

CreositySpace – Spine Fixers

Activity Descriptions and Standards Alignment

General Activity Descriptions:

Below you will find brief descriptions of the hands-on science activities associated with the *Spine Fixers* Technology Entrepreneurship Curriculum module.

Activity 1 – What is in your bones?

Objective

To show how different solutions can weaken bones.

Materials:

Chicken bones, containers with clear solutions (water, vinegar, baking soda), litmus/pH paper, nitrile gloves

General Description

The chicken bones are stored in different solutions. The students will test out the solution with the litmus or pH paper and then see how the solution impacted the strength of the bones.

Activity 2 – How is the back different than other bones?

Objective

To illustrate the extra ability of the back to bend, twist, etc.

Materials

Drinking straw, Pipe cleaner, Scissors.

General Description

Groups will build a “pipe cleaner” person – arms, legs, head and spine. In the first version they will have a solid piece of straw over their pipe cleaner person and they could see how the person they made couldn’t really move much because the back was stiff. In a modification they will take the pipe cleaner person apart and cut pieces out of the back to let it bend. If time permits, additional activities around fixing the back and other bones taking into account the need for the back to bend can be included.

Education Standards Supported

Don't see the standards for your school district? Contact us at kath@creosityspace.com and we will determine the appropriate standards alignment for your district.

Common Core ELA Standards

Grade 3

Reading Informational Text:

[CCSS.ELA-LITERACY.RI.3.1](#) Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

[CCSS.ELA-LITERACY.RI.3.2](#) Determine the main idea of a text; recount the key details and explain how they support the main idea.

[CCSS.ELA-LITERACY.RI.3.4](#) Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 3 topic or subject area*.

Writing:

[CCSS.ELA-Literacy.W.3.2](#) Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

[CCSS.ELA-Literacy.W.3.2.a](#) Introduce a topic and group related information together; include illustrations when useful to aiding comprehension.

[CCSS.ELA-Literacy.W.3.2.b](#) Develop the topic with facts, definitions, and details.

[CCSS.ELA-Literacy.W.3.2.c](#) Use linking words and phrases (e.g., *also, another, and, more, but*) to connect ideas within categories of information.

[CCSS.ELA-Literacy.W.3.2.d](#) Provide a concluding statement or section.

[CCSS.ELA-Literacy.W.3.1](#) Write opinion pieces on topics or texts, supporting a point of view with reasons.

[CCSS.ELA-Literacy.W.3.1.a](#) Introduce the topic or text they are writing about, state an opinion, and create an organizational structure that lists reasons.

[CCSS.ELA-Literacy.W.3.1.b](#) Provide reasons that support the opinion.

[CCSS.ELA-Literacy.W.3.1.c](#) Use linking words and phrases (e.g., *because, therefore, since, for example*) to connect opinion and reasons.

[CCSS.ELA-Literacy.W.3.1.d](#) Provide a concluding statement or section.

[CCSS.ELA-Literacy.W.3.4](#) With guidance and support from adults, produce writing in which the development and organization are appropriate to task and purpose. (Grade-specific expectations for writing types are defined in standards 1-3 above.)

[CCSS.ELA-Literacy.W.3.5](#) With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, and editing.

[CCSS.ELA-Literacy.W.3.6](#) With guidance and support from adults, use technology to produce and publish writing (using keyboarding skills) as well as to interact and collaborate with others.

[CCSS.ELA-Literacy.W.3.7](#) Conduct short research projects that build knowledge about a topic.

[CCSS.ELA-Literacy.W.3.8](#) Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

Speaking & Listening:

[CCSS.ELA-LITERACY.SL.3.1](#) Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 3 topics and texts*, building on others' ideas and expressing their own clearly.

[CCSS.ELA-LITERACY.SL.3.1.A](#) Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.

[CCSS.ELA-LITERACY.SL.3.1.B](#) Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).

[CCSS.ELA-Literacy.SL.3.1.c](#) Ask questions to check understanding of information presented, stay on topic, and link their comments to the remarks of others.

[CCSS.ELA-Literacy.SL.3.1.d](#) Explain their own ideas and understanding in light of the discussion.

[CCSS.ELA-Literacy.SL.3.3](#) Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.

[CCSS.ELA-Literacy.SL.3.4](#) Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.

[CCSS.ELA-Literacy.SL.3.6](#) Speak in complete sentences when appropriate to task and situation in order to provide requested detail or clarification.

Language:

[CCSS.ELA-LITERACY.L.3.1](#) Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

[CCSS.ELA-LITERACY.L.3.1.A](#) Explain the function of nouns, pronouns, verbs, adjectives, and adverbs in general and their functions in particular sentences.

[CCSS.ELA-LITERACY.L.3.2](#) Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

[CCSS.ELA-LITERACY.L.3.4](#) Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

Grade 4

Reading Informational Text:

[CCSS.ELA-LITERACY.RI.4.1](#) Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.

[CCSS.ELA-LITERACY.RI.4.2](#) Determine the main idea of a text and explain how it is supported by key details; summarize the text.

[CCSS.ELA-LITERACY.RI.4.4](#) Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a *grade 4 topic or subject area*.

[CCSS.ELA-LITERACY.RI.4.5](#) Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text.

[CCSS.ELA-LITERACY.RI.4.7](#) Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

Writing:

[CCSS.ELA-LITERACY.W.4.1](#) Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

[CCSS.ELA-LITERACY.W.4.1.A](#) Introduce a topic or text clearly, state an opinion, and create an organizational structure in which related ideas are grouped to support the writer's purpose.

[CCSS.ELA-LITERACY.W.4.1.B](#) Provide reasons that are supported by facts and details.

[CCSS.ELA-LITERACY.W.4.1.C](#) Link opinion and reasons using words and phrases

[CCSS.ELA-LITERACY.W.4.1.D](#) Provide a concluding statement or section related to the opinion presented.

[CCSS.ELA-LITERACY.W.4.2](#) Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

[CCSS.ELA-LITERACY.W.4.2.A](#) Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.

[CCSS.ELA-LITERACY.W.4.2.B](#) Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.

[CCSS.ELA-LITERACY.W.4.2.C](#) Link ideas within categories of information using words and phrases.

[CCSS.ELA-LITERACY.W.4.2.D](#) Use precise language and domain-specific vocabulary to inform about or explain the topic.

[CCSS.ELA-LITERACY.W.4.2.E](#) Provide a concluding statement or section related to the information or explanation presented.

[CCSS.ELA-LITERACY.W.4.4](#) Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

[CCSS.ELA-LITERACY.W.4.8](#) Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

Speaking & Listening:

[CCSS.ELA-LITERACY.SL.4.1](#) Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly.

[CCSS.ELA-LITERACY.SL.4.1.A](#) Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.

[CCSS.ELA-LITERACY.SL.4.1.B](#) Follow agreed-upon rules for discussions and carry out assigned roles.

[CCSS.ELA-LITERACY.SL.4.1.C](#) Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.

[CCSS.ELA-LITERACY.SL.4.1.D](#) Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.

[CCSS.ELA-LITERACY.SL.4.3](#) Identify the reasons and evidence a speaker provides to support particular points.

Language:

[CCSS.ELA-LITERACY.L.4.1](#) Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

[CCSS.ELA-LITERACY.L.4.1.A](#) Use relative pronouns (*who, whose, whom, which, that*) and relative adverbs (*where, when, why*).

[CCSS.ELA-LITERACY.L.4.2](#) Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

[CCSS.ELA-LITERACY.L.4.3](#) Use knowledge of language and its conventions when writing, speaking, reading, or listening.

[CCSS.ELA-LITERACY.L.4.3.A](#) Choose words and phrases to convey ideas precisely.

[CCSS.ELA-LITERACY.L.4.4](#) Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 4 reading and content, choosing flexibly from a range of strategies.

Grade 5

Reading Informational Text:

[CCSS.ELA-LITERACY.RI.5.2](#) Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.

[CCSS.ELA-LITERACY.RI.5.3](#) Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.

[CCSS.ELA-LITERACY.RI.5.4](#) Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 5 topic or subject area*.

Writing:

[CCSS.ELA-LITERACY.W.5.1](#) Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

[CCSS.ELA-LITERACY.W.5.1.A](#) Introduce a topic or text clearly, state an opinion, and create an organizational structure in which ideas are logically grouped to support the writer's purpose.

[CCSS.ELA-LITERACY.W.5.1.B](#) Provide logically ordered reasons that are supported by facts and details.

[CCSS.ELA-LITERACY.W.5.1.C](#) Link opinion and reasons using words, phrases, and clauses

[CCSS.ELA-LITERACY.W.5.1.D](#) Provide a concluding statement or section related to the opinion presented.

[CCSS.ELA-LITERACY.W.5.2](#) Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

[CCSS.ELA-LITERACY.W.5.2.A](#) Introduce a topic clearly, provide a general observation and focus, and group related information logically; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.

[CCSS.ELA-LITERACY.W.5.2.B](#) Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.

[CCSS.ELA-LITERACY.W.5.2.C](#) Link ideas within and across categories of information using words, phrases, and clauses (e.g., *in contrast*, *especially*).

[CCSS.ELA-LITERACY.W.5.2.D](#) Use precise language and domain-specific vocabulary to inform about or explain the topic.

[CCSS.ELA-LITERACY.W.5.2.E](#) Provide a concluding statement or section related to the information or explanation presented.

[CCSS.ELA-LITERACY.W.5.4](#) Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

[CCSS.ELA-LITERACY.W.5.8](#) Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

Speaking & Listening:

[CCSS.ELA-LITERACY.SL.5.1](#) Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 5 topics and texts*, building on others' ideas and expressing their own clearly.

[CCSS.ELA-LITERACY.SL.5.1.A](#) Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.

[CCSS.ELA-LITERACY.SL.5.1.B](#) Follow agreed-upon rules for discussions and carry out assigned roles.

[CCSS.ELA-LITERACY.SL.5.1.C](#) Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.

[CCSS.ELA-LITERACY.SL.5.1.D](#) Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.

[CCSS.ELA-LITERACY.SL.5.3](#) Summarize the points a speaker makes and explain how each claim is supported by reasons and evidence.

Language:

[CCSS.ELA-LITERACY.L.5.1](#) Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

[CCSS.ELA-LITERACY.L.5.1.A](#) Explain the function of conjunctions, prepositions, and interjections in general and their function in particular sentences.

[CCSS.ELA-LITERACY.L.5.2](#) Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

[CCSS.ELA-LITERACY.L.5.3](#) Use knowledge of language and its conventions when writing, speaking, reading, or listening.

[CCSS.ELA-LITERACY.L.5.4](#) Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 5 reading and content, choosing flexibly from a range of strategies.



Common Core Math Standards (Grades 3 – 5)

Grade 3

- MP.1** Make sense of problems and persevere in solving them.
- MP.2** Reason abstractly and quantitatively.
- 3.OA.1-3** Represent and solve problems involving multiplication and division.
- 3.OA.7** Multiply and divide within 100.
- 3.G.2** Partition shapes into parts with different areas.

Grade 4

- MP.1** Make sense of problems and persevere in solving them.
- MP.2** Reason abstractly and quantitatively.
- 4.OA.1-3** Use the four operations with whole numbers to solve problems.
- 4.G.2** Draw and identify lines and angles, and classify shapes by properties of their lines and angle.

Grade 5

- MP.1** Make sense of problems and persevere in solving them.
- MP.2** Reason abstractly and quantitatively.

Next Generation Science Standards/NY State Science Learning Standards 3 – 5

Performance Expectations

- 4-LS1-1.** Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction
- 4-LS1-2.** Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.
- 3-5-ETS1-1.** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2.** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Example NGSS “Big Idea” and Topic Bundle: How does technology improve our health and well-being?

<u>Science and Engineering Practices</u>	<u>Disciplinary Core Ideas</u>	<u>Cross Cutting Concepts</u>
<p>Asking questions / defining problems Activities and writing prompts encourage students to ask questions and define the problems they would like to solve.</p> <p>Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations/designing solutions The hands-on activities in this module give students the opportunity to model and explore how external factors may affect the human body.</p> <p>Using math & computational thinking Math word problems give students a chance to think how math is used in S&E.</p> <p>Obtaining, evaluating, and communicating information Challenge extensions and innovation prompts in the <i>Book of Ideas - Young Inventors Journal</i> enable students to design and support their solutions to a variety of challenges.</p> <hr/> <p style="text-align: center;"><i>Connections to Nature of Science</i></p> <p>Scientific investigations use a variety of methods - Scientific knowledge is based on empirical evidence Entrepreneur story/presentation and hands on activities illustrate how scientific investigations are conducted and how that information is put to use.</p> <p>Scientific knowledge is open to revision in light of new evidence The timeline discussion helps students understand how all of science is built upon what came before and that understanding evolves/changes over time.</p>	<p>LS1.A Structure and function LS1.B Growth and development of organisms The investigations into the body – its function – and things that may impact bone strength.</p> <p>ETS1.A: Defining and Delimiting Engineering Problems ETS1.B: Developing Possible Solutions ETS1.C: Optimizing the Design Solution The goals around creating better ways to heal the body addresses issues of design and redesign.</p>	<p>Cause and effect Activities, timelines, videos and introduction text highlight how certain situations and properties result in specific outcomes.</p> <p>Systems and system models Structure and function Discussion about the human body give many examples of systems and system models as well as the structure and function of various body parts and medical devices.</p> <hr/> <p style="text-align: center;"><i>Connections to Nature of Science</i> Science is a way of knowing; Science addresses questions about the natural and material world Activities give firsthand experience in questioning, observing and concluding.</p> <p>Science is a human endeavor Entrepreneur story and historical timeline highlight the human aspect of science and engineering.</p> <p style="text-align: center;"><i>Connections to Engineering, Technology, and Applications of Science</i></p> <p>Interdependence of Science, Engineering, and Technology; Influence of Engineering, Technology and Science on Society and the Natural World Introduction text, historical timeline and entrepreneur story highlight above interactions and interdependencies.</p>

Connections to Common Core State Standards

See previous Common Core Standards section for the ELA and Math standards addressed by these activities.

NY State Science Standards

Grades 3 & 4

STANDARD 1 BSCIENTIFIC INQUIRY:

S1.1 Ask "why" questions in attempts to seek greater understanding concerning objects and events they have observed and heard about.

STANDARD 1 Engineering design:

T1.1 Describe objects, imaginary or real, that might be modeled or made differently and suggest ways in which the objects can be changed, fixed, or improved.

T1.1a Identify a simple/common object which might be improved and state the purpose of the improvement

T1.1b Identify features of an object that help or hinder the performance of the object

T1.1c Suggest ways the object can be made differently, fixed, or improved within given constraints

T1.2 Investigate prior solutions and ideas from books, magazines, family, friends, neighbors, and community members.

T1.2a Identify appropriate questions to ask about the design of an object

T1.2b Identify the appropriate resources to use to find out about the design of an object

STANDARD 6 Models: *Key Idea 2:* Models are simplified representations of objects, structures, or systems, used in analysis, explanation, or design.

STANDARD 4 Physical Setting:

4.2b Humans utilize interactions between matter and energy.

STANDARD 4 Living Environment:

1.2a Living things grow, take in nutrients, breathe, reproduce, eliminate waste, and die.

7.1a Humans depend on their natural and constructed environments.

7.1b Over time humans have changed their environment by cultivating crops and raising animals, creating shelter, using energy, manufacturing goods, developing means of transportation, changing populations, and carrying out other activities.

7.1c Humans, as individuals or communities, change environments in ways that can be either helpful or harmful for themselves and other organisms.

Grade 5

STANDARD 1 – SCIENTIFIC INQUIRY:

S2.1 Use conventional techniques and those of their own design to make further observations and refine their explanations, guided by a need for more information.

S2.1a demonstrate appropriate safety techniques

S2.1b conduct an experiment designed by others

S2.1c design and conduct an experiment to test a hypothesis

S2.1d use appropriate tools and conventional techniques to solve problems about the natural world, including: measuring, observing, and describing.

S3.2 Interpret the organized data to answer the research question or hypothesis and to gain insight into the problem.

STANDARD 1 – ENGINEERING DESIGN:

T1.1 Identify needs and opportunities for technical solutions from an investigation of situations of general or social interest.

T1.1a Identify a scientific or human need that is subject to a technological solution which applies scientific principles

T1.3 Consider constraints and generate several ideas for alternative solutions, using group and individual ideation techniques (group discussion, brainstorming, forced connections, role play); defer judgment until a number of ideas have been generated; evaluate (critique) ideas; and explain why the chosen solution is optimal.

T1.3a Generate ideas for alternative solutions

STANDARD 6 – INTERCONNECTEDNESS:

Systems Thinking - Key Idea 1: Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions.

Models - Key Idea 2: Models are simplified representations of objects, structures, or systems, used in analysis, explanation, or design.

STANDARD 7 – INTERDISCIPLINARY PROBLEM SOLVING:

Connections – Key Idea 1: The knowledge and skills of mathematics, science, and technology are used together to make informed decisions and solve problems, especially those relating to issues of science/technology/society, consumer decision making, design, and inquiry into phenomena.

Texas Essential Knowledge and Skills

General

Knowledge and skills.

(1) Scientific investigation and reasoning. The student conducts classroom and outdoor investigations following school and home safety procedures and environmentally appropriate practices. The student is expected to:

- (A) demonstrate safe practices as described in the Texas Safety Standards during classroom and outdoor investigations, including observing a schoolyard habitat; and
- (B) make informed choices in the use and conservation of natural resources by recycling or reusing materials such as paper, aluminum cans, and plastics.

(2) Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and outdoor investigations. The student is expected to:

- (A) plan and implement descriptive investigations, including asking and answering questions, making inferences, and selecting and using equipment or technology needed, to solve a specific problem in the natural world;
- (B) collect data by observing
- (D) analyze and interpret patterns in data to construct reasonable explanations based on evidence from investigations;
- (F) communicate valid conclusions supported by data in writing, by drawing pictures, and through verbal discussion.

(3) Scientific investigation and reasoning. The student knows that information, critical thinking, scientific problem solving, and the contributions of scientists are used in making decisions. The student is expected to:

- (A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;
- (D) connect grade-level appropriate science concepts with the history of science, science careers, and contributions of scientists.