X-Citing X-Rays

Gr. 2-6 Activity Write Up

Actua | 111 Murray Street, Ottawa, ON K1N 5M5 | www.actua.ca | 613 234 4137

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X-Citing X-Rays

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About Actua

Actua is creating a Canada where every child has the skills and confidence they need to achieve their full potential. As a leading science, technology, engineering and mathematics (STEM) outreach organization, Actua includes over 40 universities and colleges, engaging 500,000 youth in 600 communities each year. For 25 years, Actua has focused on identifying and removing the barriers for entry into STEM and now have national programs dedicated to engaging Indigenous youth, girls and young women, Black youth, those facing economic barriers and youth in Northern and remote communities. For more information, please visit us online at www.actua.ca and on social media: Instagram, LinkedIn, Facebook and YouTube! For more information, please visit us online at www.actua.ca and on social media: Instagram, Facebook, LinkedIn, TikTok and YouTube!

X-Citing X-Rays

Activity Summary

Participants will explore x-rays and their usefulness in industries like scientific research, security, and healthcare. They will also learn some ways x-ray machines are used in veterinary medicine to diagnose medical issues in animals. Participants will act as veterinary radiologists, training an “AI” to recognize and identify ingested foreign bodies in dogs. Lastly, they will create an x-ray themed craft based on a fish or a polar bear.

Developed by Actua, 2025.

Delivery Environment	Activity Duration	Intended Audience	Tech
In-Person	55 Minutes	Grades 2-4 (*Ages 7-10*)	**Facilitators should have access to a laptop, projector, speakers, and a screen or blank wall to project onto.** • Projector • Speaker • Screen/Blank Wall • Laptops/Tablets

Achievement Goals

Learning Goals

Following this activity, participants will:

- **Understand** the physics of x-rays and how they are used to detect the density of objects.
- **Identify** medical issues in veterinary radiographs to "train" AI.
- **Apply** the understanding of how x-ray machines visualize skeletons with art.

Success Criteria

Following this activity, participants can express:

- **I can describe** what x-rays are and how they are used in a variety of careers.
- **I can identify** objects in x-ray radiographs.
- **I can use** art to represent how an x-ray machine visualizes animal skeletons.

Logistics (Timing, Group Sizing, Materials)

Section Title	Time	Group Size	Materials
Opening Hook	10 minutes	*Whole Group*	**Facilitators** • X-Citing X-Rays Activity Slide Deck (*Appendix C*)
Section 1: X-ray Investigation	20 minutes	*Small Groups (3) or Pairs*	**Facilitators** • X-Citing X-Rays Activity Slide Deck (*Appendix C*) **Per Pair or Small Group** • Train an X-Ray AI Activity Page (*Appendix C*) • Writing Utensil • Bone Word Search Activity Page (*Appendix C*)

Section Title	Time	Group Size	Materials
Section 2: Animal X-rays	20 minutes	*Individual*	**Facilitators** • X-Citing X-Rays Activity Slide Deck (*Appendix C*) • Hot Glue Guns **Per Participant** • X-ray Template Activity Page (*Appendix C*) • Colored Construction Paper • Black Construction Paper • Scissors • Scotch Tape • Writing Utensils • White Pipe Cleaners • Brass Fasteners • Googly Eyes • Miscellaneous Craft Materials
Reflection & Debrief	5 minutes	*Whole Group*	• N/A

Safety Considerations

Safety considerations have been provided below to support safety during this activity, however they are not necessarily comprehensive. It is important that you review the activity and your delivery environment to determine any additional safety considerations that you should be implementing for the delivery of these activities.

Emotional Safety

- Facilitators should understand that participants have different lived experiences and prior knowledge about AI safety, AI, and digital citizenship. This activity may involve or lead to discussions of sensitive topics, such as

ethical implications of AI. Facilitators should encourage open, respectful discussions and acknowledge all perspectives. Facilitators should always keep the participants' emotional safety in mind in these discussions, and defer to training from their institution and training received.

Glue Gun

- Ensure the glue gun is left in a safe place and the hot tip is left on something that is heat proof. Participants should be reminded that the tip of the glue gun becomes very hot while in use. Facilitators should use the glue gun for participants in Grade 6 or under.
- Should always be low-temp guns used under adult supervision.

Scissors

- Remind participants of how to use scissors properly and safely. Ensure participants are sitting down and have age appropriate scissors. Offer assistance when cutting thick materials, such as corrugated cardboard or popsicle sticks to help prevent injury.

Curriculum Links

This activity aligns with these components found in the UNESCO AI Competency Framework for Students:

Human-Centered Mindset: Human Agency

- Learners are expected to be able to recognize that AI is human-led and that the decisions of the AI creators influence how AI systems impact human rights, human-AI interaction, and their own lives and societies (p. 29-30).

AI Techniques and Applications: AI Foundations

- Learners are expected to develop basic knowledge, understanding and skills on AI, particularly with respect to data and algorithms, and understand the importance of the interdisciplinary foundational knowledge required for gradually deepening understanding of data and algorithms. They should also

be able to connect conceptual knowledge on AI with their activities in society and daily life, concretizing a human-centred mindset and ethical principles through an understanding of how AI works and how AI interacts with humans (p. 32-34).

AI Techniques and Applications: Application Skills

- Learners are expected to be able to construct an age-appropriate knowledge structure on data, AI algorithms and programming, and acquire transferable application skills. (p. 41).

This activity can be connected to the following subject areas:

Science

- Explore the basic physics behind X-rays, including their properties and how they are used to detect the density of objects.
- Understanding the role of science and technology in society and daily life.
- Apply knowledge of basic anatomy and physiology to represent and visualize animal skeletal structures.

Community Connections

Community connections are suggestions from Actua, grounded in our approach, on how facilitators can adapt the activity to reflect the strengths, interests, and priorities of the community where or with whom it is delivered. Consider the following guiding questions to adapt the activity in meaningful ways:

- **Consult with community:** Are there local organizations, Knowledge Keepers, or community members who could contribute insight or context to this topic?
- **Draw on youth experience:** How can you give participants opportunities to share, reflect on, and apply how this learning is relevant to them or their community? Invite participants to identify what knowledge, who, and where they already learn from.

- **Integrate local examples:** How can you tailor this activity to local or regional interests, industries, or community priorities (e.g. land and environment, health, technologies)?

Activity Procedure

To Do in Advance

SECTION	PREPARATION

General	• **Think ahead and be ready to adapt:**
	  ◦ Determine your **delivery method** and leverage ideas from the delivery recommendations and adaptations sections.
	  ◦ While **estimated times** are provided, it will be helpful to think about how much time you would like to spend on different activities and discussions.
	  ◦ While **group sizes** (individual, pairs, groups) are suggested, many activities are flexible for whatever will work in your classroom.
	• **Prepare for the content:**
	  ◦ Have **answers in mind** to share with participants for the various reflection questions asked.
	  ◦ Examine the provided materials to determine if they are **suitable** for your participants.
	• **Equipment:**
	  ◦ Ensure device, screen and projector are set up.

Section 1: X-Ray Investigation	• Prepare and cut out the object pieces, star markers, and x-ray images from the Train an X-Ray AI Activity Page (*Appendix C*) for each group.

SECTION	PREPARATION
	• Prepare the Bone Word Search Activity Page (*Appendix C*) for participants, and create an answer key for your reference.
Section 2: Animal X-rays	• Gather and lay out the craft materials listed above for participants. • Set up a hot glue gun station, keeping the safety considerations above in mind.

Opening Hook

1. Use the X-Citing X-Rays - Activity Slide Deck (*Appendix C*) to help explain the concept of x-rays to participants. The slides highlight how x-rays are used in scientific research, security, and healthcare.

Section 1: X-ray Investigation

1. Using Slides 8–10 from the X-Citing X-Rays - Activity Slide Deck (*Appendix C*), introduce the idea that they will be training an “AI” to read dog x-rays.
2. Distribute the Train an X-Ray AI Activity Page (*Appendix C*) to each small group or pair, along with the object pieces, star markers, and x-ray images.
3. Explain that participants need to mark the swallowed object in each x-ray image using the star markers, then identify and match the corresponding object pieces to the x-ray image showing it in the dog's stomach.
4. This is similar to how we train AI. We identify characteristics in a data set, teaching the AI what to look for.
5. If participants finish early, distribute the Bone Word Search Activity Page (*Appendix C*) to complete.

Section 2: Animal X-rays

1. Using Slides 11-14 of the X-Citing X-Rays - Activity Slide Deck (*Appendix C*) as a guide, participants will be making a craft that represents an animal x-ray.
2. Distribute the X-Ray Template Activity Page (*Appendix C*) to each participant.
3. Tell participants that they can choose to make a fish or a polar bear craft.
4. To create their animal x-ray, have each participant follow the following steps:
    a. Trace the laminate of the animal of their choosing on colourful construction paper and cut it out.
    b. Trace the wedge laminate onto a piece of black construction paper and one on colourful construction paper and cut them out.
        i. At this stage, participants should have one colourful animal cutout and two wedges - one colourful, one black.
    c. Tape the black wedge on as shown on Slide 12 of the slide deck.
    d. Flip over their animal and hot glue white pipe cleaners to represent a ribcage, as shown on Slide 13 of the X-Citing X-Rays - Activity Slide Deck (*Appendix C*).
    e. Add the colourful wedge on top as shown on slide 14 and attach it with a fastener.
    f. Decorate their animal as desired.

Reflection & Debrief

1. Discuss as a group what they learned about x-rays in this activity.
2. Have participants show their animal crafts to their peers.
3. Discuss the different careers listed in *Appendix A: Career & Mentor Connections*.

Delivery Adaptations

How might you adapt the time, space, materials, group sizes, or instructions to make this activity more approachable or more challenging? **Modifications** are ways to make the activity more accessible, **extensions** are ways to make the activity last longer or more challenging.

Modifications

SECTION 1: X-RAY INVESTIGATION

- Facilitators can reduce the number of x-ray images and object pieces used for the activity.
- Facilitators can lead the group through the *Train an X-Ray AI* and *Bone Word Search* activities together.

SECTION 2: ANIMAL X-RAYS

- Facilitators can pre-cut the animal construction paper and pipe cleaners.

Extensions

SECTION 1: X-RAY INVESTIGATION

- Discuss AI's role in healthcare more deeply using the CTV News Article - How experts expect artificial intelligence to advance health care in 2024.
- Have participants complete the bone crossword puzzle in their camp workbook if they finish quickly.

SECTION 2: ANIMAL X-RAYS

- Have participants design their own animal template to make a craft with.
- Add ailments or health flags (such as fractures or abnormal objects) to the x-ray and have another participant identify what is out of place.

References & Gratitude

Plesner, L. L., Müller, F. C., Nybing, J. D., Laustrup, L. C., Rasmussen, F., Nielsen, O. W., Boesen, M., & Andersen, M. B. (2023). *Autonomous chest radiograph reporting using AI: Estimation of clinical impact*. Radiology, 307(3). doi.org/10.1148/radiol.222268

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The Canadian Press. (2023). *How experts expect artificial intelligence to advance health care in 2024*. CTV News. ctvnews.ca/health/article/how-experts-expect-artificial-intelligence-to-advance-health-care-in-2024/

Weir, M., Williams, K., & Ward, E. (n.d.). *Radiographs (X-rays) for dogs: VCA Animal Hospitals*. VCA Canada. vcacanada.com/know-your-pet/radiographs-for-dogs

Appendices

Appendix A: Career & Mentor Connections

BIOLOGIST

- Studying life in all its forms is key to our understanding of many elements of the world around us. From the depths of the oceans to the deserts, swamp and wetlands, temperate regions and tundra and ice sheets, life is everywhere.

BIOMEDICAL ENGINEER

- Biomedical engineers design technology to be used in a healthcare setting (such as the traditional and whirly-gig centrifuge) and technology that directly treats patients such as pacemakers, prosthetic limbs.

MEDICAL DOCTOR

- Medical doctors are licensed individuals who practice medicine such as a physician, surgeon or dentist.

RADIOLOGIST

- A radiologist is a medical doctor who specializes in diagnosing and treating disease and injury, using medical imaging techniques such as x-rays, computed tomography (CT), magnetic resonance imaging (MRI), nuclear medicine, positron emission tomography (PET), fusion imaging, and ultrasound.

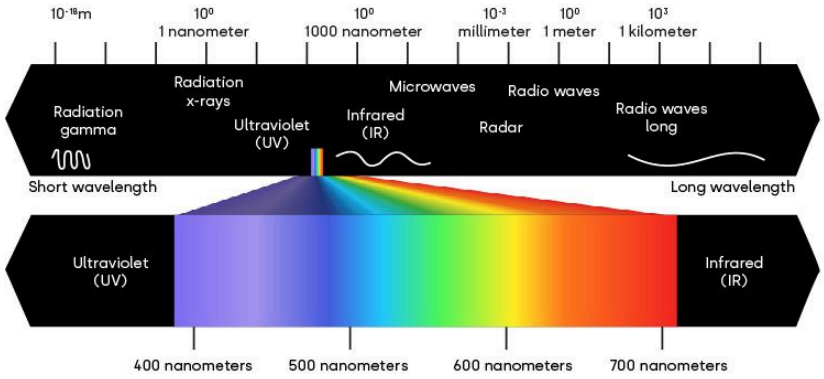
VETERINARIAN

- Veterinarians are animal doctors. They prevent, diagnose, and treat animal diseases to keep them healthy. Veterinarians work with all kinds of animals - large animals, small animals, and even wild animals!

Appendix B: Background Information

WHAT ARE X-RAYS?

X-rays are a type of electromagnetic radiation, similar to visible light, radio waves, and microwaves. However, they have much shorter wavelengths and higher frequencies than visible light. X-rays possess enough energy to remove tightly bound electrons from atoms, leading to ionization. This ionizing effect can damage biological tissues and DNA, making safety precautions crucial when working with x-rays.



Lena Lighting. (2023). The spectrum of visible light, the wavelength of light. lenalighting.com/company/knowledge-base/1795-the-spectrum-of-visible-light-the-wavelength-of-the-light/

One of the key properties of x-rays is their ability to penetrate matter. This property makes them useful for imaging structures within the human body, as well as objects in industrial settings.

ARTIFICIAL INTELLIGENCE (AI)

Artificial intelligence (AI) is a branch of Computer Science that deals with a machine's ability to simulate intelligent behaviour. This includes cognitive functions we associate with human minds, such as perceiving, reasoning, learning and adapting.

AI is becoming increasingly vital in our lives. From digital assistants, GPS navigation, and autonomous vehicles to tools like Siri/Google Home and generative AI tools (e.g., OpenAI's Chat GPT), its impact on our daily lives is growing. AI plays a crucial role in various aspects of work, enhancing efficiency, and taking on hazardous or

monotonous tasks. As AI applications grow, discussions on AI ethics and responsible practices are increasingly important.

AI in Medical Imaging

X-rays are increasingly being used in medical imaging applications. AI algorithms are trained on large datasets of x-ray images to assist radiologists in interpreting these images more accurately and efficiently. For example, AI can help in detecting anomalies in x-rays, such as fractures, tumors, or other medical conditions, by analyzing patterns and features within the images. This is especially helpful for identifying rare anomalies and for assisting with diagnostics in remote areas where radiologists may not be available.

APPLICATIONS OF X-RAYS

Healthcare Applications

X-ray imaging is commonly used in medicine for diagnostic purposes. X-ray machines produce images of the internal structures of the body, such as bones and organs. This allows healthcare professionals to identify fractures, tumors, and other abnormalities. X-rays are also extensively used in veterinary medicine for diagnosing health issues in animals. Similar to their use in human medicine, x-rays help veterinarians visualize internal structures like bones, joints, and organs in animals. This aids in diagnosing fractures, detecting foreign objects swallowed by animals, assessing organ health, and identifying other medical conditions.

Applications in Other Industries

X-rays are also used in various industries for quality control and inspection purposes. For example, they can be used to examine welds, detect flaws in metal components, and inspect baggage at airports for security purposes. X-rays also play a role in scientific research, particularly in fields such as physics, chemistry, and materials science. Techniques like X-ray crystallography are used to determine the atomic and molecular structure of crystals and complex molecules. They are also used in disciplines like paleontology to identify fossils and other hidden objects, and astronomy to detect objects in space.

ETHICS AND AI

Artificial intelligence offers powerful tools and new possibilities. As these systems learn from data, make decisions, and shape our world, it is important to consider their ethical impacts.

Actua has developed a resource (*Appendix C*) to support facilitators in leading discussions with youth about ethics and responsible AI use. Facilitators are encouraged to engage youth in meaningful conversations that empower them to think critically about how AI is designed, used, and experienced in the world around them. This resource emphasizes human agency and responsibility, supports values-based reflection, and creates space for curiosity, dialogue, and informed decision-making as digital citizens.

Appendix C: Additional Resources

GENERAL

Activity Slide Deck

- X-Citing X-Rays - Activity Slide Deck
    - ***Note:*** This link will automatically download to your device.

Supporting Resource

- AI in Context: Responsibility and Ethics in Artificial Intelligence

SECTION 1: X-RAY INVESTIGATION

Activity Page(s)

- Train an X-Ray AI Activity Page *(refer below)*
- Bone Word Search Activity Page *(refer below)*

Articles

- [CTV News] How experts expect artificial intelligence to advance health care in 2024

SECTION 2: ANIMAL X-RAYS

Activity Page(s)

- X-Ray Template Activity Page *(refer below)*

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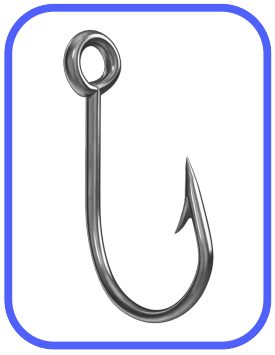
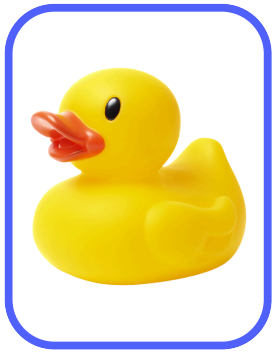
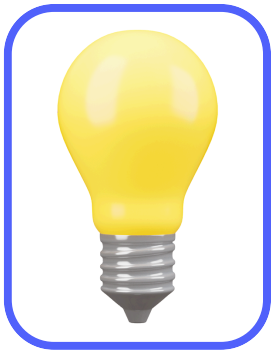
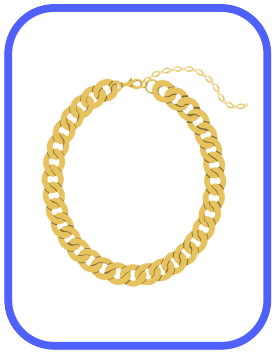
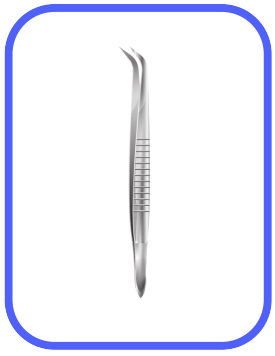
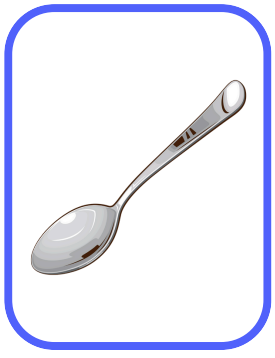
X-Citing X-Rays

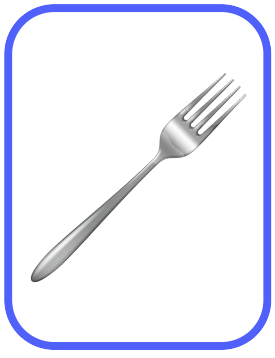
Train an X-Ray AI

Objects



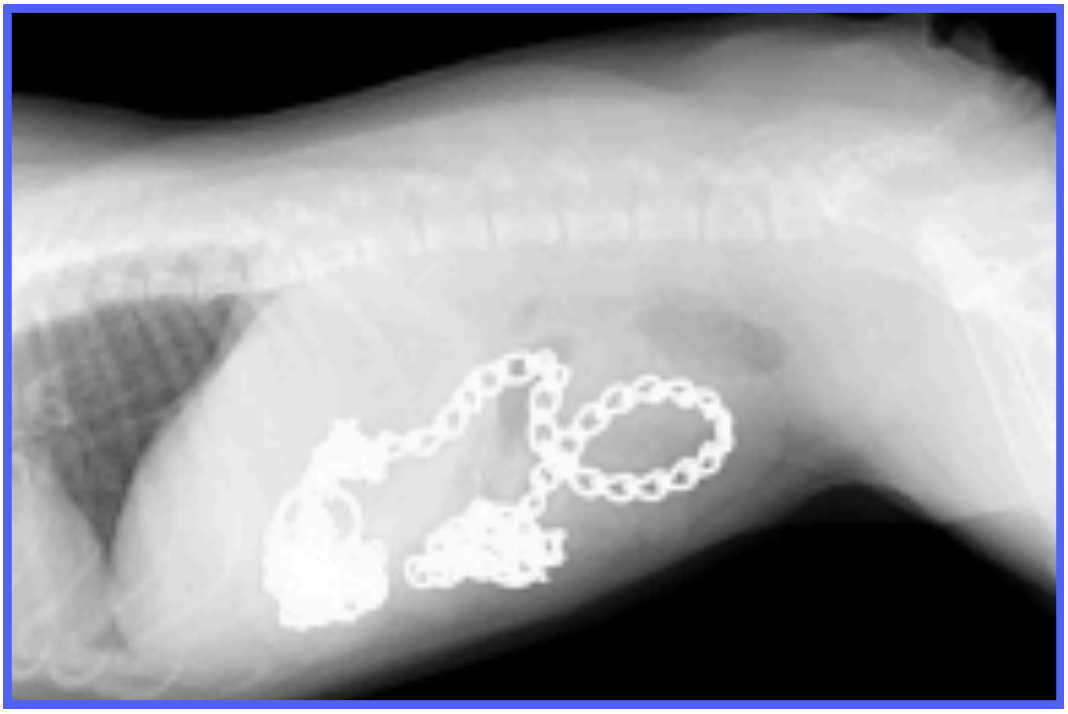






Markers

X-ray Images



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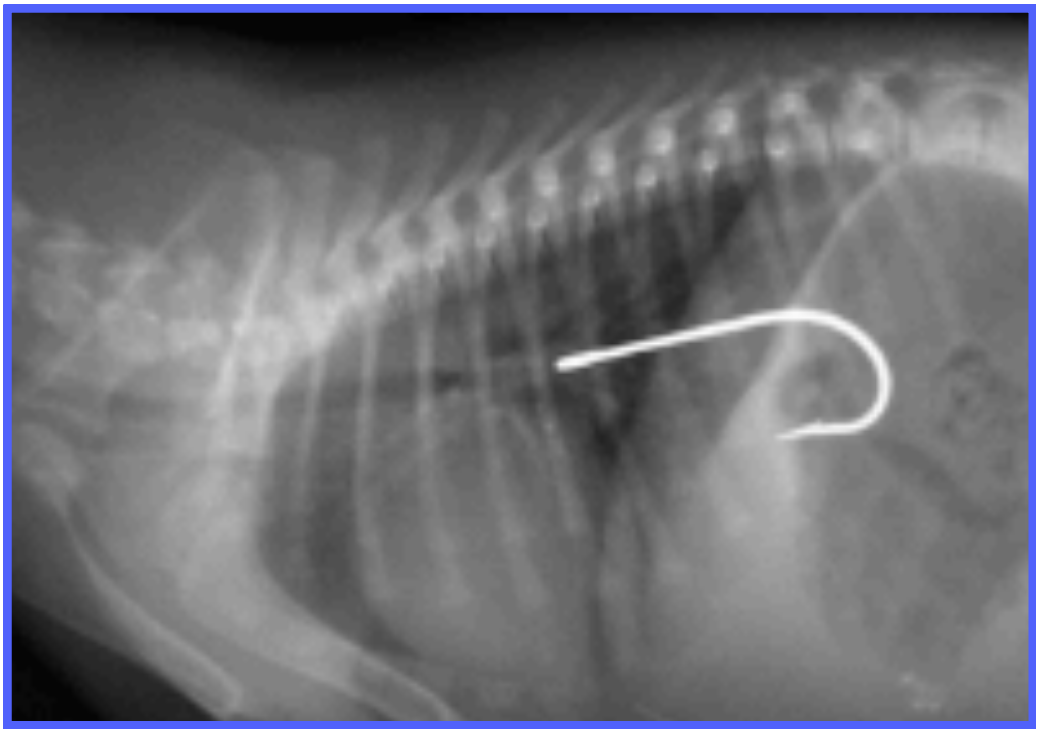

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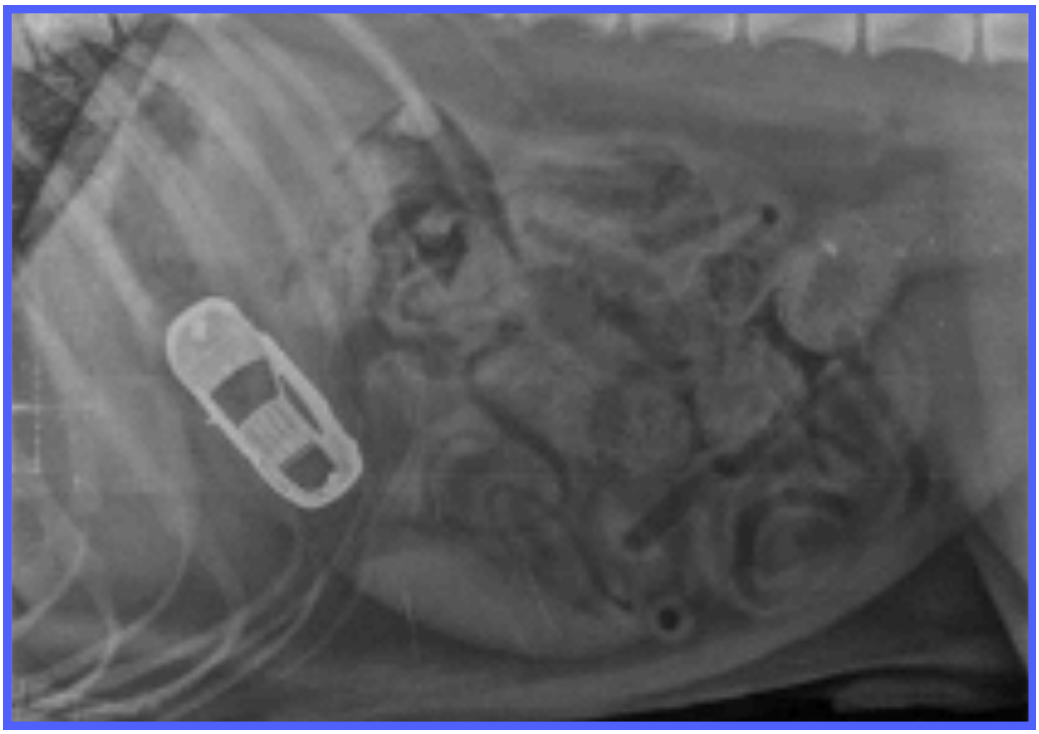

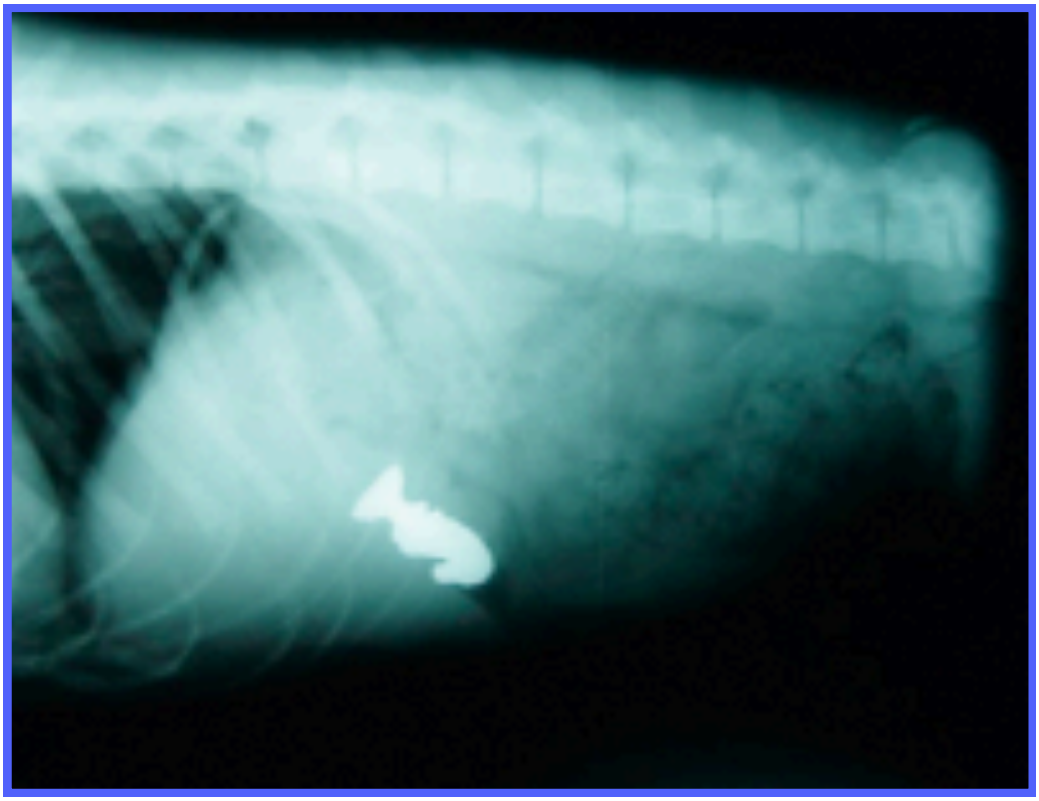

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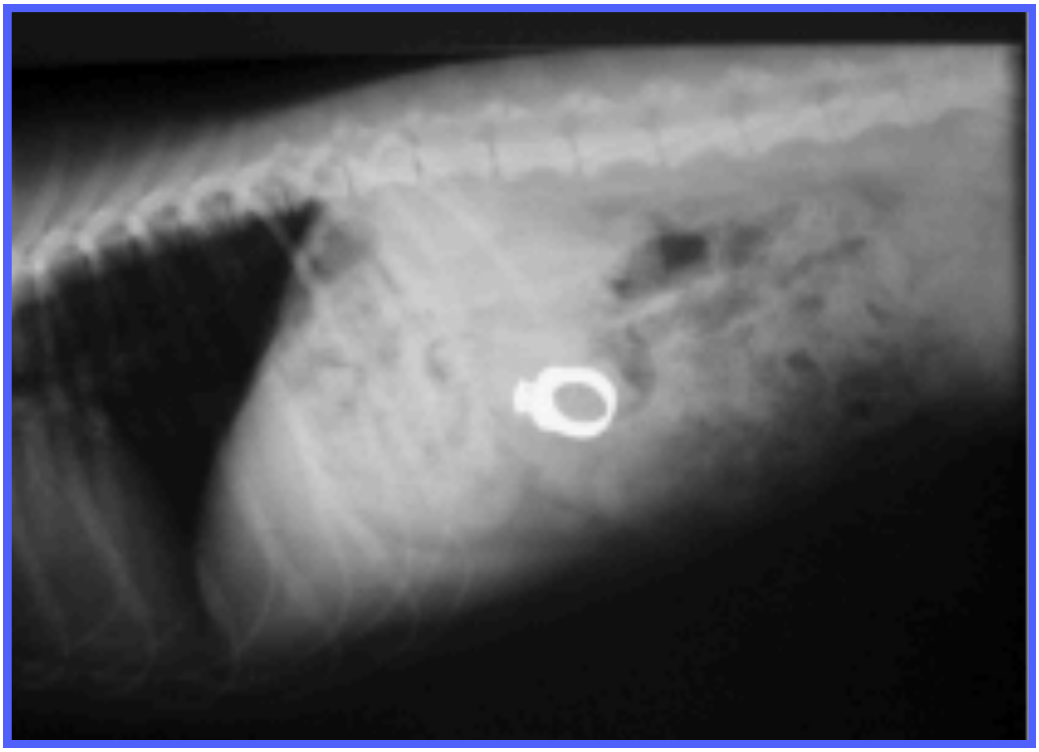

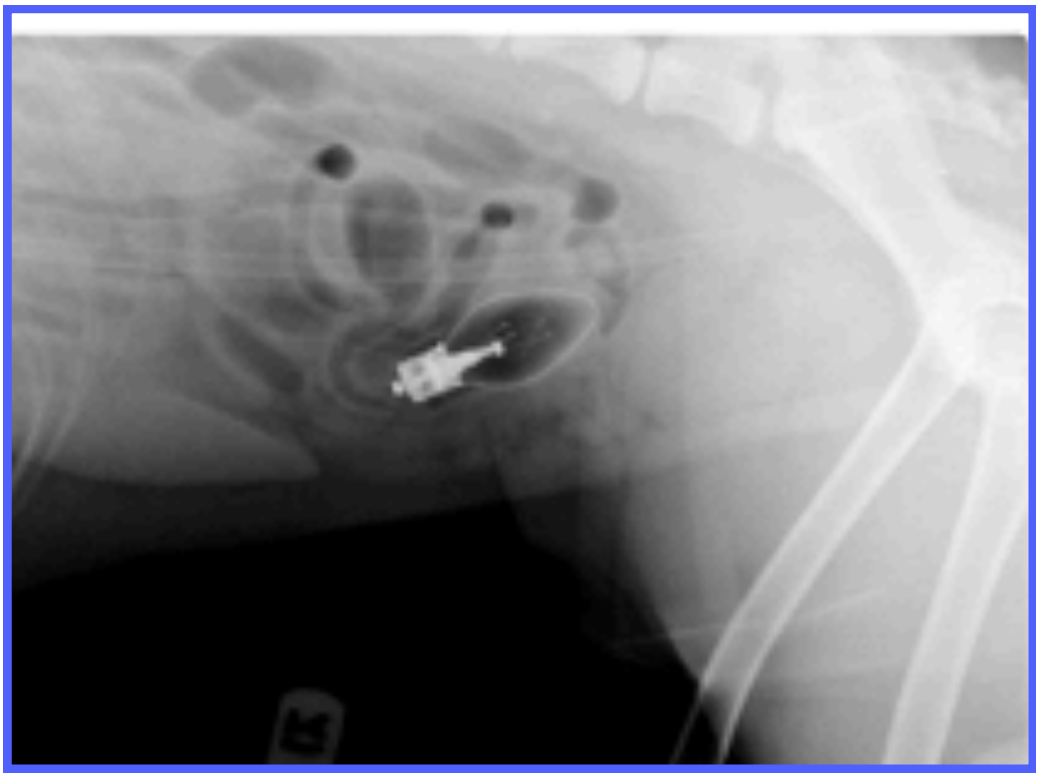

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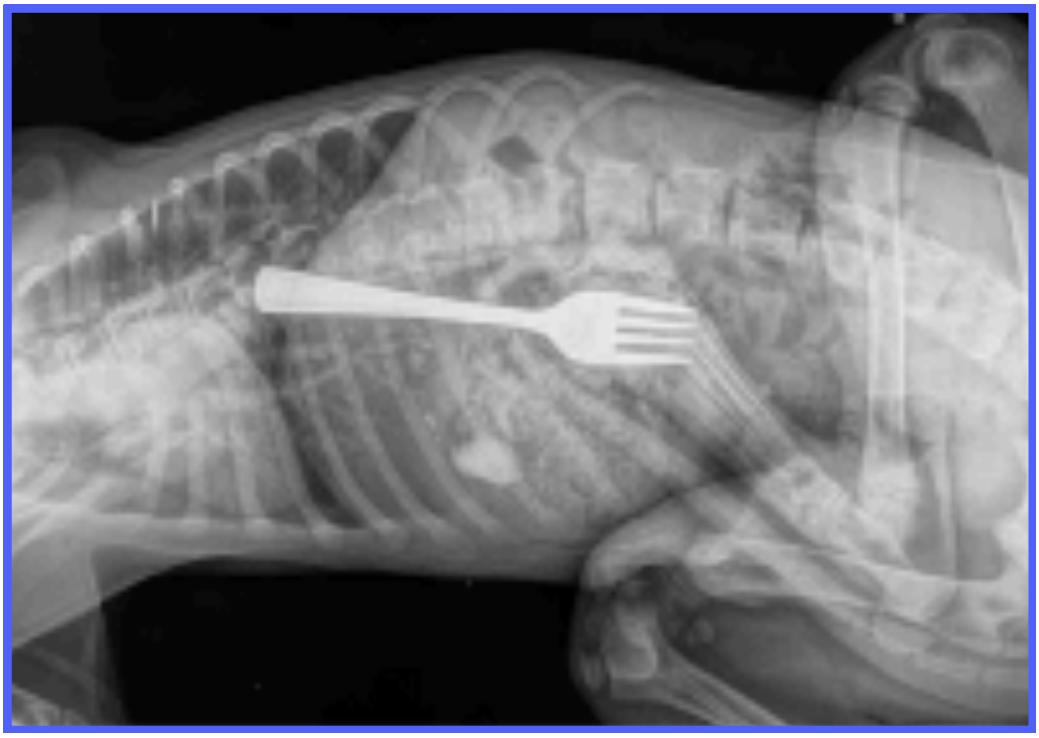

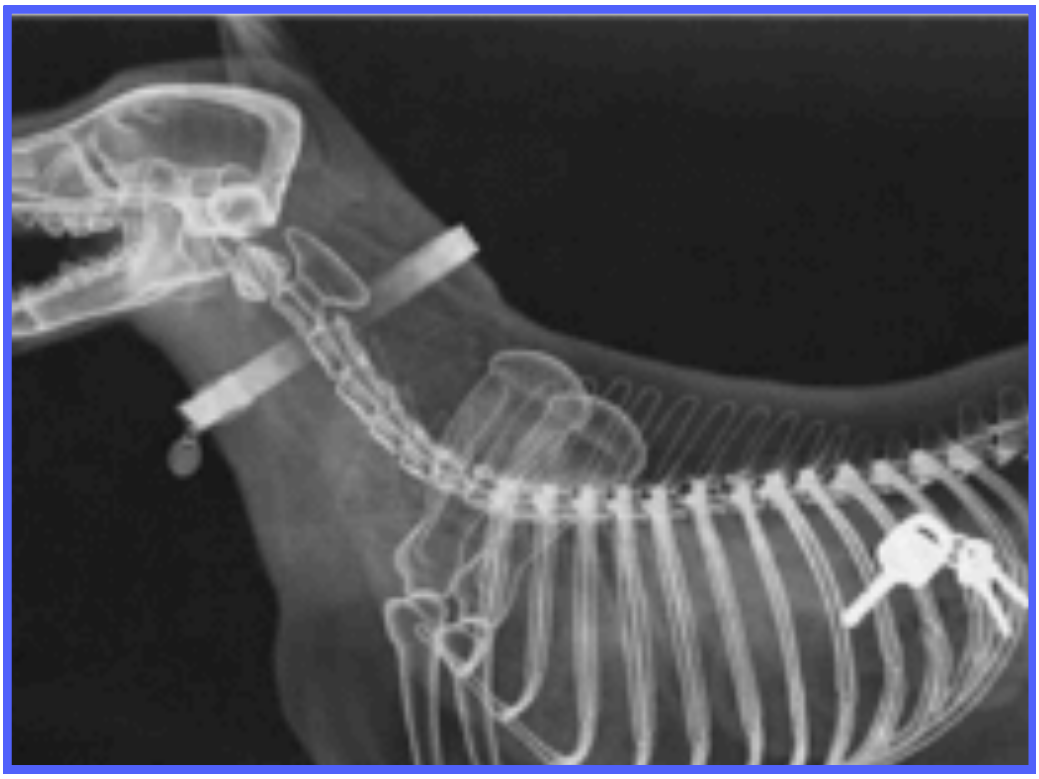

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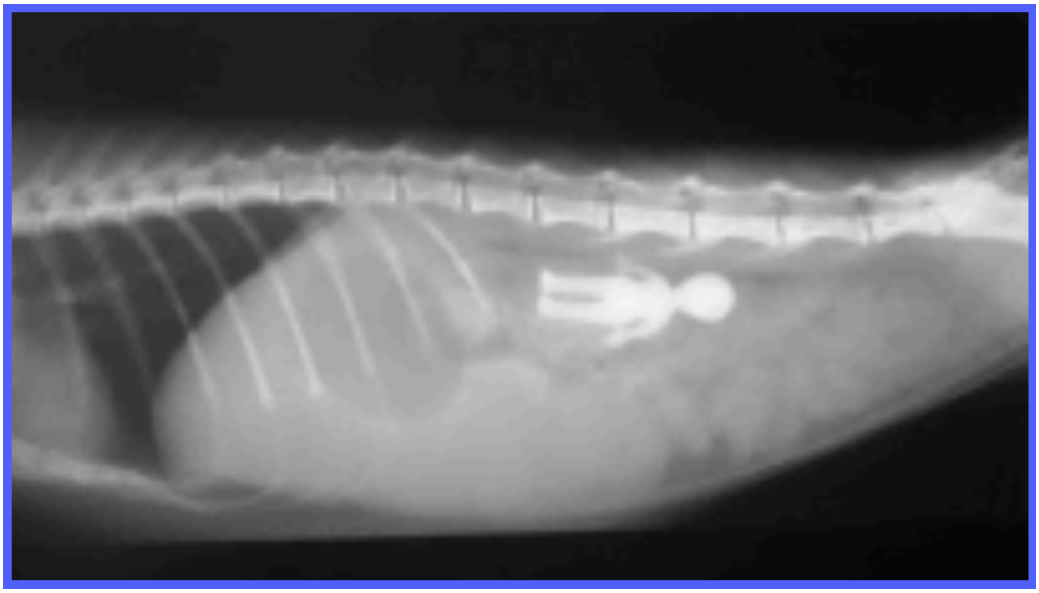

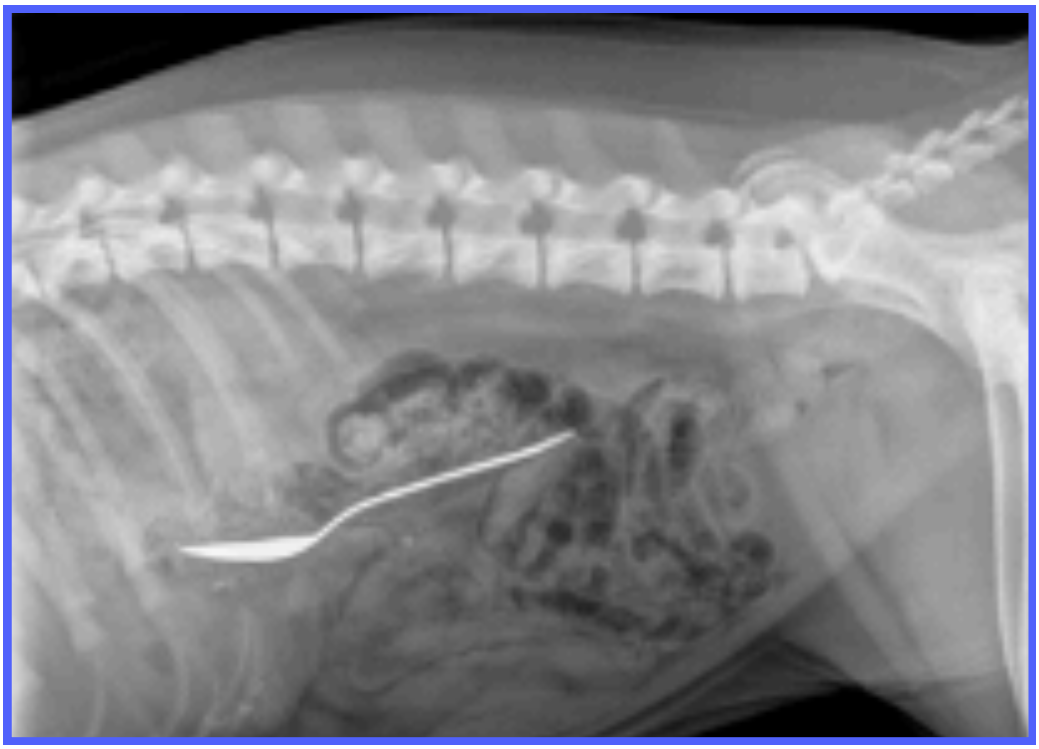

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X-Citing X-Rays

Bone Word Search

H	U	M	E	R	U	S	C	A	L	L	P	R	C
E	J	S	R	A	P	V	A	U	B	F	A	W	U
K	L	E	W	L	A	E	R	R	I	L	M	A	L
E	I	S	I	J	E	R	P	A	R	N	V	A	N
A	A	T	A	A	L	T	A	A	R	N	W	E	A
E	A	A	A	I	C	E	L	L	P	U	E	A	V
E	B	U	S	B	I	B	U	L	E	I	P	E	J
N	A	F	U	I	V	R	J	C	A	A	O	R	H
O	A	E	M	T	A	A	S	T	E	R	N	U	M
B	E	N	E	T	L	E	I	E	T	F	P	T	U
L	R	M	L	R	C	I	F	E	M	U	R	S	B
I	N	S	K	U	L	L	A	V	L	A	E	A	B
A	E	T	A	T	V	H	V	M	C	C	E	C	C
T	C	E	U	P	A	T	E	L	L	A	A	A	R

Sternum
Vertebrae
Jaw
Ulna
Rib
Tailbone
Humerus
Clavicle
Skull
Carpal
Patella
Femur

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X-Citing X-Rays

X-Ray Templates