

# What Can Pigs Teach Us About Human Influence on Genetic Traits?

**Characteristics of domestic pigs have changed to meet consumer demands, how they are used, and production systems.**

## Objectives

- Students will review information on how the traits of pigs have changed over time due to human influence.
- Students will be able to identify and explain the differences between pork production in the past and modern pork production.
- Students will examine genetics and nutrition and how societal demands have affected the pork industry.
- Students will learn how genetic modification in pigs is improving xenotransplantation in humans.

## Supplies/Resources

- Computer and Internet access for research
- Slide presentation program
- Student Project Worksheets 1 & 2

## Instructions

1. Ask students to read the information on Student Project worksheet 1.
2. Find the list of pig breeds in the presentation, and assign students or groups a unique breed. Ask students to research their breed using the Internet and record the information they find. Once the research has been completed, have students report their findings to their classmates.
3. Students should then be asked to classify each breed as a **modern livestock** breed, **heritage livestock** breed, or **pet-type** breed and explain the traits that lead them to that classification. Livestock breeds will be used primarily for food. A heritage breed is one that was once popular but is now less common as farms work toward efficiency and producing a consistent product.
4. They may also want to create a breed development timeline.
5. Provide students with additional links to articles to read and use the questions to encourage discussion.
6. **EXTENSION:** Assign the “Create a Genetically Modified Pig” activity. You may want to spend some time discussing genetic modification first. Links to resources can be found in the presentation. A grading rubric is provided.

## Next Generation Science Standards

**MS.LS4-5.** Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

## ELA/Literacy Standards

**WHST.6-8.8** Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.



## STUDENT PROJECT 1 - Human Influence on Pig Genetics

Similar to dogs, cats, and other domestic livestock, pigs belonging to the genus and species *Sus domesticus* have a wide variety of traits, such as size, color, and body shape. Human needs and preferences have largely influenced those differences over time, and we continue to see traits change today.

### Where do modern pigs come from?

One theory is that the first “pigs” appeared in Southeast Asia about two million years ago and spread to Eurasia and Africa. Humans hunted wild pigs for food and other resources, and a cave painting that looks like a Sulawesi warty pig (*Sus celebensis*) was recently found in Indonesia. That cave painting is the oldest known representation of an animal created by humans, estimated at 45,500 years old through carbon dating.

Based on other archeological evidence, it is believed that wild pigs from both Asia (*Sus indicus*) and Europe (*Sus scrofa*) were domesticated by humans about 9,000 years ago. However, genetic evidence has shown that most modern pigs, even Asian breeds, share most of their DNA with *Sus scrofa*, the European wild boar<sup>1</sup>.

Scientists believe that coat color may have been one of the first traits humans influenced in their domestic pigs to distinguish them from the wild pigs. Pigs evolved bright coat colors rapidly after domestication thanks to necessity and novelty. Yet gene analysis shows that today’s wild pigs are evolving through natural selection to maintain camouflage colors and escape predators’ detection.

### What factors influenced changes in pig traits?

You will be provided a pig breed (an animal group with many of the same characteristics) to research. Find the information listed to the right and create a slide or poster. Then categorize the pig breeds by type and discuss/answer the questions.

Collect the following information for your pig breed:

- Name of pig breed
- Photo or drawing
- When and where the breed was developed
- Size, color/pattern, and other unique physical characteristics
- Noticeable behavior traits (mothering, intelligence)
- Meat characteristics
- Age when breed reaches reproductive maturity
- Average litter size
- Best or typical environment
- Why was the breed developed, or if the information has not been provided/found, why do you think this breed was developed?
- Has the breed changed over time to have different traits?

Present your breed information to the other students in class. Then decide if the breed is considered a **modern livestock** breed, **heritage livestock** breed, or **pet-type** breed. Does it belong in more than one category?

You may also want to **create a timeline** of pig breeds, placing them in chronological order of development.

### Discussion Questions:

1. What factors had the largest impact on how pig breeds were developed? Discuss geography, climate, how the pigs were handled and fed, how the pig was used (food and resources), culture, and health.
2. At what points in history did you see a shift in traits? What encouraged the change?
3. How may humans influence genetic variation in the future?
4. What would your “perfect” pig breed look like?

<sup>1</sup>E Giuffra, J M H Kijas, V Amarger, Ö Carlborg, et al, 2000 The Origin of the Domestic Pig: Independent Domestication and Subsequent Introgression Genetics 154-4: 1785–1791 <https://doi.org/10.1093/genetics/154.4.1785>

## Create a Genetically Modified Pig

Review the information in the presentation about genetic modification or research “genetically modified pigs and xenotransplantation” on your own. The pigs’ genes were altered to serve a medical need, increasing options for patients needing new organs while reducing organ rejection.

Your task is to create a new Genetically Modified Pig that will help the world’s growing population.

### GMO Design Checklist

#### Design: (75 pts)

- A unique name has been created.
- At least 2 foreign genes have been used and an explanation has been included for the purpose of inserting these genes.
- The organism is creatively designed to help the environment (or at least it will not hurt our precious environment.)
- The GMO has the potential to help feed our growing population.
- Societies concerns are well thought out and include ideas we discussed in class.
- The picture is creative, a mixture of the different organisms and has color.
- The slogan is included with the picture.

#### Presentation: (25 pts)

- Clear, loud voice while presenting.
- Each question on the worksheet is addressed during the presentation.
- The picture is shown to the class.
- Questions are answered to the best of the presenter’s knowledge.

### New Organism Article: 100 pts

- I. Introduction
  - A. Attention grabber (General statement, question, or statistic) \*Hint, see if either of these questions can help you get started.
    - a. Is the demand for food greater than the supply?
    - b. What happens when the world can no longer feed itself?
  - B. Introducing the organism
    - a. How exactly the organism was created
    - b. Description of the organism
    - c. Name (What is it called)
    - d. Why was the organism created?
- II. Habitat or biome (describe where it lives). How does that effect how it grows, and helps to feed the growing population?
- III. Food source (Predator, prey, carnivore, herbivore, etc.)
- IV. Hunting techniques (stalk, ambush, run down, infrared, heat sensor, radar, sonar)
- V. Mating and gestation period
- VI. Life span
- VII. Conclusion

### Article Rubric

Project is on topic - 10 pts

All pieces of the introduction are complete - 10 pts

All pieces from the 2nd paragraph about the organism’s niche are included - 10 pts

All pieces from the 3rd paragraph about the life span are included - 10 pts

The conclusion wraps up the article nicely - 10 pts

Student writes with ownership and pride - 10 pts

It is seen that project was completed independently with original thought, and the writing is creative and completed neatly - 15 pts

Proper spelling, punctuation & capitalization - 15 pts

The writing was completed on time - 10 pts

Your task is to **create a new Genetically Modified Pig** that will help the world’s growing population.

1. What is the name of your pig? \_\_\_\_\_
2. What different organisms (genes) have you added to make your “new and improved” pig?  
How does each gene help your organism to be productive? (answer these questions below)

Source of the genes (organism)	Purpose of the gene

3. Explain the benefits (environmental, nutritional, medicinal...) of your modified pig?

---



---



---

4. Explain the characteristics that help the world’s growing population?

---



---



---

5. What are some concerns people might have about the new organism?

---



---



---

6. Draw a picture of your new organism, write the name & color it.

7. Create a slogan to help promote your organism. Write it under your drawing and below.

---



---



---