provided either in hard copy or electronically.

PDF and customizable versions of the guide can be downloaded from the Cyberbiosecurity Education Resource Collection at <https://doi.org/10.21061/cyberbiosecurity>

Safety:

There are no special safety concerns for this “pencil and paper” activity.

Setting the stage:

Instructions: Lead discussion to activate prior knowledge using the following prompts

1. How do we know the location of things?
 - a. Lead to the idea of GPS data in tracking location (common in cell phones, collars for hunting dogs, AppleTags, etc.)
2. How do we identify things?
 - a. Lead to the idea of RFID chips and databases (common for house pets, contactless payments, entry key cards, etc.)

Activity facilitation steps:

There are 5 parts to this activity, as described here. In each part, the facilitator provides new information about the case and helps participants develop their ideas for what happened based on the evidence that they have. The Youth Activity Guide has the introductory scenario and places for participants to take notes as they work through the new information provided in each part.

Part 1: Introduction to Scenario and Suspects

Instructions: Review the following with participants (read aloud, etc.)

You roll out of bed, phone ringing, swipe the answer key and groggily ask who is calling. You wake up sharply when you realize it is your cousin Vinny, calling with a case for your fledgling PI business. You stumble over to your desk and fire up the laptop, quickly browsing to the newest news releases and find the article Vinny was talking about:

BREAKING NEWS: Top Kentucky Derby Contender Disappears Before Race
For Immediate Release

Richmond, VA. This morning, the VA community was shocked to learn that MegaByte, the top-ranked and VA-bred Kentucky Derby contender, had disappeared during transport just 4 days before the starting bell rings. MegaByte, a 3-year-old superstar owned by Donald Bytes, self-made computer billionaire and business mogul, was transported from his training stable run by notable, multi-time Kentucky Derby winning trainer Doug Waffle, to Churchill Downs overnight; however, upon turning up to feed him this morning MegaByte's groom, Celeste Hammel, found his stall empty and no sign of the potential champion on the grounds. "I'm devastated," Hammel remarked in an interview with the Independent Press, "Chomper just put in one of his best works and I'm certain he would have performed exceptionally this weekend." "Chomper", as MegaByte is lovingly referred to around the farm, had indeed, just clocked the best training time of any horse in the field, stomping the personal record of GoPhish the horse identified as MegaByte's major competition for the garland of roses. When we interviewed George Lopez, owner of GoPhish, about the developing situation he remarked "we are very saddened for MegaByte's connections and hope they are able to recover the horse before this weekend – it was certainly shaping up to be quite an exciting race." Indeed, the horse racing community is on pins and needles, waiting for any developments that might lead to MegaByte's recovery and inclusion within the race. Donald Bytes, owner of this racehorse, is offering a reward of \$500,000 for the location and successful recovery of MegaByte.

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Part 1 (cont.): Introduction to Scenario and Suspects

Your job!

As a new PI, this could be your break-out case! You immediately dig into the evidence and begin making inquiries. The first thing you do is identify the potential individuals who may have information about MegaByte's whereabouts.

Instructions: Participants have a blank table of potential suspects in the Youth Activity Guide. They should now use the information they have in the press release to start to fill in what they know about the potential suspects (connection to MegaByte and activities on the night in question). They should then interview you for additional information about suspects. Once they have all of this information, they will rank their top suspects and explain why.

Suspect	Connection to MegaByte	Activities from 8 pm to 8 am on Tuesday Evening
Donald Bytes	Owner	Presented as Keynote Speaker at Computers for a Cause event until 10 pm, returned to hotel in an uber, checked into room at 11 pm, ordered room service at 5 am, checked out of hotel at 9 am.
Doug Waffle	Trainer	Training 2 other horses set to run in Derby, currently under investigation for illegal drug use in other horses trained previously.
Celeste Hammel	Groom	Has groomed MegaByte since he was purchased as a yearling, prepped him for transport and helped load him onto the trailer
George Lopez	Owner of Rival Horse	Spent the evening at home with family
Tamra Bytes	Wife of owner	Attends races but horses aren't her thing. Attended Computers for a Cause event with Donald.
Marina Bytes	Daughter of owner	Occasionally cools MegaByte out after races. Was doing online advanced placement courses from 8 pm to 11 pm, went to sleep, and woke up at 5 am to Zoom with her parents over breakfast.
Harrold Vance	Transporter	20 years experience transporting show jumpers but just got into transport of race horses. Picked horse up from training barn at 8 pm and delivered to Churchill Downs at 12:30 am. Had to park outside the farm in the loading area following the temporary construction signs.
Felicia Kind	Trainer of Rival Horse	Trainer of GoPhish, spent the evening alone, working on training plans for her horses after a date got canceled last-minute.

Part 2: New Information from Investigations

Instructions: Share the new information below with the participants. They have a place in the Youth Activity Guide to record their notes, important clues, and suspects they can now rule out.

Investigations ramp up into George Lopez and Felicia Kind – could the Kentucky Derby Disappearance be foul play?!

- Lopez cleared, wife and family testify, SmartLock system on house confirms he was home whole night.
- Lopez in poor financial state, needs this win to keep horse business afloat.
- “Canceled Date” reveals that Felicia Kind was the one who called date off, Felicia maintains she did not.
- Kind has no alibi and all the motive, Kind barn is searched, MegaByte is found!

Part 3: New Information about found horse

Instructions: Share the new information below with the participants. If desired, you can show participants the lookup tool and discuss ID tracking. They have a place in the Youth Activity Guide to record their notes, important clues, and suspects they can now rule out.

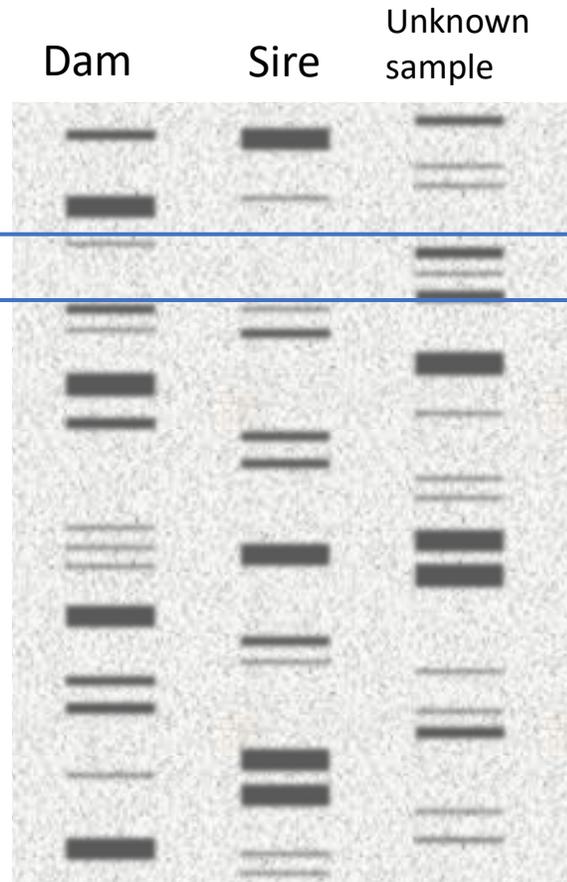
BREAKING NEWS: Lopez pulls GoPhish amid Kentucky Derby Scandal allegations

- Lopez loads all 6 of his horses on a trailer and heads home to distance himself from the scandal
- Owner Donald Bytes noticed that the horse was acting a bit differently than MegaByte’s typical behavior and started to suspect that this was not his horse. He called the vet to scan the horses’ ID chip. A search in the Equine Microchip Lookup Tool™ database for the 15-digit number on the chip reveals that the ID number on the microchip in the horse found in the Kind barn does not match MegaBytes! It matches another horse that is being trained by Kind.
- To confirm that the microchip is correct, Donald Bytes also ordered a DNA paternity test for the found horse.

Instructions: Work with participants to interpret the DNA gel electrophoresis data provided in the Youth Activity Guide. Gel electrophoresis is used to identify individuals or animals that are related based on their genetic sequence. To read an electrophoresis gel, you must compare all three genetic samples and compare the bands for similarities and differences. In this case, the dam and the sire are compared to an unknown sample. By using the bands from the dam and sire, you can see which bands are a match to each parent. If it is a match, the unknown specimen should not have any bands that the dam or sire do not. Genetic samples are commonly required for verification and national registries. The data registered for MegaByte is provided for comparison to the sample collected from the found horse. Participants should conclude that the found horse is definitely not MegaByte.

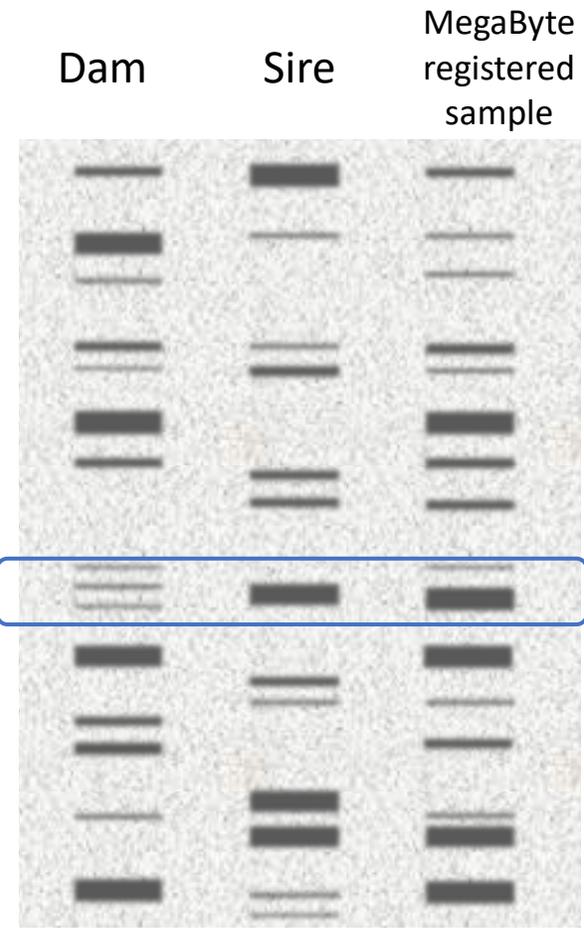
The gels on the next page are annotated with examples of matches and mismatches you can use to help participants understand what they are looking for.

Part 3 (cont.): New Information about found horse



The unknown sample has several bands that do not match either the dam or the sire. An example is circled here where none of the bands on the unknown sample in the highlighted window match with bands from the sire or dam.

All of the bands for MegaByte's registered sample match either the dam or the sire. An example is circled here where the top (thin) band of the sample matches the dam and the bottom (thicker) band matches the sire.



Part 4: New Information about the night in question

Instructions: Share the new information below with the participants. They have a place in the Youth Activity Guide to record their notes, important clues, and suspects they can now rule out.

BREAKING NEWS: Vance claims horse was not dropped off at Churchill Downs

- Traffic patterns from night of disappearance suggest commute should have been 6 hours.
- After comparing notes about the drop off spot, Vance and Hammel find some concerning discrepancies. Hammel drives Vance to the site where he should have dropped MegaByte off and it looks different. He can't be sure because he dropped MegaByte off at night, but Vance is pretty sure this isn't where his GPS told him to go.
- Vance dropped horse with younger, female handler, who appeared familiar with horse.
- Hammel says she received instructions from track officials that said she was not needed to be there to receive horses; she was told racetrack officials must receive him.
- Racetrack officials were interviewed and indicated no communications with Hammel or Vance took place; but Hammel and Vance were able to produce text messages appearing to come from Churchill Downs officials.
- Lead rope matching description of MegaByte's found in trash at Waffle barn near Hammel's locker.
- Hammel has no alibi for time of MegaByte's disappearance. She says she went home after loading him on the trailer but doesn't have any evidence to confirm that.

Part 5: Who Done It?

Instructions: In this part, participants use the evidence they have to pose a possible solution to the mystery. This section can be facilitated as a whole group discussion or small group work guided by the following questions. Key insights that the participants should have noted are provided here to help you move things along if they are stuck. Try to give hints and guidance without giving it away too quickly. The explanation provided here is a plausible solution, but participants are free to come up with their own ideas provided that they fit with the available evidence.

What parts of the story don't add up?

- Horse dropped at wrong site, despite driver using GPS
- Discrepancy in who canceled Kind's date
- Discrepancy in who was supposed to receive horse

What do we know about when the horse was received?

- ~12:30 am
- By younger female, appeared familiar with horse

Part 5 (cont.): Who Done It?

Who done it? How? Why?

- Marina Bytes, after logging out of her AP courses, hacked into the dispatcher's computer system to put in the wrong GPS coordinates and rerouted him to a satellite farm owned by her father.
- She placed traffic signs to prevent entry to the farm, met the driver, and unloaded the horse. She also sent fraudulent text messages to Vance and Hammel appearing to come from the racetrack staff.
- Initially framed Kind with canceled date; however, when that didn't stick, had to try to frame Hammel with lead rope.
- Was trying to prevent horse running in race because she didn't trust trainer and was concerned horse would get hurt.
- Her advanced placement courses and upbringing around computers made her a skilled hacker.

Processing questions

Share

1. What role does identification data play in agricultural systems?
2. What role does location data play in agricultural systems?

Generalize

1. What other data vulnerabilities can you think of in agricultural systems?

Apply

1. What ideas do you have for a new technology or software that could help protect data in agricultural systems?

Acknowledgments

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About this project

Cyberbiosecurity is an emerging field that focuses on creating security measures for digital aspects of our food and agriculture systems, creating a structure and opportunity for a safe food system that can meet the large needs of a growing population and world. This educational resource was developed as part of a project to support formal and non-formal agricultural educators in integrating cyberbiosecurity topics and research-based strategies for engaging middle-school-aged girls in STEM into their educational programs.

The entire resource collection can be accessed here: <https://doi.org/10.21061/cyberbiosecurity>

The project is an outreach effort of the Virginia Tech Center for Advanced Innovation in Agriculture.



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This definition of OER is provided by [The William and Flora Hewlett Foundation](#).

How to access these templates

The main landing page for these resources is <https://doi.org/10.21061/cyberbiosecurity>.

This page includes a downloadable and editable Word document for the:

- Student fact sheet
- Student activity sheet
- Faculty guide

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Example: Adapted by [your name] from “Agricultural Cyberbiosecurity: Big Data” by David Smilnak, Anne Brown, Joseph Simpson, Jaylan Day, and Hannah Scherer from <https://doi.org/10.21061/cyberbiosecurity>. [CC BY-NC-SA 4.0](#).

Style guide

Student fact sheet

- Headers
 - Font: Baloo Bhaijaan (should already be installed in Microsoft Word)
 - Size: 18
 - Color: #E58F00 (orange), #5A6A45 (green), #7E7495 (purple)

Student activity sheet

- Headers
 - Font: Baloo Bhaijaan (should already be installed in Microsoft Word)
 - Size: 18
 - Color: #8498B2 (blue)

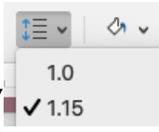
Facilitator's guide

- Headers
 - Font: Baloo Bhaijaan (should already be installed in Microsoft Word)
 - Size: 18
 - Color: #8498B2 (blue)

Body text (for all 3 templates)

- Font: Encode Sans (can be downloaded [here](#) if not already in Microsoft Word)
- Size: 11
- Color: #000000 (black)

You can add more pages to any template by clicking insert > blank page. Copy the background image and paste onto your blank page.

All text should be justified () and have a line spacing of 1.15 ().

Elements to copy & paste into the student activity sheet

About this activity

Write your text here.

You will need:

1. Write text here.
2. Write text here.
3. Write text here.

STEP

Write text here.

1

Elements to copy & paste into the student fact sheet

Fun fact!

Type your text here.

Introduction

Type your text here.

Type your text here.

Figure caption

