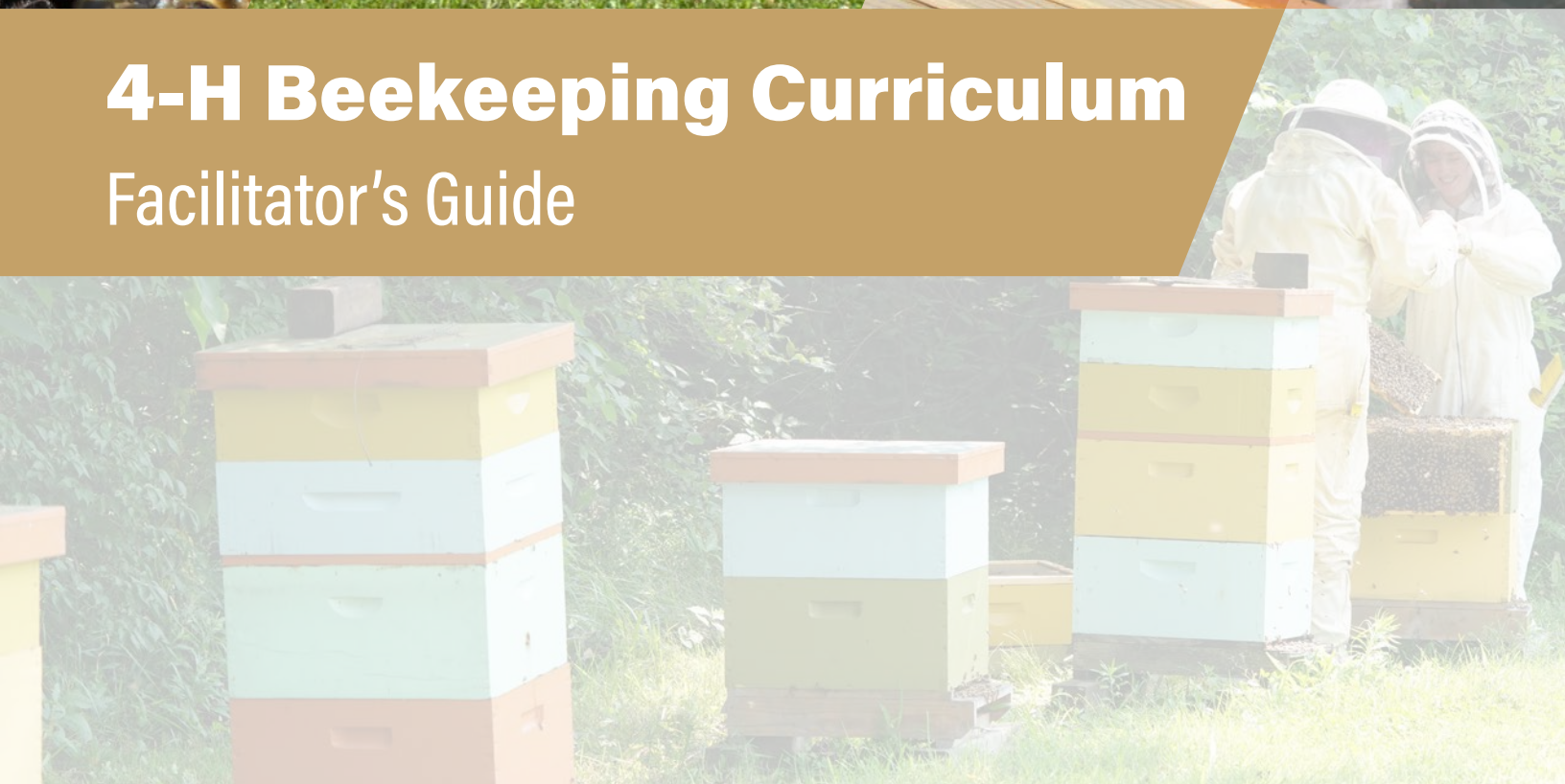
PURDUE UNIVERSITY | Extension - 4-H Youth Development

4-H-1060-W

4-H Beekeeping Curriculum

Facilitator's Guide



Note to the 4-H Project Facilitator

Thank you for taking the time to help a young person learn more about beekeeping. Studying and learning about bees can be both fun and profitable. The 4-H Beekeeping curriculum is for youth who want to learn about bees and beekeeping. Beekeeping offers many hands-on, educational experiences, from learning about bees and nectar to raising bees and producing honey.

The curriculum is divided into three manuals. The major focus of each is described below.

Level 1, *Learning About Beekeeping*, is intended for upper elementary students. It covers information on the basic facts of beekeeping: types of bees, the honey and wax they produce, plants that attract bees, and introductory beekeeping equipment. Youth are not required to have bees as they prepare to take care of a honey bee colony of their own.

Level 2, *Working with Honey Bees*, is for youth who have completed the Level 1 manual and feel ready to start a beehive. We expect a parent or other advisor/mentor to guide the new beekeeper. Activities in this manual help youth as they acquire a colony and learn how to care for their beehive throughout the year. It also introduces basic beekeeping operations resulting in the production of extracted, chunk or cut comb honey.

Level 3, *Advanced Beekeeping* is for a young beekeeper who is experienced and knowledgeable in the basic care of a beehive. Advanced topics include increasing the number of honey bee colonies; increasing honey production; producing special kinds of honey; more about bee societies; and how to manage honey bee diseases and parasites.

Authors: Natalie Carroll, Greg Hunt, Krispn Given
Reviewer: Mindy Wilkinson
Editor: Nancy Alexander
Designer: Tim Thompson

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Notes:

- The amount of reading in the Level 1 manual may be difficult for younger members (third and fourth graders). We recommend that an adult read with the 4-H member and pause to discuss the Quiz Yourself questions.
- If someone is stung by a bee and appears to be having a reaction to the sting call 911 immediately and follow the instructions from the dispatcher.

Experiential Learning

Learning about beekeeping is based on experience-centered activities. Youth are encouraged to take responsibility for their beekeeping project. They can enhance their learning by consulting others who raise bees and, as the youth mature, by reading books and online publications and attending bee association meetings. Youth are encouraged to have an experienced beekeeper as an advisor and mentor throughout their beekeeping career.

Experiential learning is the hallmark of 4–H youth development education. The five steps of experiential learning can enhance every learning experience. Encourage youth to:

- Experience an activity or project.
- Share what happened during the activity or project.
- Reflect on your work.
- Generalize what you learned.
- Think about how you can apply what they learned to other situations and life in general.

The beekeeping curriculum exemplifies the 4-H motto, "Learn by Doing." Youth are expected to work with a mentor/facilitator beekeeper. The manuals offer guidance and information but do not provide activities for youth to perform on their own before discussing the experiential learning questions with their facilitator. Beekeeping must be learned with a knowledgeable adult. A few questions are included in the first two manuals for facilitators to discuss with the young beekeeper(s).

You can strengthen learning by encouraging the 4-H beekeeper to discuss what they're doing and learning with you, their mentor and anyone else who is interested.

Facilitators help youth by being involved. Discussing what the 4-H member learned and what they didn't understand helps the youth have a better learning experience. Everyone likes to have others interested in what they're doing, particularly young people. Youth take on more responsibility for their learning and move to independent learning as they mature, but they still enjoy discussing their work. Facilitator interest and support reinforces learning at any age. Your teaching and involvement helps 4-H beekeepers grow and mature, and makes 4-H a rewarding and fulfilling experience. Thank you!

Learning Goals

Learning About Beekeeping

- Begin to learn about bees and beekeeping
- Develop understanding of and appreciation for honey bees
- Share learned information

Working with Honey Bees

- Set up a hive and care for it throughout the year
- Expand knowledge of bees and beekeeping
- Harvest extra honey
- Keep beekeeping records
- Exhibit to teach others about bees
- Share learned information

Advanced Beekeeping
(learning depends on chosen activities)

- Successfully expand the apiary
- Improve record-keeping skills
- Gain competency in caring for queens, splitting colonies and/or using bees for pollination
- Develop expertise in seasonal management
- Understand common bee problems and know what to do
- Develop a business and marketing plans
- Understand the dangers of pesticides and bees
- Educate others about beekeeping through presentations or mentoring younger 4-H members

4-H Life Skills

4-H programs help youth develop knowledge and skills that help them become caring, competent adults. In their publication, Targeting Life Skills in 4-H, Norman and Jordan define life skills as competencies that assist people in functioning well in the environments in which they live (M.N. Norman and J.C. Jordan, University of Florida Extension, product number 4H FS101.9). 4-H uses the Targeting Life Skills Model (Hendricks, 1998) to identify important assets that youth can learn through 4-H programming. The model uses the 4-H Pledge to categorize various life skills under four general competency areas: Head, Heart, Hands and Health. These categories are described below.

Head: knowledge, reasoning and creative competencies

- *Thinking* – using one's mind to form ideas and make decisions; to imagine; to examine carefully in the mind; to consider
- *Managing* – using resources to accomplish a purpose

Heart: personal and social competencies

- *Relating* – establishing a mutual or reciprocal connection between two people that is wholesome and meaningful to both.
- *Caring* – showing understanding, kindness, concern and affection for others

Hands: vocational and citizenship competencies

- *Giving* – providing, supplying or causing to happen; social responsibility
- *Working* – accomplishing something or earning pay to support oneself through physical or mental effort

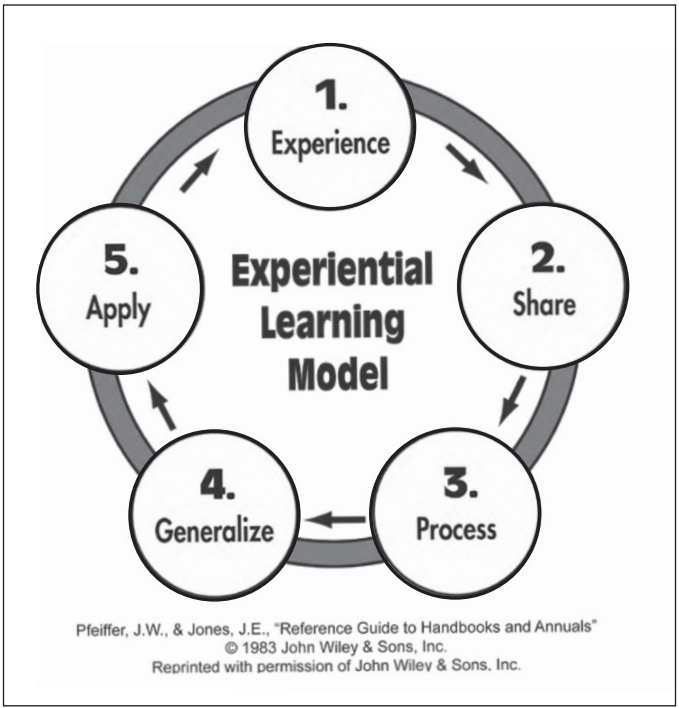
Health: health and physical competencies

- *Living* – acting or behaving; the manner or style of daily life
- *Being* – living one's life; pursuing one's basic nature; involved in personal development

The Experiential Learning Model

According to the Experiential Learning Fact Sheet from National 4-H Headquarters, "Experiential learning takes place when a youth is involved in an activity, looks back at it critically, determines what was useful or important to remember, and uses this information to perform another activity. 4-H uses this hand-on learning approach to teach new topics and life skills." (Experiential Learning Principles. M.N. Norman and J.C. Jordan, University of Florida Extension, product number 4H FS101.10)

The experiential learning model helps youth make the most of any activity. It distinguishes 4-H activities from many other educational methods. Experiential learning allows youth to first learn by doing, before being told or shown how, and then to process the experience. Activities are designed so youth **experience** a learning activity; **share** what they did; **process** what they did through discussion, analysis and reflection; **generalize** what they learned to test their comprehension and appreciation of the activity; and think about how they can **apply** what they learned to other situations.



Youth Development Stages

Source: Ages and Stages of Child and Youth Development: A Guide for 4-H Leaders. J. Karns and J.A. Myers-Walls, Department of Child Development and Family Studies, Purdue University. North Central Regional Extension Publication No. 292 (out of print).

Understanding their physical, mental, social and emotional development helps you in working with young people. Of course, no two people develop at the same rate, and transitions are sometimes quick and sometimes gradual. Youth of the same age vary greatly in physical, mental, social, and emotional growth and interests. These differences are even more marked between age groups.

However, research has shown some generalities that can help you understand how to plan activities for different age groups. People — parents, guardians, mentors, advisors and teachers — who are immersed with high school youth, for example, may not remember how younger age groups think, act and interact. These generalities are provided as reminders and guidelines. Understanding them may contribute to a successful relationship with youth, both individually and in groups.

Early Elementary (Pre-4-H Age)

This is an active age, so it's important to keep these children busy. They're concrete thinkers and need to understand what you want them to do and how to do it. They are generally more interested in making something than in completing a project (process

more interesting than product). Children in this age group tend to seek adult approval and depend on adults, although their peers' opinions are beginning to be important. They do best in small groups with set rules and rituals. Competition is inappropriate for this age group.

Upper Elementary

This is also a physically active age, so hands-on activities work best. Children in the upper elementary grades are still fairly concrete thinkers — things are black/white or right/wrong — but they're beginning to think logically and symbolically. Because this age group has a strong need to feel accepted, an adult should evaluate each product rather than hold a competition among peers with only one winner. A child this age prefers to know how much they have improved against past efforts and how to improve in the future.

Upper elementary children are beginning to identify with peers but continue to value adult guidance. They are also beginning to discover the benefits of making other people happy, but more for the benefits to themselves rather than to others. They begin to take responsibility for their actions and to develop an increased independence of thought, which may allow them to try new things. Letting this age group help in decisions of the club helps them start learning about leadership.

Middle School

Middle school youth are beginning to move to more abstract thinking. Justice and equality are important to this age, so they may view project judging in terms of what is fair as well as a reflection of self-worth. Youth in their middle school years prefer to find their own solutions rather than get them from adults. Try to provide supervision without interference. Independent thoughts and actions begins to emerge. Avoid comparing middle school youth with each other; instead, compare performance with past accomplishments.

Junior volunteer organizations are often popular with teens in the upper end of this age group, particularly if they offer opportunities to develop leadership skills and interact with other youth.

High School

Most high school-aged teens usually know, or think they know, their abilities, interests and talents. They tend to be concerned with themselves and their peer group. While they can understand the feelings of others, they lean toward being self-absorbed, particularly in the earlier years of high school. Relationship skills are usually fairly well developed. Getting a driver's license increases both independence and interactions with peers. Acceptance by other youth is important.

High school-aged youth begin to think about the future and make realistic plans. They enjoy career exploration and preparation. Their vocational goals influence the activities they select.

Projects requiring research and creativity give teens an opportunity to demonstrate how much they have learned and what they can accomplish. Teens set goals based on their personal needs and priorities and reject goals that others set for them.

As teens master abstract thinking, they may try new ideas in ways that confuse adults. Teens can generally initiate and complete tasks without supervision. A leader can help by arranging new experiences in areas of interest to teens but must allow them plenty of input. Assume the role of advisor/coach for independent workers, rather than teacher/lecturer. Club meetings, rituals and uniforms do not generally appeal to this group. Many teens enjoy looking back on their achievements in 4-H and teaching younger 4-H members, and they appreciate special recognition for leadership activities. By the time they graduate from high school and begin college or a career, youth feel they have reached full maturity and expect to be treated as such.

Some Final Thoughts

You are an asset to the youth you work with and your community. These guidelines for stages of child and youth development — in combination with your special skills and interests in youth — will help you plan and carry out a successful 4-H program and make a positive impact on the lives of young people.

Next Generation Science Standards

www.nextgenscience.org/
The Next Generation Science Standards (NGSS) were introduced in A Framework for K-12 Science Education by the National Research Council. NGSS describe student performance expectations and are organized around the core ideas in the major field of Natural Science from the Framework. It lists 11 core ideas, four of which are in life sciences. The core ideas are divided into sub-ideas, which detail what students should understand about that sub-idea at the end of grades 2, 5, 8 and 12. These grade-specific statements are called disciplinary core ideas.

See How to Read the Next Generation Science Standards at https://www.nextgenscience.org/understanding-standards/understanding-standards for more information.

Reference: Next Generation Science Standards for States, By States, Volume 1, The Standards (ISBN 13: 978-0-309-27227-8; ISBN 10: 0-309-27227-0; Library of Congress Control Number: 2013939525)

Learning about bees and beekeeping will help youth learn and understand many NGSS Life Science (LS) topics in the LS1, LS2, LS3 and LS4 Core Ideas.

LS1 – From molecules to organisms: structures and processes

LS2 – Ecosystems: interactions, energy, and dynamics

LS3 – Heredity: inheritance and variation of traits

LS4 – Biological evolution: unity and diversity

The performance standards youth are most likely to learn through beekeeping are:

Grade 3

3-LS1-1. Develop models to describe organisms that have unique and diverse life cycles, but all have in common birth, growth, reproduction, and death. Examples:

- Develop models to describe phenomena.
- Science findings are based on recognizing patterns.
- Reproduction is essential to the continued existence of every kind of organisms.
- Patterns of change can be used to make predictions.

LS1 – From Molecules to Organisms: Structures and Processes

LS1.A. Structure and function – Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.

3-LS2-1. Construct an argument that some animals form groups that help members survive. Examples:

- Construct an argument with evidence, data, and/or a model.
- Being part of a group helps animals obtain food, defend themselves, and cope with changes.
- Cause-and-effect relationships are routinely identified and used to explain change.

3-LS4-2. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates and reproducing. Examples:

- Use evidence (e.g., observations, patterns) to construct an explanation.
- Cause-and-effect relationships are routinely identified and used to explain change.

3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all. Example:

- Cause-and-effect relationships are routinely identified and used to explain change.

Grade 4

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. Examples:

- Construct an argument with evidence, data, and/or a model (4-LS1-1)
- Use a model to test interactions concerning the functioning of a natural system.

Middle School

Middle school students should have opportunities to learn standard techniques for displaying, analyzing, and interpreting data; such techniques include different types of graphs, the identification of outliers in the data set, and averaging to reduce the effects of measurement error. Students should also be asked to explain why these techniques are needed.

MS-LS2. Ecosystems: interactions, energy, and dynamics

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms. Emphasis is on cause-and-effect relationships between resources and the growth of individuals and the numbers of organisms during periods of abundant and scarce resources.

Example:

- Organisms and populations of organisms are dependent on their environmental interactions both with other living things and with nonliving factors.

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations.

High School

Learners need to develop skill in additional techniques for displaying and analyzing data as they progress through various science classes in high school and their investigations become more complex. They may use x-y scatterplots or cross tabulations to express the relationship between two variables. Students should be helped to recognize that they may need to explore more than one way to display their data in order to identify and present significant features. They also need opportunities to use mathematics and statistics to analyze features of data such as covariation. Also at the high school level, students should have the opportunity to use a greater diversity of samples of scientific data and to use computers or other digital tools to support this kind of analysis.

HS-LS2. Ecosystems: interactions, energy, and dynamics

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. Put emphasis on quantitative analysis and comparison of the relationships among interdependent factors, including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets. Examples:

- Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges as predation, competition, and disease.

- Organisms would have the capacity to produce populations of great size, were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in eco- systems of different scales. Examples of mathematical representations include finding the average, deter- mining trends, and using graphical comparisons of multiple sets of data. Example:

- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.

HS-LS2-6. Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or seasonal flood, and extreme changes such as volcanic eruption or sea-level rise.

- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions.
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Quiz Yourself Answers

Learning About Beekeeping

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Note: Lorenzo Lorraine Langstroth and another beekeeper and cabinetmaker, Henry Bourquin, made the first movable frame beehive. Langstroth invented this beehive in 1851 and received a patent for it in October 1852 (Patent: No 1851: 5 October 1852, No. 9300, "Improvement in bee-hives"").
Stefano Della Rocca, a Catholic priest from the Greek island of Syros, had invented the first wooden hive with movable comb in 1780.

- Honey bees pollinate about **one-third** of the food we eat and about **75%** of all crops.
- Honey bees are excellent pollinators because **they are hard workers, visit only one type of flower on a particular trip and their beehives can be moved to areas where flowers need to be pollinated.**
- Bee space is an open space of about 3/8 inch that the bees leave between their honeycombs so that **they have room to move and work.**
- Another term for beekeeping is **apiculture.**

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- Bee sub-species are commonly called a **race**.
- The original bee races have been hybridized for desirable traits and particular uses. A hybrid is **a cross between any two distinctly different populations**.

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- The castes of honey bees are **queen, drone and worker**.
- The queen's only job is **to lay eggs**.
- A drone is an **unfertilized male bee**.
- Which caste collects, stores and cures flower nectar and pollen; secretes beeswax; and serves as the guards, nurses and cleaning crews of the hive? **worker bees**

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- A queen bee emerges as an adult **16** days after the queen egg is laid.
- Drones emerge **24** days after the egg is laid.
- Worker bees emerge **21** days after the egg is laid.
- Which bee caste has the longest body? **queen**
- Which bee caste is shorter and heavier than the queen but larger and clumsier than the workers? **drone**

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- Flowers and the pollinators have a **symbiotic** relationship.
- Field worker bees suck up nectar using their **proboscis**.
- Field worker bees have **two** stomachs.
- Ripe honey is ripe has less than **20%** water.
- It takes about **20,000** bees to collect a pound of nectar.
- A pound of nectar makes about **one-quarter** pound of honey.

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One pound of nectar makes about a quarter pound of honey.

- Seven pounds of honey make about **one** pound of wax.
- So, one pound of wax requires about **28** pounds of nectar! **(4 x 7 = 28)**

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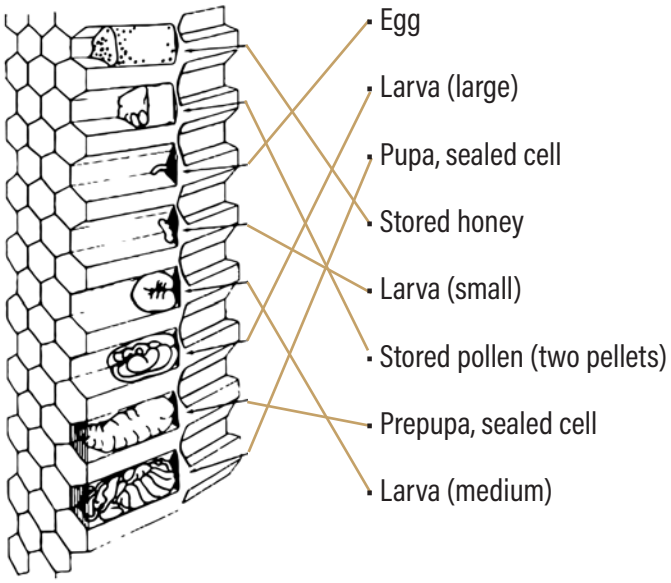
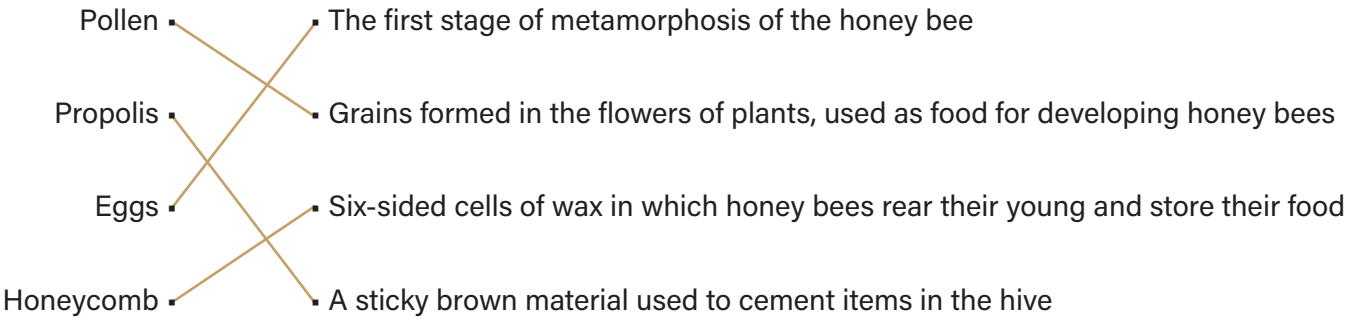
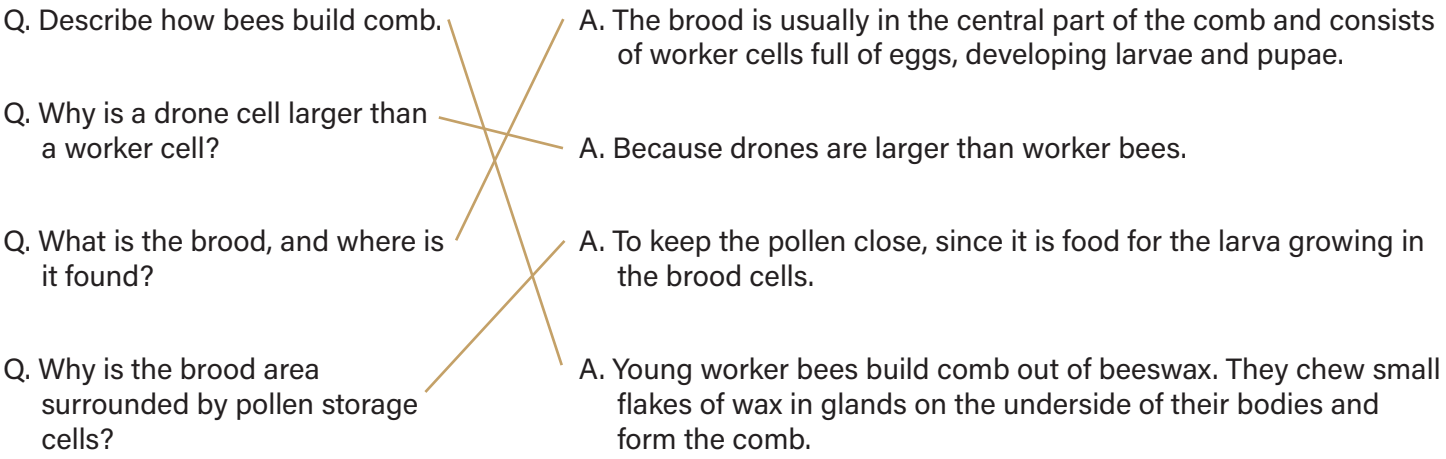


- Newly constructed comb is usually **white or light yellow** in color.
- Honeycomb cells have a **hexagonal (six-sided)** shape.
- Why is older comb darker than new comb? **When a new bee is born it sheds its skin, which becomes part of the cell and makes it darker.**

Draw a line from each thing you can find in a honeycomb to its definition.



Draw a line from each question to its correct answer.



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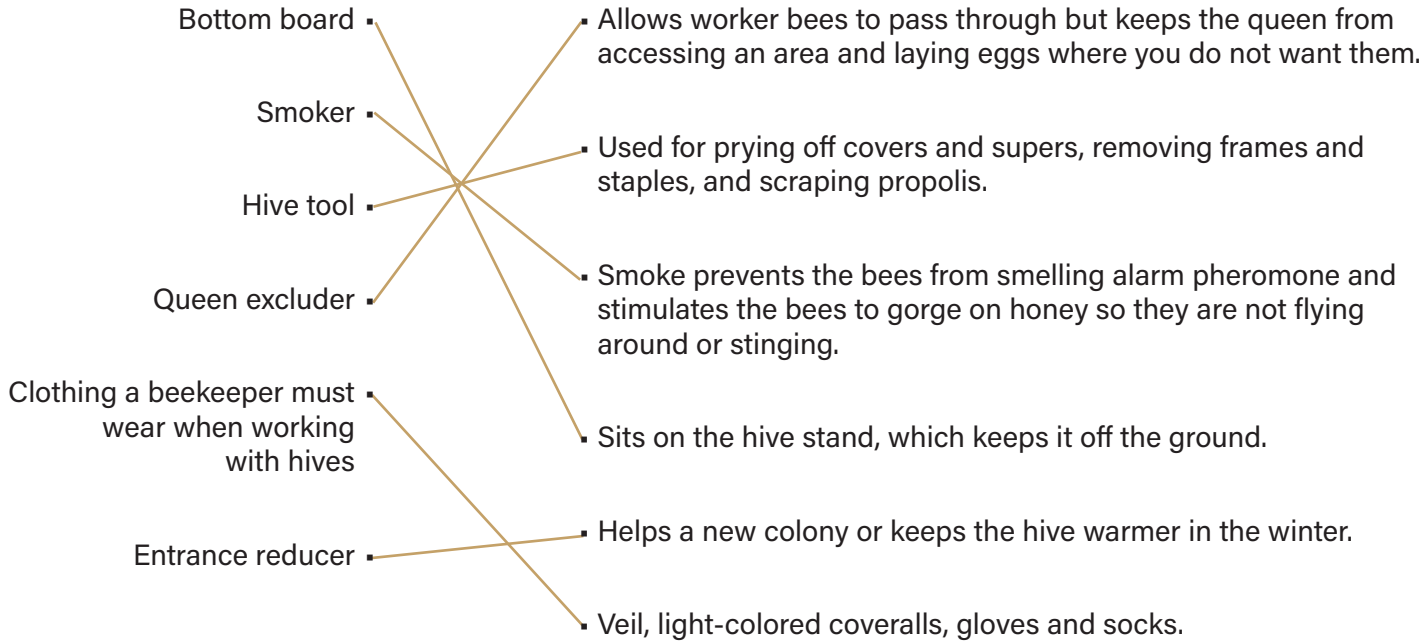

Working with Honey Bees

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- What special considerations must the backyard beekeeper with close neighbors make? **Locate your hive where the bee's flight path to flowers will not bother your neighbors.**
- What should you consider when looking for your beehive location? **Nectar, water, drainage, sun and wind, and vegetation.**
- Bees need a constant supply of **water**.

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- What are the four recommended methods for getting bees to fill your hive? **Catch a swarm, buy an established colony, buy a package of bees, or find a beekeeper to sell you a nuc (nucleus) colony.**
- You should stay out of your hive, opening it only briefly in an emergency and when temperatures are at least **45°F** to protect your colony from the cold.
- Honey bee eggs and larvae are incubated at **93°F**, regardless of the outdoor temperature.
- Windbreaks are needed in all northern states and southern states where winter temperatures range between **45 and 68°F**.

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- **Feed syrup** to simulate a honey flow before, during, and after you introduce a new queen.
- About what percentage of the hive is estimated to leave when it swarms**? 67%**
- Young bees just testing their wings are sometimes mistaken for **robber bees**.

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Column 1

- What are the signs of Nosema disease? **Brown spots and streaks on hive box where bees come out. Foul smell.**
- How would you protect your bees from Nosema? **Treat hives with 2:1 sugar syrup in fall.**
- What are the signs of American foulbrood disease? **An uneven pattern of brood with lots of empty cells. Some cell cappings may look darkened and sunken. Cells may be partially opened by bees. Larvae die after cell is capped.**
- Describe how American foulbrood can be successfully treated. **Sprinkle powdered sugar mixed with Terramycin according to the label instructions.**

Column 2

- What is chalkbrood disease? **Dead larvae become white or grey cottony "mummies" inside of cells**.
- How is chalkbrood disease treated? **Usually no treatment (Rx) is required. Feed sugar syrup, add more brood or requeen**.
- How would you know if your bees have Varroa mites? **Look for Varroa mites in capped cells (especially drone cells) or on adult bees**.
- What would you do to treat for Varroa mites? **Use Apistan strips, Checkmite+strips or Apilife VAR tablets**.

NOTES

NOTES

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June 2022