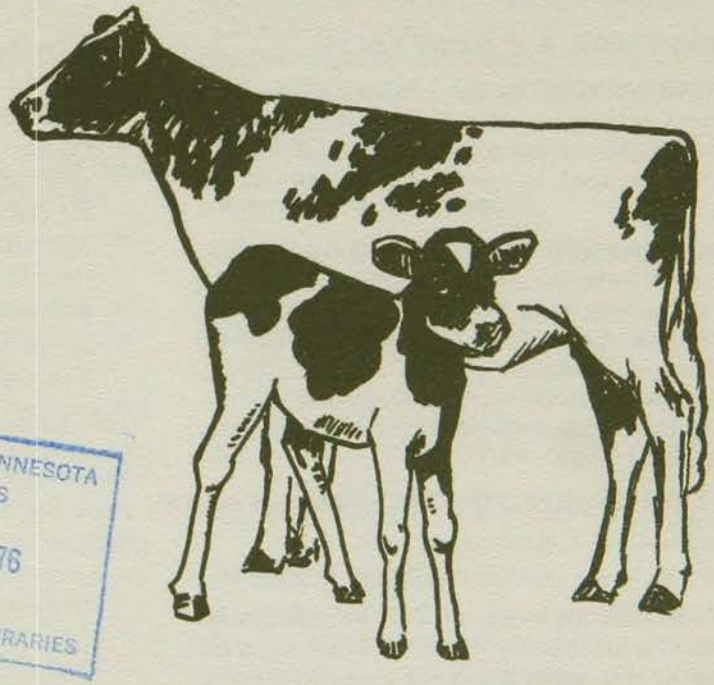
4-H B-10 – Revised 1975

DAIRY...
calves & heifers



A 4-H DAIRY PROJECT
WORKBOOK

COOPERATIVE EXTENSION PROGRAMS

ILLINOIS MINNESOTA
IOWA WISCONSIN

University of Minnesota Agricultural Extension Service

DAIRY . . . calves & heifers is a cooperative publication written jointly by extension dairy specialists from Illinois, Iowa, Minnesota, and Wisconsin. State extension youth specialists have contributed guidance and direction to the effort. A special thanks goes to Hoard's Dairyman, Fort Atkinson, Wis., which provided many photographs.

Robert Appleman, Minnesota
Wayne Carlson, Minnesota
Joseph Conlin, Minnesota
David Dickson, Wisconsin
Michael Hutjens, Minnesota
Ralph Johnson, Illinois
Maurice Sutton, Iowa
Ray Whitmore, Iowa

MINNESOTA 4-H DAIRY FACTS

PROJECT REQUIREMENTS. The project can consist of activities, project without an animal, and animal projects. Animals can be added or purchased at any time or age. Members are encouraged to continue with animals and expand.

SHOW REQUIREMENTS. Animals that are going to be exhibited must be selected and owned by members by *April 1st* of the project year. Heifers must be owned by the member before the heifer has its first calf (and by April 1st). *Remember*, this is a show requirement. No animal can be owned in partnership outside of the immediate family (no syndicates). Members do not have to begin with a calf.

CLASSES AT THE MINNESOTA STATE FAIR 4-H SHOW

1. Animals are selected at local county fairs.
2. Classes are split in the purebred and grade groups.
3. Production awards are based on DHI records (owner sample and official). Blue (10% above breed ave.), red (10% below to 10% above breed ave.), and white (10% below breed ave.) awards are presented. ADA awards (official records only) are presented to the top producing cows.
4. Classes include calf, junior yearling, senior yearling, 2 year old, and 3 year old and older. Holstein classes split the calf class into summer calf (July 1 to Sept. 30) and fall calf (Oct. 1 to Dec. 31). Holstein cow classes include 2 year old, 3 year old, 4 year old, and 5 year old and above.
5. Senior yearlings that calve automatically show in the 2 yr. old class.

This publication is a new concept in 4-H dairy project work. We hope you enjoy using it. While it can stand alone, it will still be important for you to find and use other resources.

Michael F. Hutjens,
Extension Dairyman.

MEMBERS' GUIDE

The 4-H Dairy Project can provide you with a variety of experiences, opportunities, and learning situations. How much you learn in the dairy project depends on *you*. Skills in feeding, management, genetics, reproduction, herd health, and dairy husbandry can be explored and experienced. Communications, junior leadership, cooperation, and teamwork are other components of a well-rounded dairy program.

Objectives To help you:

. . . develop an appreciation of dairying and its importance in the economy of the community, state, and nation.

. . . understand the role of science in the function of the dairy cow and in the production of dairy foods.

. . . learn the application and use of sound business principles as they apply to the operation and management of the dairy project program.

. . . recognize the importance of patience, kindness, and understanding in handling dairy cattle.

. . . obtain knowledge and skills in dairying to be successful in establishing and/or managing a dairy herd.

. . . experience the satisfaction and feeling of accomplishment from working with dairy cattle to produce a nutritious, healthful product for human consumption.

Using this workbook

This workbook contains all the information and forms needed in the calf and heifer projects. Additional material is available for dairy cow and herd management projects. No member is expected to complete the workbook in 1 year. Members will use this workbook throughout their 4-H dairy project years. Below are guidelines in using the workbook:

1. How is the workbook organized? Eight sections are in the workbook. Each section has two to five units. At the end of each unit, a "things to do" section contains suggested activities and exercises. You may select one or more activities that interest you.

2. How many sections or units should I do? As a guide, you should select a minimum of *two* units in any *section(s)* (not the entire sections) that you find interesting. Enter the units you select in your 4-H record summary. In your 4-H story, describe what you did in each unit.

3. What about next year? Select different units each year to expand your dairy background and program. Repeat a unit if you want to learn more about that specific area. You do NOT have to complete all units or sections.

4. Are some units easier than others? Yes! In most sections, the first units are written for younger members. Older members should select units at the end of each section. Here are guides for your consideration.

Beginning members

SELECTING YOUR PROJECT ANIMAL
MILK AND DAIRY PRODUCTS
DAIRY NUTRITION: Feeding your calf (Unit I)
SELECTION AND BREEDING: Dairy cattle families—breeds (Unit I)
REPRODUCTION: Baby calves—miracle of birth (Unit I)

Intermediate members

MILK AND DAIRY PRODUCTS
All about the dairy industry (Unit 5)
How milk is processed (Unit 6)
ANIMAL CARE: Keep your calf healthy (Unit 1)
DAIRY NUTRITION: Colostrum (Unit 2)
DAIRY NUTRITION: Calf feeding (Unit 3)
DAIRY NUTRITION: Feeding your yearling heifer (Unit 4)
SELECTION AND BREEDING: Getting to know the breeds (Unit 2)
REPRODUCTION: Managing a breeding program (Unit 2)

Advanced members

ANIMAL CARE: Keep your heifer healthy (Unit 2)
DAIRY NUTRITION: What's in feed (Unit 5)
SELECTION AND BREEDING: Hows and why's of inheritance (Unit 3)
DOLLARS AND DAIRYING
LEADERSHIP AND CAREERS

Remember, these are only guidelines. Look over the units and select any and all that you want to study.

5. How are project animals recorded? Each project animal should have a "lifetime dairy record." Enter and update information as events occur (health, breeding, calves, completed lactations, etc.). Each year, the form should be certified stating that the animal was a project of the 4-H member. If you have more than two animals, copy or duplicate extra pages.

6. Should pages be removed from the Workbook? Check with your local dairy leader or extension 4-H agent. Worksheets and lifetime dairy record sheets can be placed into your 4-H project books or left intact in the workbook.

7. What about fitting, showing, and judging? Much information is readily available on these topics. Contact your dairy leader or extension 4-H agent. Be sure to participate in these areas and activities.

LEADERS' GUIDE

The 4-H Dairy Project provides many experiences to help boys and girls develop. It teaches a great deal in addition to dairy skills.

Leading a 4-H club can be a rewarding endeavor for you. As a dairy leader, you can help youth develop skills which will be useful to them throughout their lives.

As a guide, try to envision your leadership as providing some of these skills in addition to the traditional "fitting, showing, and judging" that all dairy members experience:

- Does your program teach youngsters to ask questions? Does it make them wonder why?
- Do your members learn to work together in activities? Can they relate to the older and younger members in the club? To their parents? To the "older generation"?
- Have you taught them to accept new ideas? Do you stress the fact that this is a changing world and that we must change to keep pace?
- Does your program teach youth the art of communication? Do your members give demonstrations or "reasons for judging"? Do they interact at meetings? Can they express their thoughts and ideas?
- Do you present the importance of science and technology to dairying? Do your members understand the changes science has brought to our industry?
- Have you given your members a chance to explore careers related to dairying? Do you take tours to agricultural industries? Do you go on field trips to automated dairy operations? Do you invite speakers to attend your meetings to talk about what they do?

These are skills young people will use throughout their lives—whatever occupation they choose. Much of the strength of our 4-H program lies in the continued development of these skills in our youth.

Leaders provide tips and information to 4-H dairy members.

Encourage your new members to begin the dairy project with a single project animal—probably a calf. As the member develops his interests, understanding, and skill in the project, he may add additional project animals and become more involved in other phases of the project. Because of the nature of dairying, the youngster and the project grow and develop together.

The dairy project can teach skills in feeding, managing, and breeding dairy cattle. It also develops responsibility and individual initiative. Useful as vocational training or as a stimulating hobby, the dairy project provides learning experiences applicable to all the animal sciences. Numerous opportunities for group experiences are also available.

Ideas are exchanged at project meetings.

Objectives

Help young people:

. . . develop an appreciation of dairying and its importance in the economy of the community, state, and nation.

. . . understand the role of science in the function of the dairy cow and in the production of dairy foods.

. . . learn the application and use of sound business principles as they apply to the operation and management of the dairy project program.

. . . recognize the importance of patience, kindness, and understanding in handling dairy cattle.

. . . obtain knowledge and skills in dairying to be successful in establishing and/or managing a dairy herd.

. . . experience the satisfaction and feeling of accomplishment from working with dairy cattle to produce a nutritious, healthful product for human consumption.

Your job as a dairy leader

1. Plan and conduct regular dairy project meetings. Regular meetings should be held. At least four meetings each year are necessary for youngsters to benefit from your leadership. More are preferred. Some leaders meet as often as once each month. Select topics from this workbook or other sources that are timely, interesting, and of value to your members. At each meeting, have a demonstration or activity that relates to the topic you choose. Youth do not

enjoy lectures. They are apt to learn more if they can be involved.

2. Encourage and assist members to work with their dairy projects. If possible, visit each member annually to see his project animal. Together with his parents, help him decide what he would like to do in his dairy project each year. Talk with him at the end of the year about how well he accomplished his goals. Suggest how he may improve the next year.

3. Encourage members to keep records on their projects. Have members keep notebooks, growth records, feed records, and production records. These and any other records may be kept in this workbook. Encourage members to bring the workbook to club meetings. Some of the exercises make excellent group projects.

4. Involve parents in dairy project meetings and activities. Hold meetings when parents can attend. You may want to meet occasionally with parents alone to keep them informed about what members are doing or are expected to do. Parents should always be invited to attend activities and events in which your club participates.

5. Involve members in as many phases of the project as possible. There is something in the dairy project for everyone. Encourage members to find what they like best. Do this by giving them the opportunity to get involved in all project activities. Members can also help you plan your meetings. Find out their interests and wants. Invite them to help plan the year's activities.

How to use this workbook

1. This workbook contains more information than most club members will ever use. You will find much material that is useful for your club meetings. Use it even though some members may have completed the exercises.

2. Use the workbook as a guide for planning each member's work. Help younger members select two or three units they find interesting. Encourage older members to do more. Try to match each youngster's ability to the amount of work he chooses to do.

3. Many exercises in the workbook do not provide answers. Be prepared to help some members answer the questions. Answers to all questions can be found in the written material that precedes the questions in each unit.

4. Older members are more apt to be independent. They frequently prefer to work on their own. The "Leadership" and "Do Your Own Thing" sections provide some ideas they may want to try.

5. Fitting and showing information and judging information has purposely been left out of this workbook. A great deal of information is readily available on these topics. We suggest that you obtain such material from the national dairy breed associations, and from slide sets, textbooks, and other appropriate sources. Call your county extension 4-H agent if you need help with these areas.

Your dairy project may begin with your father's herd.

PARENTS' GUIDE

You are the most important and influential person in your child's life. You can nurture and cultivate his interest in this project by guiding him in his planning, by assisting him in carrying out his project, and by recognizing him for a job well done.

The information in this 4-H dairy publication can provide significant learning experiences for your child. Planning the things he will learn and do and assessing his progress will help make his experiences more worthwhile. The dairy project leader may provide individual guidance for your child. However if this is not possible, you can fulfill this need.

Here are ways you can help your child get the most out of this project:

—Become familiar with the material in this and other dairy project literature.

—Help your child select goals he can achieve.

—Help him decide what tools, equipment, and supplies he will need and what he can realistically expect to have.

—Help him understand and learn to do the tasks required to carry out his plan. *Do not do his work for him.*

—Help him schedule his time.

—Discuss his progress with him from time to time.

—Help him recognize a good job from a poor one.

—Commend him on things he has done well. (As the most important person in his life, a pat on the back from you is one of the highest rewards he can receive.)

—Help him understand where he needs to improve.

—Help him to know himself, his strengths, and weaknesses and to compete with his own abilities.

—Help him evaluate what he has done and what he has learned on the basis of the goals he has set for himself. *Do not compare his progress with others.*

TABLE OF CONTENTS

RESOURCES

State and national 4-H dairy awards and programs

The 4-H Dairy Program
The National 4-H Service Committee
150 N. Wacker Drive
Chicago, Ill.

David P. Dickson
Extension Dairyman
Room 282
An. Sci. Bldg.
University of Wisconsin
Madison, Wis. 53706

Ralph V. Johnson
Extension Dairyman
Dairy Science Department
University of Illinois
Urbana, Ill. 61801

Michael F. Hutjens
Extension Dairyman
101 Haecker Hall
University of Minnesota
St. Paul, Minn. 55101

Ron Orth
Extension Dairyman
4 Kildee Hall
Iowa State University
Ames, Iowa 50010

National Breed Associations

David Gibson, Jr.
Executive Secretary
Ayrshire Breeders' Association
Brandon, Vt. 05733

Max Dawdy
Exectuive Secretary
The American Guernsey Cattle Club
Peterborough, N. H. 03458

James Cavanaugh
Executive Secretary
The American Jersey Cattle Club
2105-J South Hamilton Rd.
Columbus, Ohio 43227

The Purebred Dairy Cattle Association
Peterborough, N. H. 03458

Marvin Kruse
Executive Secretary
Brown Swiss Cattle Breeders Association
Box 1038
Beloit, Wis. 53511

Robert Rumler
Executive Secretary
The Holstein-Friesian Association of America
Brattleboro, Vt. 05301

Harry Clampitt
Executive Secretary
The American Milking Shorthorn Society
313 South Glenstone Ave.
Springfield, Mo. 65802

Catalogs of materials, literature, and supplies

The National Dairy Council
111 North Carral Street
Chicago, Ill. 60606

National Agricultural Supply Co.
Ft. Atkinson, Wis. 53538

Dairy magazines and publications

Hoards Dairyman
Wisconsin Agriculturist
Prairie Farmer
Dairy Herd Management

Successful Farmer
Wallace's Farmer
Farm Journal

Picking a good calf is the first step.

SELECTING A DAIRY PROJECT ANIMAL

Selecting the right project animal requires study and thought. This section will help you make a good choice. Also, work closely with your parents, leaders, and others to make the decision.

Planning your choice

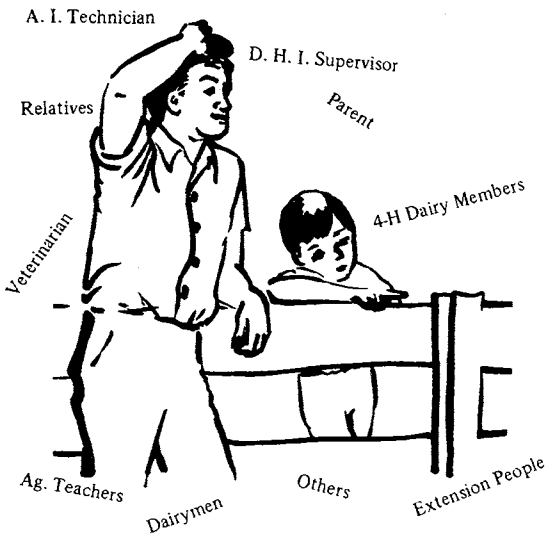
What will your animal be to you?

A dairy project can be all of these things to you—and more. What do you want your animal to be to you?

What are your options?

You have many options. Make your choice carefully to fit you—and what you want your animal to be to you.

	Age	Breed	Reg. or Grade
1st choice			
2nd choice			



Who will help me?

Seek the help and advice of others. List the people you know that you can talk to to get advice. Who are you going to ask?

Name

What about finances?

Animals cost money to buy, feed, and care for. What arrangements have you made to pay for your animal and the feed, equipment, housing, and other expenses?

What is your plan for housing, feed, equipment?

A. Where will your animal be housed and what arrangements have you made?

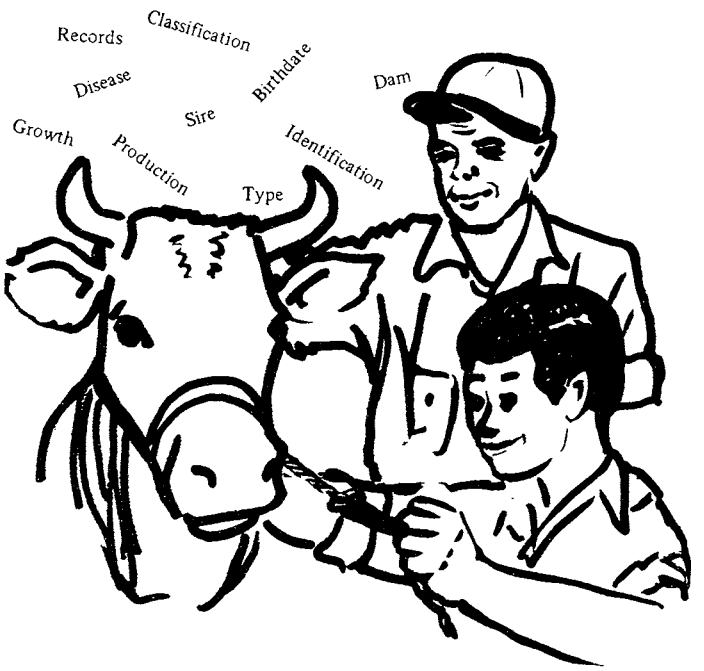
B. What will you feed your calf, where will you get it, and what arrangements have you made for it?

C. What equipment will you need and where will you get it?

Where are you planning to look for your animal?

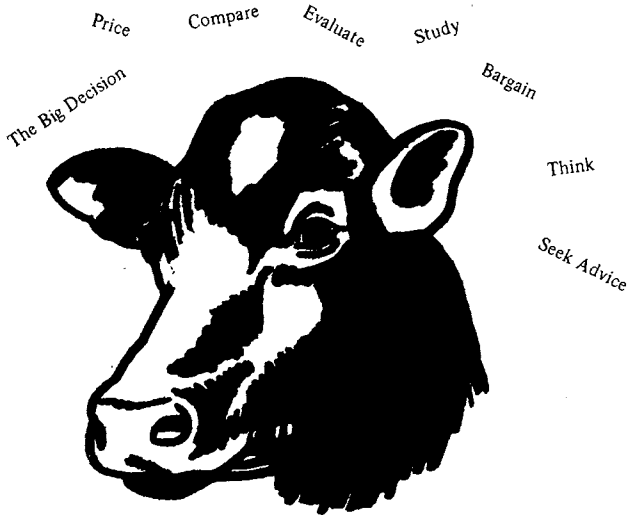
List places where you plan to look:

Name



What are you going to look for?

List the things important to you:



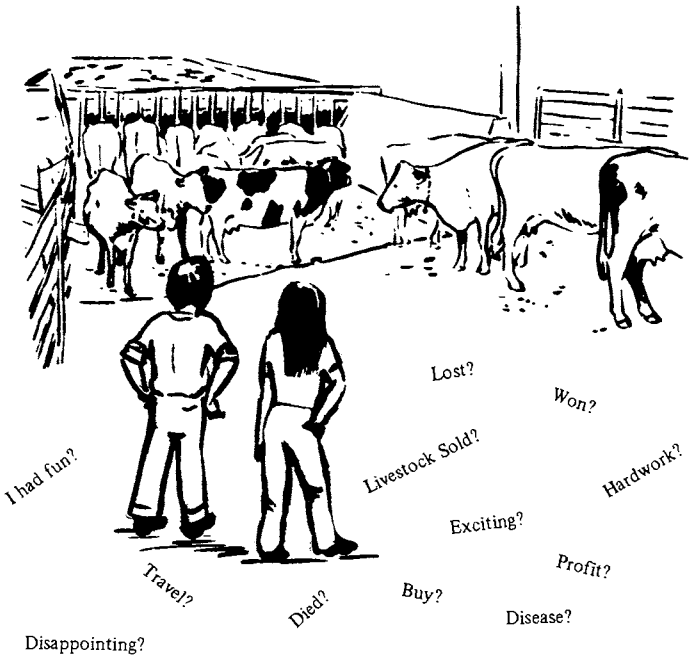
What did you find available?

What is your choice?

Compare the animals you have to choose from:

	Animal 1	Animal 2	Animal 3	Animal 4
Herd				
Animal name				
Age				
Size for age				
Health				
Sire's production				
Sire's type				
Dam's production				
Dam's type				
Price				

Which one did you choose and why?



What were the results?

Tell your experiences with your animal: (to be done at the end of the year)

MILK AND DAIRY PRODUCTS

Dairy products are an important part of a healthy diet.

Milk—Nature's most nearly perfect food
Unit 1

What more can one say. Its use goes back to the domestication of animals—probably about 10,000 years. Milk is mentioned 47 times in the Old Testament of the Bible. Its food value has long been common knowledge. When Christopher Columbus made his second voyage to America in 1493, he brought dairy cattle with him. He forgot to do so the first time, and the lack of milk was said to have a bearing on the high death rate, particularly of children. Dairy cows and other animals were required to be brought in on all subsequent voyages. What more can we say—this: "Never in the history of the United States has its citizens enjoyed a better quality product. And . . . milk is a cool, cool refresher. This combination of quality and taste appeal is hard to beat." Let's take a look at milk's composition. Chemists find that the solids of cow's milk constitute about 13 percent of the whole. Although it is a liquid, it is not a dilute food. It is more concentrated than squash, cabbage, or tomatoes, for example.

Percentage composition of milk from different species

Type	Protein %	Fat %	Carbohydrate %	Minerals or ash %
Cow's milk	3.5	3.5	4.9	.7
Goat's milk	3.2	4.0	4.6	.7
Human milk	1.1	4.0	9.5	.2

What does this mean in food value? Milk is one of the most valuable of all foods. It contains more nutritive value, pound for pound, than any other food. And pound for pound, milk costs less than almost any other food.

In addition, there is absolutely no waste. Every part of this delicious food can be enjoyed and easily digested—down to the last drop. *No other* food qualifies for that statement.

How much milk do I need? These amounts of milk (in 8-ounce glasses) are usually recommended for daily use: CHILDREN—3 or more glasses (smaller glasses for some children under 9); teenagers—4 or more glasses; adults—2 or more glasses; expectant mothers—4 glasses; nursing mothers—4 glasses.

MILK

Now that we have the facts, let's dispel some of the fiction—

. . . Adults *do* need milk.

. . . Constipation is *not* caused by drinking milk or eating cheese.

. . . Milk *should be* included in a weight reduction program.

. . . The calorie content is the *same* in butter and other commonly used table fats.

. . . The important nutrients in milk and meat are *not* influenced by the feed of the animal.

. . . You *can* eat dairy foods and seafood at the same time.

Let's look to the future—your future. The human body is in a constant process of change. Every time we move a muscle, we wear out and destroy both cells and tissues which must be replaced. Scientists have discovered that the average person wears out every cell in his body in 7 years. That means that each of us has to build an entirely new body every 7 years for as long as we live. Hence, if milk is important in building the bodies of children, it is just as necessary for the continuous rebuilding of the bodies of adults.

Drink milk for a "pick up." It never "lets you down."

Things to do:

1. Write a milk commercial.
2. Define these different types of milk—

Whole milk	Whole dry milk
Acidophilus milk	Evaporated milk
Buttermilk	Fortified milk
Certified milk	Low sodium milk
Chocolate milk	Skim milk
Chocolate dairy drink	Soft curd
Concentrated fresh milk	Two percent milk
Sweetened condensed milk	Yogurt
Nonfat dry milk	

3. Visit a dairy.
   a. Observe the various quality control measures.
   b. Learn how the butterfat content of milk is measured.
4. Develop a table showing the nutrients present in milk and various milk products.
5. Answer these questions:
   a. Why is milk pasteurized?
   b. Does pasteurization destroy the nutrients in milk?
   c. What is homogenization?
   d. How should milk be stored?

6. Take milk apart. (These could be done in a chemistry class).
   a. Separating milk fat from milk or cream:
      Put 1 cup of cream into a 1 quart jar. Add 3 drops of lactic acid. Vigorously shake the jar until the fat particles appear in the cream. Strain the mixture through a cheesecloth over a funnel. Squeeze all liquid from the mixture. What do you have left in the cheesecloth? Another method for collecting the fat is to pour the coagulated fat into cold water. The fat can then be worked into a ball with the fingers.

   b. Separating Curds and Whey:
      Pour 1 cup of milk into a beaker. Put the beaker in a pan of hot water. Crush ½ rennet tablet and mix it in 1 teaspoon of water. Add the rennet mixture to the warm milk and stir. Let milk stand until it coagulates (about 5 minutes). The lumps are the curds, and the yellowish-green liquid is the whey. Heating the curds and whey will bring about a more complete separation. Pour the mixture through a cheesecloth in a funnel into a beaker. What remains in the funnel? What part goes into the beaker?

Ice cream—a fun food
Unit 2

Ice cream is a fun food. It is one of the few fun foods that can justify its consumption nutritionally. A generous serving is about equal to ½ glass of milk in calcium, protein, and B vitamins. It's also a good source of milk's minerals, phosphorus, vitamin A, and riboflavin.

The origin of ice cream dates back 3,000 years. It was considered the greatest of delicacies. During the reign of Charles I of England, ice cream was held in such high esteem that he ordered it confined to the royal table only. Its popularity today can be attested to by the Howard Johnson Company, the world's largest restaurant chain. Howard Johnson's annually sell enough ice cream to fill more than 360 million cones. The company claims it requires 15,000 dairy cows working 7 days a week (do cows get paid time and a half on Sundays?) to produce the ice cream they sell.

It's not only fun to eat ice cream, but also fun to make. Here is a simple way to make and enjoy ice cream without a freezer. This works great for a relatively large group; everyone can participate.

Making homemade ice cream is fun, and eating it is a real treat!

Country style vanilla ice cream—Yield: 12 individual ½-cup servings

3 eggs	1 cup whipping cream
1½ cups sugar	2 tbsp. vanilla extract
5 cups milk	¼ tsp. salt

In a large mixing bowl, beat eggs until foamy. Gradually add sugar; beat until thickened. Add milk, cream, vanilla, and salt thoroughly. Chill.

Materials (for each individual making ice cream)

1. A ½-gallon milk carton, cut down to 4" in height
2. A 6-oz. tin juice can (or glass)
3. Metal spoon
4. Ice
5. Ice cream (rock) salt

Directions

1. Partially fill can or glass with ice cream mixture (approximately one-half full).
2. Put can in center of milk carton and surround with ice and ice cream salt. (use four parts ice to one part salt) Be careful not to get salt in ice cream mixture.
3. Stir mixture until frozen (approximately 20 minutes). Be sure salt does not get into ice cream mix, or it won't freeze.
4. Enjoy your homemade ice cream.

Many variations of this ice cream can be made. Here are three. (When using other flavorings, remember to decrease vanilla to one tablespoon).

Banana-marshmallow

10 oz. bag marshmallows
2 cups pureed ripe bananas
fresh lemon juice
maraschino cherries—1 cup chopped (optional)

Reduce sugar to 1¼ cups. Heat milk. Add marshmallows, stirring constantly until melted. Cool. Combine puree and lemon juice to avoid discoloration.

Black walnut

2 cups finely chopped black walnuts

Mocha chip

¼ cup instant coffee
1 cup semi-sweet chocolate pieces

Heat in portion of milk to dissolve. Finely chopped chocolate pieces can be substituted.

Try making country style ice cream and/or its variations at your next outing.

Make sure you have enough equipment for everyone.

If you own an ice cream freezer, here are rules for operating it. A freezer basically whips air into the cream mixture. If this is not done, you will produce a hard, icy mass.

Basic principles

1. Make ice cream mixture and chill.
2. Wash can, dasher, and cover. Then cool.
3. Measure salt. For 1 gallon, you will use about 3-4 cups rock salt.

4. Position container and dasher in freezer bucket. Fill can. (½ to ⅔ capacity). Place cover on can.
5. While freezer is turning, add ice and salt in layers. Begin with 6 cups ice (about 2 inches), then evenly distribute about ¼ cup rock salt. Alternate ice and salt until container is surrounded and covered. For a hand freezer, turn dasher, stirring mixture for 1 minute.
6. Make sure the hole in the freezer bucket remains unobstructed to allow brine to drain.
7. For a hand freezer, turn dasher faster to whip air into ice cream. Turn until it becomes difficult.
8. Drain brine by tilting freezer. Clear away ice and salt down to about 2 inches below cover. Remove motor or crank. Wipe cover and can free of ice and salt. Carefully remove cover and dasher. Scrape dasher.

Homemade ice cream is best when eaten right after hardening. If you wish to store it, transfer it to a plastic freezer container after the ice cream has hardened for 3 hours. Ice cream is a suitable and welcome dessert any time of the year. People who make homemade ice cream have the most popular backyards in the neighborhood.

Say cheese please
Unit 3

The use of cheese was pictured on stone tablets in 4,000 B.C. Legend says the first cheese was made accidentally by a shepherd who carried milk in a pouch made from a sheep's stomach. The rennet in the pouch's lining, in combination with the sun's heat, caused the milk to separate into curds (solid portion) and whey (liquid portion).

From Asia to Europe, and then to the United States, the cheesemaker's art was practiced and constantly improved.

Cheesemaking evolved from a farm activity to a business when the first cheese factory was built near Rome, N.Y., in 1851.

Many cheeses are named after the places where they were first made: like Cheddar, England; Muenster, Germany; Swiss, and, of course, American cheese. Today, every foreign variety of cheese is made in the United States; American cheesemakers are among the best in the world. Approximately one-fifth of the milk produced in the United States is used for making cheese.

Cheesemaking process

Making natural cheese is an art. Cheese is made by removing most of the solids from milk by coagulating the milk with rennet, a bacterial culture, or both, and then separating the curd from the whey by heating, draining, and pressing. Most cheeses in this country are made from whole milk. Both milk and cream are used for some cheeses. For other types, skim milk, whey, and mixtures of these are used.

The distinctive flavor, body, and texture of cheeses are determined by: the kind of milk used; the methods used for coagulating the milk and cutting, cooking, and forming the curd; the type of culture used; the salting method; and ripening conditions.

After cheese has been formed into its characteristic shape, it is coated with wax or wrapped and aged. Cheese may be classified as: very hard; hard; semisoft; or soft.

Cheese adds a special plus for snacks and desserts.

Nutritional value of cheese

Cheese, in its concentrated form, contains many of milk's nutrients—especially the complete protein casein, calcium, phosphorous, and vitamin A. It is one of nature's most versatile foods and is both nutritious and readily digested.

One pound of Cheddar cheese requires approximately 10 pounds (almost 5 quarts) of milk.

Nearly one-half the total solids of whole milk and approximately four-fifths of the milk's original protein remain in the cheese curd.

The butterfat content of cheese is about 20-30 percent of its total weight.

One and one-half ounces of Cheddar contains about the same amount of calcium as 1 cup of whole, skim, or buttermilk, or 1½ cups of ice cream.

Three ounces of Cheddar have about the same protein as 3 large eggs, 3 ounces of cooked chicken, or a beef pot roast.

In a well-balanced diet, cheese is almost completely digested and doesn't interfere with bodily functions.

Things to do:

1. Learn to identify and sample these cheeses: Blue, Brick, Camembert, Cheddar, Colby, Cottage, Cream, Edam, Gorgonzola, Gouda, Limburger, Monterey, Mozzarella, Muenster, Provolone, Ricotta, and Swiss.
2. Develop a cheese commercial.
3. Visit a cheese plant.
4. Visit a specialty cheese mart.
5. Give a demonstration on serving cheeses.
6. Discuss refrigeration and storage of cheese.
7. Make cottage cheese.

Cottage cheese

Ingredients	Equipment
5⅓ cups dry milk	2-gallon container
1 cup buttermilk or	Collander or cloth
2 junket tablets	Knife
	1-gallon container
	1 measuring cup

Reconstitute 1 gallon of dry milk in a 2-gallon container. Follow package directions.

Add 1 cup buttermilk or two junket tablets dissolved in ½ cup water.

Place the container in a warm place until the milk coagulates. The container may be placed in hot water to hasten coagulation. Quick setting makes a sweeter cottage cheese.

Cut through coagulated milk in a crisscross manner with a knife. The size of the crisscross determines the size of the curds.

Pour about 1 gallon of boiling water over the mixture.

Let stand for about 1 minute.

Test the curd by spooning up a small amount and squeezing with fingers. If curd holds imprint of fingers, it has heated sufficiently.

Pour cold water through curds to wash out all whey. This improves the flavor and keeps the quality.

Drain well.

Season to taste with salt and cream if desired.

Yield: One pound cottage cheese from 1 gallon milk.

Sources: Tennessee Cooperative Extension Service; American Dairy Association.

Let's make butter
Unit 4

When one thinks of butter as a dairy product, some questions come to mind—

"How does yellow butter come from white milk?"

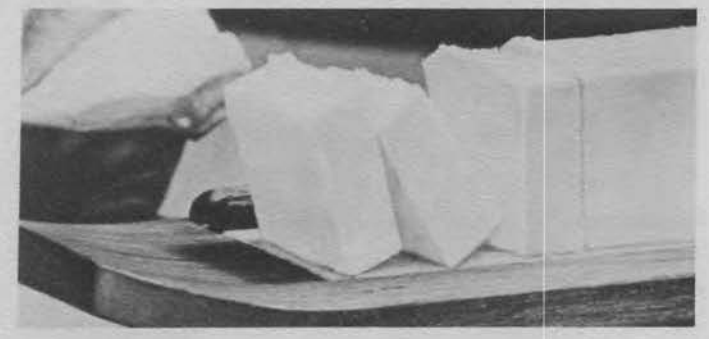
"Why do you cut butter, but pour milk?"

Butter has been used since Biblical days—in fact, butter is mentioned seven times in the Old Testament. It takes 21.1 pounds of milk to make 1 pound of butter. Butter contains the natural fat of milk and is made by putting milk through a separator and churning the cream until the butter particles cling together. The liquid formed in this process is buttermilk.

Butter contains much energy. One teaspoon of butter yields 33 calories. It is also rich in vitamin A. Creamery butter is made from pasteurized sweet cream. This butter is packaged by machine in special materials which protect its delicate flavor. Then it is always kept under continuous refrigeration.

Butter has long been subject to quality standards. In fact, a royal French edict of 1481 stated that "anyone who sells butter that contains stones or other things to add to the weight will be put into our pillory; then the butter will be placed on his head until entirely melted by the sun. Dogs may lick him and people offend him with whatever defamatory epithets they please without offense to God or king."

For cooking, baking, and spreading, butter has all the extras.



Let's make butter

Materials needed

1. A rotary egg beater in a fitted bowl, or a small churn (pint jars with tightly fitted screw caps may be used instead.)
2. Small mixing bowl
3. Wooden spoon or paddle
4. Measuring cup and set of measuring spoons
5. Knife
6. Toothpicks for tasting butter
7. Small paper cups for tasting buttermilk
8. Salt
9. Whipping cream (minimum butterfat 30 percent; ½ pint of cream makes ⅓ cup of butter)

Note: the butter forms more quickly and the buttermilk has a tangy taste if ripened cream from a dairy is used.

Directions

1. Keep cream cold. Take it from the refrigerator about 10 minutes before churning so it is at room temperature.
2. Pour the cream into your container. Your bowl, churn, or jar should be ½ full of cream.
3. Beat, churn, or shake it until small lumps of butter form throughout the cream (20 to 30 minutes).
4. Pour off the buttermilk.
5. Put the butter in a bowl.
6. Work remaining buttermilk out of butter with a wooden spoon or paddle.
7. Wash the butter several times with cold water.
8. Add ¼ teaspoon of salt for every cup of cream used (taste the butter before and after salting).
9. Work the salt in.
10. Sample the buttermilk and butter.

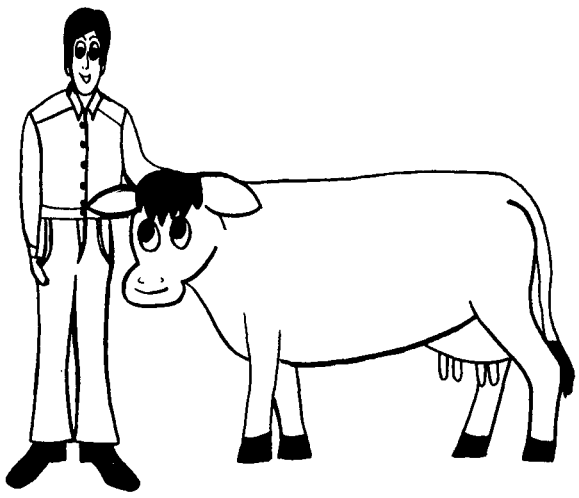
Things to do:

1. Make butter using the three different methods (bowl and beater, churn, and jar).

   Which method is quickest?
   Is there any difference in taste?

2. Visit a creamery to see modern buttermaking methods.
3. Obtain a glass jar of whole milk (not homogenized). This will answer the question: "How do we get yellow butter from white milk?"
4. Learn this song—

   Oh a-churning we will go
   A-churning we will go
   We'll take the cream
   And shake it so
   And get the butter, Oh!
   (Tune, "A Hunting We Will Go")
   Maurice Sutton



Man and the dairy cow
Unit 5

Man has always lived with animals, and animals have been an important part of his life. Our earliest history books are the drawings prehistoric men left on the walls of their caves. Most of these pictures were of animals.

Animals held the key to early man's life—and to his death. He relied on animals to provide his food and clothing. And he had to protect himself from animals that were dangerous.

For many years, man went hunting when he was hungry or cold. As time went on, he learned there was an easier way to get his food and clothing from animals. He found that certain animals could be tamed and trained.

Animals that have been tamed to live with man and to help man are called *domestic animals.* Today there are many domestic animals—man could not get along without them.

Dogs and cats give us company and protection. Cattle, hogs, sheep, and chickens give us milk, meat, leather, wool, and eggs. Horses are used for work and pleasure.

Here is a list of 11 domestic animals. Can you tell how each animal helps man?

1. Horse _____
2. Dog _____
3. Cat _____
4. Sheep _____
5. Pig _____
6. Rabbit _____
7. Duck _____
8. Beef cattle _____
9. Turkey _____
10. Dairy cow _____
11. Goat _____

One of the most amazing of all the domestic animals is the dairy cow. Thousands of years ago, man began to specialize the cow. He discovered that cows' milk was good to drink. He kept the cows that gave the most milk and raised their calves. Cows that did not give much milk were used to plow the fields or for meat. This is called *selection.* Through selection, the cow has become a very specialized milk-producing machine. Today's cow can easily give 16 quarts of milk each day. The world record cow produced over 25,000 quarts of milk in one year!

How many quarts of milk do you drink each year? _____
If an average cow gives 16 quarts of milk each day, figure out how many cows it would take to give enough milk for your class at school. _____

Milk is used in many ways to make other dairy foods. Here is a list of dairy foods you may use in your home or that you may have tasted.

	We use it at home	I have tasted it
Milk (whole)	_____	_____
Milk (2%)	_____	_____
Milk (skim)	_____	_____
Milk (chocolate)	_____	_____
Cream or "half and half"	_____	_____
Butter	_____	_____
American cheese	_____	_____

	We use it at home	I have tasted it
Evaporated or condensed milk	_____	_____
Ice cream	_____	_____
Yogurt	_____	_____
Cottage cheese	_____	_____
Dry milk	_____	_____
Other kinds of cheese	_____	_____
Sour cream	_____	_____
Buttermilk	_____	_____

As you can see, man has invented many uses for milk. Milk tastes good, and it is very good for you. All of us need milk because it contains many *nutrients* that keep us healthy. A nutrient is a food or part of a food that can be used by our bodies.

One of the most important nutrients we get from milk is *protein*. You need protein to live and to grow. Four glasses of milk each day provide about half of the protein you need. You get the rest of your protein from meat, bread, eggs, and other dairy foods.

Milk also contains almost all the *calcium* you need. Calcium is a mineral your body needs to build bones. It's also needed in all your other body tissues. *Phosphorus* is another mineral milk provides in large quantities. It is used with the calcium to build and maintain bones. Many other minerals are also present in milk, but in smaller amounts.

Many *vitamins* you need are in milk. Vitamins are nutrients that you need so your body can use the food you eat. Milk is especially rich in the vitamin called *riboflavin*. If you buy your milk at the store, it also contains plenty of *vitamin A* and *vitamin D*. Most people are not out in the sunshine long enough to get the vitamin D they need. A quart of vitamin D milk provides enough of this vitamin to work with milk's calcium and phosphorus to build strong bones. To be sure you get enough vitamin D from your milk, extra vitamin D is added at the milk plant.

Fat and sugar provide the energy in milk and the flavor that makes it taste so good. *Milk fat* has lots of vitamin A and is easy to digest. *Milk sugar* is called *lactose*. Lactose is found only in milk. It is not as sweet as table sugar.

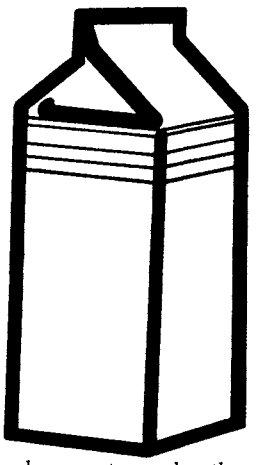
Milk's energy is measured in calories. A glass of whole milk contains about 160 calories. A glass of skim milk—having much of the milk fat removed—has about 90 calories. A teenage girl uses up about 2,500 calories, and an active boy needs about 3,000 calories.

The *solid* part of the milk includes the milk sugar, the milk fat, the protein, the minerals, and the vitamins. As it comes from the cow, milk is about 13 percent solids and 87 percent water. The chart illustrates the average makeup of milk.

Composition of whole milk

1% minerals & vitamins
4.9% lactose
3.5% protein
3.5% fat

87% water



Milk solids can be separated in several ways to make the many different kinds of dairy foods. It takes about 7 quarts of whole milk to make a gallon of ice cream and about 11 quarts of whole milk to make a pound of butter.

More things to do:

1. Learn the number of calories you eat each day for a week. You will need a "calorie counter" to help you. Your mother or a 4-H leader may have one. Figure what percentage of the calories came from dairy products.

	Day						
	1	2	3	4	5	6	7
Total calories eaten (A)							
Calories from dairy foods (B)							
Percentage of calories from dairy (B/A x 100)							

Average calories per day (total ÷ 7) _____ (C)

Average calories per day from dairy foods (total ÷ 7) _____ (D)

Average percentage of calories from dairy foods (D/C x 100)

2. Make a list of foods you can eat that contain dairy products like milk, cream, cottage cheese, cheese, or butter. Can you list 10?

1. Pizza (with lots of gooey cheese)
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

3. What are some of the products that might be made from the hide, bones, hooves, and other remains of a slaughtered cow? Can you list 10?

   1. Soap (for a clean start)
   2. _____
   3. _____
   4. _____
   5. _____
   6. _____
   7. _____
   8. _____
   9. _____
   10. _____

4. Can you think of some problems that man has to live with because he has domesticated animals?

   A. Find some of the diseases which man can catch from his domestic animals. List five.

      1. _____
      2. _____
      3. _____
      4. _____
      5. _____

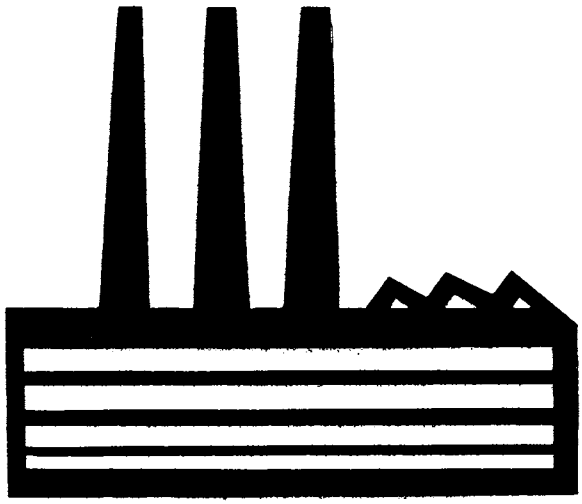
      Do any of these come from dairy cattle? _____

   B. How do we solve the problems of the waste materials we get from all animals?

      1. Pets _____
      _____
      _____
      _____
      _____

      2. Chickens _____
      _____
      _____
      _____
      _____

      3. Dairy cattle _____
      _____
      _____
      _____
      _____



All about the dairy industry
Unit 6

Milk is one of the oldest foods known to man. Historians tell us there are records of cows being milked in 9000 B.C. That is nearly 11,000 years ago!

Perhaps you have noticed that the Bible mentions milk in many places. One you may remember is in Exodus 3:8, where the "land of milk and honey" is described. Hippocrates, a famous doctor 500 years before Christ, had his patients take milk as a medicine.

The first dairy cattle to come to the Americas traveled with Christopher Columbus on his second voyage in 1493. He brought cattle and other farm animals to the West Indies to provide milk and meat for the settlers.

In 1611, cows arrived at the Jamestown colony. Among the first laws written by Lord Delaware, governor of the Virginia Colony, protected the cows.

Pilgrims landed at Plymouth Rock in 1620. However, they did not bring cows until 1624. The lack of milk in the colony probably added to the high death rate, especially among the children. Today, in Boston, Mass., there is a large park called "The Commons." It was once a community pasture where cows from throughout the settlement were brought to graze. This "pasture" is kept to memorialize the cows that arrived in 1624—bringing new hope to the hungry colonists.

From their earliest beginnings in America, dairy cattle have spread throughout the land. When the West was settled, the family cow was tied behind the covered wagon. She followed settlers throughout the United States—providing milk and butter all along the way. Today, cows are found in every state in America—including Alaska and Hawaii.

The United States has more dairy cattle than any other country in the world. Cows in the United States produce twice as much total milk as the next leading country. While all states produce a great deal of milk, the largest numbers of cows are found in the upper midwest—especially Wisconsin, Minnesota, and Iowa. Many cows are also found

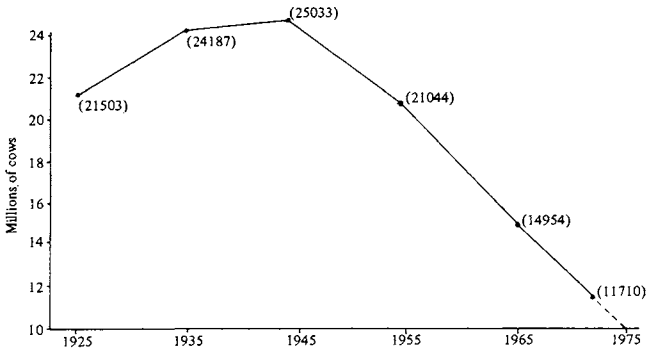
in New York, Pennsylvania, and the New England states. Another area with a heavy concentration of dairy cows is the mideast; Ohio, Michigan, and Kentucky are the leading dairy states in the mideast. California and Texas also have large numbers of dairy cattle.

The dairy cow grew in her importance and in numbers in the United States. The early 1900's were boom years for dairy cattle. By 1935, there were more than 24 million cows in this country. That year, these cows produced 47 billion quarts of milk.

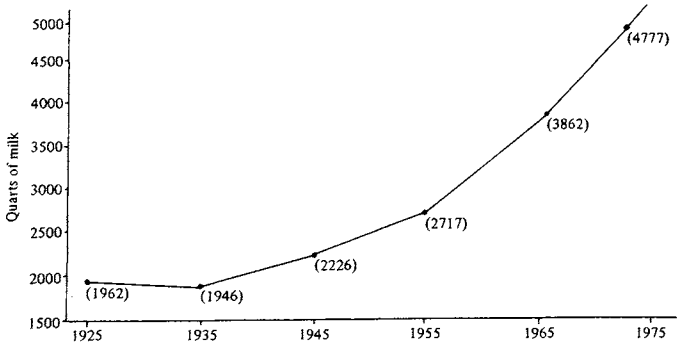
After World War II, people began to move from the nation's farms to the cities. With this came a rapid decrease in the number of cows. From 1945 to 1965, the number of cows in the United States dropped from 25 million to 15 million. Today, all the milk produced in the United States comes from less than 10 million cows.

With the help of agricultural scientists, however, total milk production remains about the same. Nutritionists, geneticists, agronomists, agricultural engineers, bacteriologists, physiologists, biochemists, veterinarians, and other scientists have all done their part to make today's dairy cow the most efficient of all farm animals. For example, scientists have discovered how cows can satisfy their own protein requirements through consumption of urea—an oil byproduct. Milk production per cow in the United States is 220 percent of what it was in 1945!

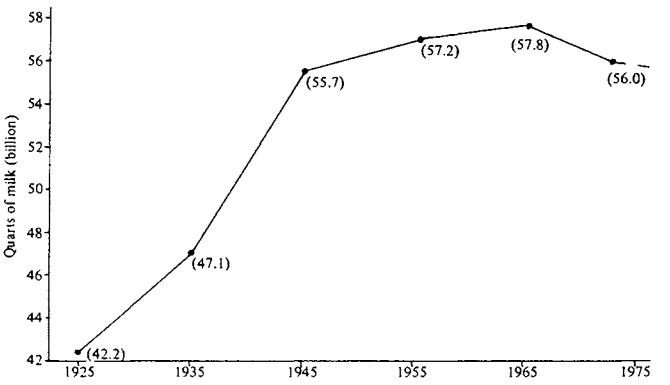
Number of cows in the United States



Yearly production per cow (quarts of milk)



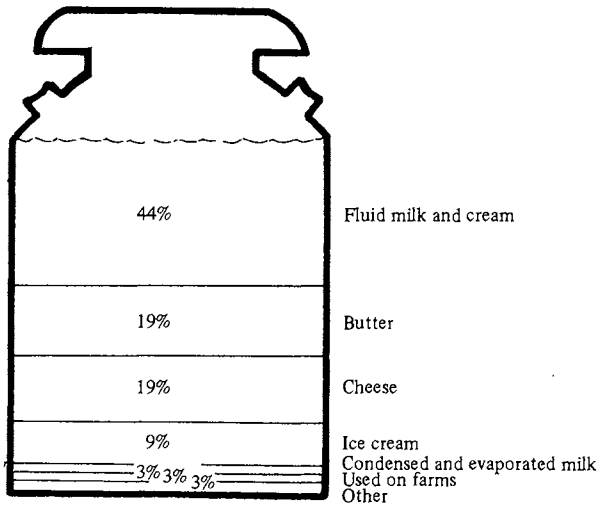
Total yearly U.S. milk production (quarts)



The milk that farmers sell each year is worth about 7 billion dollars. This money is a little more than 13 percent of the total income from all kinds of farms in the United States.

This milk is used mostly as fluid milk or cream. Each year, however, more milk goes into making cheese. The table below shows how milk is used.

How milk is used in the United States



As milk is changed to other dairy foods, its value increases. It takes people, expensive machines, and costly time to turn milk into ice cream, butter, and cheese.

Things to do:

1. Find out all you can about the dairy industry in your state or county. Your 4-H leader or county extension agent can help you answer some of these questions.

	1960	Now
1. Number of cows	_____	_____
2. Number of dairy farms	_____	_____
3. Production per cow	_____	_____
4. Number of milk plants	_____	_____
5. Number of cows on an average farm	_____	_____

Write a short paragraph explaining the changes.

_____

_____

_____

_____

_____

_____

_____

_____

2. Visit a milk plant. Write a story of what happens to milk before it goes into the carton.

_____

_____

_____

_____

_____

_____

_____

3. Look up the name Louis Pasteur in an encyclopedia. Write a short story about what this man did for the dairy industry.

_____

_____

_____

_____

_____

_____

_____

_____

How milk is processed
Unit 7

Milk on the farm is kept cool in large, refrigerated tanks. Every other day it is taken by refrigerated tank trucks to a milk plant.

A modern milk plant is filled with shiny stainless steel, glass, and tile. Automatic equipment does almost everything from the time the milk arrives until it is made into a product ready for your table. All the machines, tanks, and pipelines the milk passes through are kept extremely clean. All the equipment is washed, rinsed, and sterilized each day to protect the milk you drink.

The law requires that all milk be *pasteurized.* Pasteurizing the milk kills any harmful bacteria that may be present. However, it doesn't change the flavor or the food value of the milk. Milk is pasteurized by heating it in a large machine. In most plants, the milk is heated to 161° F. for 15 seconds and immediately cooled to about 35°.

Your milk is probably *homogenized.* In the homogenizing machine, warm milk is forced through small openings. They are so small that the milk fat is broken into very tiny pieces. These small milk particles stay suspended throughout the milk. If milk is not homogenized, the milk fat will rise to the top as cream.

At a milk plant, you also can see a machine that adds vitamin D to the milk. A concentrated form of this vitamin is added to the milk to give you enough of the sunshine vitamin to meet your bodily needs.

If you like chocolate milk, you can almost guess how it is made. A chocolate powder or syrup is added to whole milk. Chocolate dairy *drink* is usually the name given to the product when most of the fat has been removed from the milk. Check the dairy case to see which your grocer has for sale. Which should cost more? _____ Why?____

_____

_____

There are many kinds of cheese. They are usually produced in special cheese plants. These plants usually produce only one or two kinds of cheese since each kind is made a little bit differently. To make cheese, the milk is first heated. Then a *curd* is made by adding some helpful bacteria and *rennet*. The rennet contains an *enzyme* which helps coagulate the curd. Rennet is a material contained in the lining of the stomach. In fact when you drink milk, your stomach makes curd much as cheesemakers do.

Next, the curd is allowed to set and the *whey* is drained off for further processing. As the curd cures and ages, the bacteria develop the flavor that makes your favorite kind of cheese taste so good. What nursery rhyme tells about "curds and whey?" _____

Ice cream making is another interesting process. A *mix* is created from pasteurized milk and cream and flavoring. The mix is a liquid from which the ice cream will be made. Fruit, nuts, or other things you like can be added. If the mix were only frozen, it would be a hard, icy material. To give ice cream its smooth texture, exactly the right amount of air must be whipped into the mix during freezing.

Butter is made by churning or whipping pasteurized cream. The churning process "sticks" the fat particles of the milk together. Some of the other milk solids also cling to the fat. The butter is worked and washed. Salt is usually added to improve the flavor. The liquid part remaining after butter is made is called *buttermilk*. Many people like the flavor and taste of buttermilk. Have you ever tasted buttermilk? _____ Can you describe its taste? _____

_____

_____

How would you describe its texture and appearance?

_____

_____

More things to do:

1. Visit a dairy plant or a cheese factory. Write a short story about what you thought was the most interesting.

_____

_____

_____

_____

_____

_____

_____

_____

_____

2. Hold a club meeting to taste dairy foods that the members have never tried before. What did you like best?

_____

Can you explain how it is made?

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

3. Visit a dairy store. Make a list of the dairy products in the dairy case. Find out from the manager which products are most popular and which are least popular.

Most popular dairy foods Least popular dairy foods

_____

_____

_____

_____

_____

_____

_____

4. Have everyone in your club make a poster for JUNE DAIRY MONTH. Each member might want to make his poster tell about a different dairy product. Try writing some catchy dairy slogans about each product.

yogurt "Yogurt is yummy—and good for your tummy!"

butter _____

milk _____

cheese _____

buttermilk _____

ice cream _____

See if some of the stores in your town would like to put the posters in their windows during June.

Dipping the calf's navel at birth with iodine prevents infection.

Keeping your calf healthy Unit 1

You must feed your calf correctly. However, it is equally important to provide suitable housing and to give your calf proper care. Below is a step-by-step outline of what is necessary to house and care for your calf. Your goal is to raise a healthy calf that develops and grows normally. You will need some help. Ask your dad, project leader, or other adults to assist you.

When the calf is born

Step 1. When the calf is born, see that it is breathing normally. Remove any mucous from its mouth.

Step 2. If the cow does not lick the calf dry, you should dry the calf with a burlap bag or other cloth as soon as possible. This stimulates the calf and gets it breathing normally. It also helps prevent early chilling in cool weather.

Step 3. Paint the navel cord with iodine. Repeat again the next day. This helps prevent "navel ill" and other infections.

Step 4. Within 15 minutes or so after the calf is born, be sure the calf nurses the dam or is fed its mother's colostrum. The mother's first milk (called the true colostrum) is important in keeping the calf healthy. (See Nutrition, Unit 2). However, be sure the mother's teats are clean.

Step 5. Separate the calf from her mother after the first day. You will enjoy feeding the calf. More important, you will learn how much milk the calf drinks.

Housing the calf

Step 1. Don't let the calf barn be too warm. Try to keep the temperature below 60°F. Also, fresh air is needed. However, don't allow any big blasts of wintry air to blow on the calf.

Step 2. Put the calf in an individual pen that is well-bedded with clean straw. A pen about 4 x 6 feet is about right. The walls may be either solid or wire mesh. Since most calfhood diseases are airborne, the type of pen wall has little effect in controlling spread of disease.

If the young calf is penned in an elevated tie stall, use 2 to 3 inches of bedding to prevent drafts from below. These stalls should be at least 2 feet wide and 4 feet long. This type of stall is more common in an environmentally controlled calf barn.

Managing the calf

Step 1. Identify the calf. When you have only one calf, you will remember how she looks. But will you recognize 30, 40, or 50 calves? Identification can be accomplished several ways. These include:

A. Permanent methods
   1. photos or color sketches of each side of the animal (Ayrshire, Guernsey, and Holstein)
   2. tattoos (Brown Swiss, Jerseys, and Milking Shorthorn)
   3. freeze brands

B. Supplemental methods
   1. eartags used by A.I. technicians, DHI supervisors, and the State Livestock Sanitary Board
   2. neck chains
   3. ankle straps
   4. brisket tags

Step 2. Make a permanent written record. Plan a system, and use your plan. Be sure the record includes the following:

A. Permanent identification number
B. Supplemental identification number (if there is one)
C. The calf's name
D. Birth date
E. Sire's name and number
F. Dam's name and number

Other data you may want to include on your written record include:

G. Weight (pounds) and/or chest circumference (inches) at birth, at weekly intervals until weaning, at 3 months, 6 months, etc.
H. Daily rectal temperature (degrees F.) until the calf is weaned
I. Daily water intake until the calf is weaned
J. Date dehorned, extra teats removed, etc.
K. Date of vaccination for brucellosis, IBR, PI_3, Leptospirosis, etc.
L. Date of observed heat periods
M. Date of breeding and sire used
N. Date of pregnancy test and results
O. Place for veterinarian records concerning reproductive disorders and other health conditions.

Step 3. Teach your calf to drink. Either a nipple pail or an open bucket are suitable for feeding milk or milk replacer. The top of the feeding bucket or the nipple should be about 20 inches above the bedding.

To teach your calf to drink from an open pail, place your fingers in its mouth. When it starts to nurse, lower its head into the pail of warm milk or milk replacer. You may need to repeat this process several times. You may need to restrict a stubborn calf by backing it into a corner and placing its neck between your legs.

Step 4. The pail must be cleaned thoroughly after each feeding. Dried milk is a good place for bacteria to grow, and this bacteria may cause your calf to get sick. First rinse the bucket in warm water, then wash in hot water with a good cleaning agent. After this, rinse with cool water containing a sanitizing agent. If your calves are to be fed at once, a separate pail for each calf is recommended. This helps reduce the chance of spreading disease. Individual pens for each calf help prevent calves from sucking one another.

Step 5. Keep fresh water by the calf. If a bucket is used, change water at least once each day. The tops of both the water bucket and the dry feed trough should be about 20 inches above the floor. In cold housing, your calf should receive fresh water at least twice a day.

Step 6. Dehorn your calf. Get the help and advice of an adult. This job is most easily performed when the horn buttons form at about 2 weeks of age. The most humane method is the use of a dehorning iron. First, clip the hair with a pair of scissors. Be sure the iron surface is a cherry red color before touching it to the calf's head. Apply the red-hot iron over each horn button for 10 to 15 seconds; then remove it. Make sure there is a continuous copper-colored ring around each horn. If a spot is missed, make a second application.

Another method is use of a dehorning paste. Follow directions carefully when using a caustic paste. The hair needs to be clipped from each horn button. The dehorning paste is then rubbed vigorously over the horn buttons until the skin is soft. To avoid damage to the calf's eyes, place a ring of vaseline around the base of each horn before applying the caustic. This prevents the caustic from running down the calf's eyes.

Electric dehorning is a quick, safe method of removing the horn buttons on baby calves.

Step 7. Remove extra teats. Extra teats can be removed as soon as you can determine which are the extra ones. If in doubt, *wait*. Extra teats can be snipped off with a *sharp* scissors.

Step 8. Control flies and insects. The best fly control is good management, thereby preventing breeding sources. Screened buildings increase the effectiveness of wall residuals, baits, and space sprays. Carefully read the directions for chemicals. Certain chemicals must not be used on calves less than 3 months of age. Also, obtain your state's latest recommendations on pesticides. These recommendations are available from your county extension agent.

Step 9. Vaccinate for brucellosis (Bangs disease). Heifers need to be vaccinated between 3 and 6 months of age. Vaccination often produces a fever and upsets the calf for a few days. Have your veterinarian vaccinate your calf when it is healthy and not under stress.

Step 10. Trim hoofs. Your calf's feet may need trimming before you turn it out on pasture, especially if the calf has been kept on bedding or small stalls. The bottom of the feet may need to be shaped, and the long toes should be cut back. Long, sled runner toes force an animal to walk on its heels. Have an adult help you do this job.

Disease control and prevention

Step 1. Control simple calf scours. This type of scours is from overfeeding milk or milk replacer, feeding from dirty pails, allowing the calf to drink too fast, or keeping the calf in cold, damp, and drafty quarters.

The symptoms are loose bowel movement and an unthrifty appearance. Control the problem by recognizing its source and eliminating it. It may be desirable to reduce the amount of milk or milk replacer fed by one-half. After the scouring has disappeared, gradually increase the amount. It is difficult to determine whether a calf has simple calf scours or infectious diarrhea. Calves with infectious diarrhea (white scours) have an abnormal scouring, loss of appetite, and a fever. Some calves die. Your veterinarian can prescribe treatment and work out a program for preventing a reoccurrence of scours. Call your veterinarian any time the calf's temperature exceeds 103°F.

Step 2. Avoid calf pneumonia. This disease is contagious (can be spread from calf to calf) and is caused by a poor environment: over-crowding; poor ventilation; and excess moisture. Calves can tolerate a cold, dry, well-ventilated pen far better than a warm, damp calf pen. To avoid pneumonia, improve the environment and work out a prevention and treatment program with your veterinarian.

NOTE: See the section entitled "Keeping Your Heifer Healthy" for a complete table of common calf and young stock infectious diseases, signs to look for, and prevention measures.

Things to do:

1. Determine the calf's weight monthly by using a tape measure to determine the chest circumference of the calf. This will give you an idea of the calf's normal growth. You can relate your calf's response to the breed average. (Tape your heifer immediately behind her front legs.)

Age in months	Holstein and Brown Swiss		Ayrshire		Guernsey		Jersey		Your Calf	
	Inches	Pounds	Inches	Pounds	Inches	Pounds	Inches	Pounds	Inches	Pounds
At birth	31	96	29½	72	29	66	24½	56	____	____
1	33½	118	32	98	31½	90	29½	72	____	____
2	37	161	35½	132	34½	122	32½	102	____	____
3	40¼	213	38¾	179	38	164	35½	138	____	____
4	43½	272	42¾	236	41¼	217	38¼	181	____	____
5	47	335	45½	291	44¼	265	41½	228	____	____
6	50	396	48¼	340	47	304	44½	277	____	____
7	52½	455	51¼	408	49¾	362	47¼	325	____	____
8	54¾	508	53	447	51¾	410	49¾	369	____	____
9	57	559	55	485	53¾	448	51¾	409	____	____
10	58¾	609	57	526	55	486	53¼	446	____	____
11	60½	658	58	563	56¾	521	55	481	____	____
12	62½	714	59	583	58¼	549	56½	520	____	____
13	63¼	740	60¾	630	59¼	587	57½	540	____	____
14	64¼	774	62	666	60½	615	58½	565	____	____
15	65¼	805	63	703	61¾	640	59	585	____	____
16	66¼	841	64	731	62½	674	59¾	611	____	____

2. Take the rectal temperature of your calf until after the calf is weaned. Record the temperature on your calf's record sheet. This will demonstrate variations, and you can relate that to any scours condition or other sickness.

Note: Be sure a long string is attached to the thermometer so that it is not lost in the rectum.

Age	Date	Time (Try to take the temperature at the same time each day.)	Temperature
1 day			
2 days			
3 days			
4 days			
5 days			
1 week			
2 weeks			
3 weeks			
4 weeks			
2 months			
3 months			
4 months			
5 months			
6 months			
1 year			

Note: Before the calf is 3 weeks old, determine the rectal temperature several times each day to determine normal variation.

	Time	temperature	Time	temperature
Date				
Age in days				

3. Measure and record daily water intake. Depending on the amount of milk or milk replacer fed, your calf will not consume much water until he begins eating dry starter feed (unless the calf barn environment is too warm—above 70°F.). A calf that is going to be sick will frequently increase its water consumption. Knowing how much water the calf is drinking each day helps you anticipate sickness.

Note: If you don't have a scale, add water a pint at a time and mark on the bucket the level of each pint added. One pint holds about 1 pound of water.

Thrifty, fast-growing dairy heifers should be your goal.

Keeping your heifer healthy Unit 2

This section deals with older calves and yearling heifers —up to the time of freshening. You may have purchased a calf already weaned from milk or milk replacer, or perhaps you have graduated from the previous project outline entitled KEEPING YOUR CALF HEALTHY. Now you have a heifer more than 3 months of age. What are her housing and management needs? Here is a step-by-step listing of items to consider:

Housing and facilities

Step 1. Group the weaned calves. Group the calves about 1 week after they are weaned. This allows for more efficient feeding and care. Keep each group at about the same age. Do not put a young calf into a group of mostly yearling heifers. The young calf may not get enough to eat because of competition.

Step 2. Provide adequate housing. Sheds should only open downwind (south or east). Allow 20 to 30 square feet per head for calves under 600 pounds and 30 to 40 square feet per head for larger heifers.

Step 3. Provide bedding to keep heifers dry, comfortable, and healthy. Recommended materials include: straw; corn cobs; sawdust; chopped corn stalks; and shavings. Use the lowest cost bedding. Ask a dairyman or feed dealer what is available and the cost.

Step 4. Use free stalls to save bedding. These are suggested sizes.

Age (months)	Size (in feet)
2- 4	2′ x 4′
4- 8	2′6″ x 5′
8-14	3′ x 4′6″
14-20	3′6″ x 6′6″

Step 5. When the weather allows exercise, provide lot space. The size of the lot varies according to type:

A. Paved lots—50 to 75 square feet per head

B. Combination (paved and dirt)—75 to 100 square feet per head

C. Dirt lots—100 to 150 square feet per head

Step 6. Be sure the feed bunk and watering troughs are the right height. The top of the feed bunks should be 24 inches high for calves less than 600 pounds and 30 inches for larger heifers. Feed bunks should be 8 inches deep for grain and 8 to 12 inches deep for silage or green forage.

Step 7. Provide plenty of water. The amount a heifer drinks varies by size of the animal, the feed she eats, and the weather. This table provides a guide for Holstein heifers.

Size of calf	Age of calf	Expected daily weight gain	Daily water intake in gallons when the climatic temperature is: Below 40°	70°	90°
(lb)	(months)	(lb)	gallon		
200	3	1.65	2.0	2.9	4.8
400	7	1.65	3.7	5.3	8.7
600	11	1.65	5.0	7.3	11.9
800	15	1.65	6.3	9.2	15.0
1000	20	1.53	7.3	10.7	17.4

General management

Step 1. Train your animal to lead. Calves should be halter-broken and trained to lead soon after they are weaned. Start by tying the young calf with a rope halter to a wall or a fence. Then walk beside it, assisting the calf with a gentle push from the rear when necessary.

Step 2. Separate males (bulls) from the females (heifers) before they are 6 months of age. Some animals develop sexual maturity by 9 or 10 months of age. This prevents unwanted early breeding.

Control disease

Step 1. Prevent warts. Warts can be prevented, to some extent, by isolating animals with warts. If warts occur on your calf, clip them off or tie a sterile thread tightly around the base of the wart for a few days until the wart sloughs off. Disinfect the stump of the wart with iodine.

Step 2. Avoid lice. Lice are common wintertime pests. Get the latest recommendations from your county extension agent. Use only recommended compounds. Spray or dust the treatment thoroughly around the head, ears, and under the flank and elbows.

Step 3. Control mange (barn itch). This is caused by a parasite during the winter. Thickened rough skin that is itchy around the tail and head is a sign of mange. Treatment is similar to that for lice.

Step 4. Prevent cattle grubs (warbles). This condition results from certain flies attacking heifers on pasture. The flies deposit eggs on the lower hind legs. These eggs develop into wormlike larvae on heifers' backs during late winter. Consult your veterinarian or county extension agent for control measures.

Step 5. Treat ringworm. This fungus infection is common where heifers are kept in dark, poorly ventilated housing. Sunlight kills the organism, so ringworm normally isn't a problem in summer or in open housing, even in the winter.

Step 6. Avoid internal parasites. Poor nutrition is a common cause of internal parasites. Heifers suffering from parasites are unthrifty, poor growers, have a rough hair coat, sometimes have a swelling under the jaw, and may have diarrhea (scours). Prevention programs involve good sanitation, proper nutrition, and separation from older cows on pasture. Treatment depends on the degree of infection and kind of parasites. If you suspect internal parasites, take a tablespoonful of fresh manure from each of several heifers to your veterinarian. He will examine your samples under the microscope and prescribe treatment.

Step 7. Other health conditions. Several other health conditions may affect your heifer. Consult your local veterinarian about the prevalence of leptospirosis, vibriosis, and trichomoniasis. These reproductive diseases are much more common in some areas than in others.

Step 8. Study the two accompanying tables thoroughly. Table 1 is a complete list of diseases common to young stock. Table 2 lists symptoms and possible causes.

Table 1. Diseases

Infectious disease	Signs	Prevention
1. Scours (Salmonellosis)	Profuse slate-colored or greenish diarrhea, may become bloody. Fever, lack of appetite, rapid dehydration, death. Generally in animals under 3 months of age.	Organisms commonly carried by rodents which contaminate feed, especially milk replacer. Protect feed from contamination and keep feeding utensils clean and sanitary.
2. Enterotoxemia	Sudden death, usually in best-looking calves. Preceded by neuromuscular signs—twitching, spasms, circling, prostration, coma. More common in lambs than in calves.	Perfringens bacteria is a common intestinal inhabitant. Sudden change in diet, especially high milk intake, grain or lush pasture causes the organism to produce toxin. Don't overfeed, make feed changes gradually. In herds where disease is a problem, immunizing dam with toxoid may give offspring some immunity.
3. Bovine virus diarrhea (BVD virus)	Generally in older calves. Diarrhea, erosions inside lips and mouth, fever, lack of appetite. Early death or prolonged illness. Mortality high. Calves infected before birth may be blind or have brain lesions.	Vaccinate dam at least .30 days before breeding. The next and following calves will get antibody in colostrum.
4. Leptospirosis (lepto)	Fever, lack of appetite, anemia, bloody urine (coffee-colored), pain in kidney area, reluctance to move, jaundice. Most common in calves over 1 week old. May cause death.	Vaccinate herd annually, control rodents (carriers). It is spread in urine driplets. Isolate infected calves. Good sanitation. Vaccinate other calves if first case is diagnosed early.
5. Diphtheria	Fever, lack of appetite, cough, labored breathing due to throat swelling, necrotic areas in throat, foul-smelling breath.	Avoid coarse feed, isolate infected calves, disinfect pen thoroughly. Use separate utensils for feeding sick calves.
6. Pink-eye	Watery to pussy eye discharge, cloudy spot in center of cornea which enlarges outward. Inflamed conjunctiva. Corneal ulceration, temporary or permanent blindness.	Reduce dust and control flies. Isolate affected calves in a darkened, screened area.

Disease	Signs	Prevention
7. Navel-Ill	Local infection of the stump of the umbilical cord. Local abscess formation, extension of infection to joints causing purulent arthritis and lameness.	Sanitation, dip navel in iodine after birth.
8. Coccidiosis	Diarrhea frequently bloody, dehydration. Generally in calves at least 3 weeks of age.	Sanitation, avoid overcrowding. Segregate infected calves. Treat all calves in the group, whether showing signs or not. Rotate pastures or pens, drain wet areas.
9. Ringworm	Circular spots of raised hair becoming grayish, scaly, and gradually increasing size. Frequently on head and neck, especially around the eyes. Usually not itchy. Caution: Ringworm is transmissible to humans.	Provide more exposure to sunlight. Add supplemental vitamin A to diet at 4000 units/lb. feed. Feed sanitation. Spray animals and pens with captan solution. Ciodrin may be added for louse and mange control.
10. Blackleg	Usually in older calves on pasture. More common in beef cattle because of method of management. Sudden death. Muscles swollen, especially in rear quarters and dead tissue. Crackling feeling when skin is rubbed. Occurs on some farms more than others.	Where disease has appeared, routine vaccination is essential in following years. Spores in soil; therefore, change to different pasture may help. Avoid ground contamination when moving dead animals, and bury them deeply.

Parasitic diseases

Disease	Signs	Prevention
1. Stomach and intestinal worms.	Rough hair coat, potbellied, unthrifty appearance, mild anemia in some cases. Appetite good to poor, slow growth rate. Low parasite burden may retard growth rate without other signs.	Eggs pass out in manure and are ingested for reinfection; therefore, avoid overcrowding, don't feed hay or grain on floor or ground. Clip and rotate pastures. Practice good sanitation. Management is more effective and cheaper than drugs.
2. Lungworms	Chronic cough, slow growth rate, unthrifty.	Eggs pass out in manure and hatch in presence of moisture and warmth. Infective larvae climb most walls, grass, etc., and are licked up and swallowed for reinfection. Sanitation, ventilation to reduce moisture. Clip pastures to hasten drying and exposure to sunlight.
3. Mange	Intense itching, especially around tailhead, flanks, and rear legs. Reddening of skin, raw areas from licking or rubbing.	Spray cattle and stable routinely in fall with 0.2% Ciodrin. Use sparingly on very young calves. In case of outbreak, spray and repeat in 14 days.
4. Lice	Intense itching, especially along back and neck. Hairless patches. Less skin inflammation than with mange. Adult lice may be seen. Anemia in severe infections may lead to death.	Routine dusting with rotenone. Spray as for mange.

Deficiency diseases

Disease	Signs	Prevention
1. Rickets (Vitamin D)	Poor growth rate, lameness, bone and joint deformity.	Add vitamin D to the ration, permit exposure to sunlight.
2. Hypovitaminosis A (Vitamin A)	Retarded growth rate, increased susceptibility to diseases affecting epithelium (respiratory disease, ringworm). Blindness in extreme cases, also diarrhea and convulsions.	Add vitamin A to diet or supplement by injections. Colostrum provides adequate vitamin A.
3. White muscle disease (selenium/vitamin E)	Stiffness, reluctance to move. Sudden death following exercise. Some animals show labored breathing as in pneumonia.	Vitamin E reduces need for selenium; therefore, supplement E in diet or by injection. On soils where Se deficiency is great, Se and vitamin E can be injected into a muscle. Selenium is not approved by FDA as a feed additive.
4. Cobalt deficiency (Cobalt)	Limited to certain geographic areas. Poor growth rate, anemia.	Supplement cobalt in the diet.
5. Hypomagnesemia (Magnesium)	Only in calves over 8 weeks old on exclusive milk diet. Irritability, nervousness, and lack of appetite. Temporary blindness, circling, and convulsions.	Feed grain in addition to milk.

Table 2. Differential diagnosis

Symptom	Possibilities
Fever 103° + F.	Scours, pneumonia, navel infection, nonspecific bacterial infection, leptospirosis, parainfluenza, rednose (I.B.R.), diptheria, salmonellosis
Watery eyes	Dust or other irritation, pink-eye, I.B.R., parainfluenza
Cloudy eyes	Pink-eye, I.B.R., vitamin A deficiency, occasionally leptospirosis
Sunken eyes	Dehydration from scouring (colibaccillosis, noninfectious diarrhea, salmonellosis, coccidiosis), parasitism, B.V.D.
Nasal discharge clear to sticky	Pneumonia, rednose (I.B.R.), B.V.D.
Scouring (diarrhea)	Improper diet, overfeeding, colibaccillosis, salmonellosis, parasitism, coccidiosis, B.V.D.
Rapid breathing	Pneumonia, I.B.R., anemia, advanced pneumonia, diptheria
Coughing	Pneumonia, lungworms, I.B.R., parainfluenza
Unthrifty, potbellied	Malnutrition, chronic pneumonia, parasitism
Lameness, stiffness	Arthritis, white muscle disease, rickets
Sudden death	Scours (septicemia), white muscle disease, blackleg, enterotoxemia
Convulsions	Congenital brain defect, thiamine deficiency, enterotoxemia, lead poisoning, septicemia, chlorinated hydrocarbon toxicity, hypomagnesemia
Bloody urine	Leptospirosis, kidney infection, drinking excessive amounts of ice cold water
Ulcers or necrotic areas in mouth and throat	B.V.D., diptheria

Tables 1 and 2 were taken from Economical Rearing of Dairy Herd Replacements, Cornell University Animal Science Mimeo. Series No. 12, January 1972.

Things to do:

A. Travel with your local veterinarian to area dairy farms; visit the heifer-raising facilities; and study how each farmer raises his heifers. Write a story and summary on each far visited, comparing the differences in the growth and thriftiness of young stock and how they are managed.

B. Avoid overfeeding. Estimate your heifer's weight at monthly intervals by taking a chest measurement and determining her daily weight gain. Too many 4-H project heifers are overfat. Your heifer should gain about 1.6 to 1.7 pounds daily from 200 pounds until she weighs 1,000 pounds.

C. Record how much time and money was spent on each disease control practice needed to keep your animal healthy.

DAIRY NUTRITION

Milk or milk replacer fed in clean equipment gets your calf off to a good start.

Feeding your calf
Unit 1

New words you'll need to know

Colostrum—the milk your calf's mother first produces after your calf is born. This milk is thick, creamy, and high in feed value.

Taping your calf—estimating your calf's weight by placing a calibrated tape measure behind its front legs, pulling tight, and reading the body weight designated on the tape.

Weaning—switching your calf from milk or milk replacer to water and dry feed. This occurs at 1 to 2 months of age.

Calf starter—a dry grain mixture you begin feeding your calf after it is 1 week old. When your calf is eating 1 pound of this starter each day, you can wean it.

Linseed meal—grain containing protein and energy. Linseed meal makes your calf's hair coat slick and shiny.

Molasses—a feed which is sweet and tastes good to your calf. Molasses can be wet or dry.

Bloat—a large amount of gas trapped in your calf's stomach, and its stomach gets big. Your calf can die from bloat.

Hints to help you care for your calf

Step 1: *At birth.* Immediately after your calf is born, feed it milk from the calf's mother *(colostrum).* Feed 2-4 pounds (1 to 2 quarts) in a nipple bottle or nipple pail. Be sure the nipple is clean.

Step 2: *First days after birth.* Feed your calf colostrum for 3 days. Overfeeding can make your calf sick. Six percent of your calf's weight (100 pounds x 6 percent = 6 pounds per day) is enough. You can estimate your calf's weight by *taping* your calf (see definition above) or weighing it on a feed scale.

Step 3: *After 3 days,* you can switch your calf to whole milk from the herd or to a commercial milk replacer. Feed an amount equal to 8 percent of your calf's weight. At this time, begin offering your calf a good, tasty calf starter. Adding molasses may encourage your calf to eat this starter. A little hay can be fed, but don't feed corn silage.

Step 4: *At weaning.* Your calf will be 1 to 2 months old when it's weaned. Switch your calf from milk or milk replacer to water when it is eating 1 or more pounds of calf starter daily. Make this change slowly by gradually reducing the amount of milk. Your calf may bawl, but it is not being harmed. Keep fresh calf starter available to your calf and feed it some hay. Offer fresh feed each day; don't let feed get old and stale. Be sure fresh, clean water is available.

Step 5: *After weaning.* Continue to feed your calf grain (good calf starter) at the rate of 2-4 pounds per day. This mixture should have energy, protein, minerals, and vitamins. Ask your father, older brother or sister, dairy leader, or feed dealer to help you. Give your calf all the good quality hay or hay-silage it will eat. Keep plenty of fresh water available at all times.

Step 6: *After 4 months of age.* Your calf should be growing well and be eating plenty of hay or hay silage. You can put your calf on pasture or feed it corn silage, but then also feed it grain to keep it growing at a desirable rate. The amount and type of grain mix will depend on the forage you are feeding your calf and the calf's condition. Don't let your calf get too fat!

Step 7: *Before the county fair.* If your calf is on pasture, get her back into the barn 2-6 weeks before the fair so you can switch her to dry hay and grain. A little linseed meal will make your calf's coat slick. Add a little molasses to the drinking water. Your calf will get used to this taste, and you can add molasses to the water at the fair. Otherwise, the fair water may taste different. Be sure your calf will drink from a pail before you take the calf to the fair.

Step 8: *At the county fair.* Bring feed from home; don't switch to different feed. Dry hay will fill your calf. Feeding wet beet pulp can encourage your calf to eat additional bulky feed. If your calf will not drink the water, add some molasses to hide any different taste or flavor. Don't let your calf steal feed from neighboring animals. Different feed may cause your calf to bloat or otherwise get sick.

For more information on why you do these things, turn to section 3 (Calf feeding).

Things to do:

1. Write a story about your project calf. Discuss any problems you had and what you plan to do differently next year.
2. List all the different feeds you fed your calf. Check feed tags to be sure your list is complete.

Colostrum
Unit 2

When your calf is born, you must get it started on the right feeding program. Your calf was living inside the cow. There it was protected from disease and was nourished by its mother's blood. Now your calf must eat its own food, digest this food, and grow.

Colostrum is the milk your calf's mother produces immediately after your calf is born. This milk is yellow, thick, and has high feed value. Below is a comparison of colostrum and normal milk. You should know these nutrients (if not, go to Section 5) and why they are important.

	Colostrum	Normal milk
Total solids (percent not water)	29%	13%
Protein (makes muscle)	19%	3%
Milk fat (energy source)	6%	4%
Lactose (milk sugar)	3%	5%
Ash (minerals)	1%	0.7%

Your newborn calf must have colostrum because of the extra protein, energy, and minerals colostrum provides to get your calf off to a fast start. Colostrum also:

—has 10 to 100 times more vitamin A than normal milk;
—has 3 times more vitamin D;
—cleans out the digestive tract;
—contains antibodies.,

Antibodies are compounds in colostrum milk that protect your calf from disease. Without colostrum, your calf has little or no protection from scours, respiratory ailments, and other diseases. The antibodies are produced in the cow's blood and transferred into the milk. When your calf drinks the milk, the antibodies are absorbed into the calf's small intestine. After 24 hours, your calf cannot absorb antibodies. That's why you must feed colostrum to your calf as soon as possible after birth.

Here are questions and answers about feeding colostrum:

1. When do you feed colostrum?

The sooner the better! Within 30 minutes after your calf is born is best. Your calf will get nutrients to live plus be able to absorb antibodies.

2. How much colostrum should you feed?

This depends on the size and breed of your calf. Two to four pounds (1 to 2 quarts) is enough for the first feeding. A good rule is 6 percent of the calf's body weight (an 80 pound calf x 6 percent = 5 pounds of colostrum *per day*). *Do not overfeed your calf.* This can cause scours and stress.

3. How long should fresh colostrum be fed?

Fresh colostrum milk from the calf's mother should be fed for at least 3 days (six feedings). After 3 days, the calf can be fed milk replacer, whole milk from the herd or the calf's mother, or sour colostrum.

4. How can you feed colostrum?

There are several methods. You can let the calf nurse the cow for 1 to 2 days. This method is easy, but you have no way of knowing how much milk the calf is drinking. If the udder is not clean, the calf could be exposed to bacteria and disease. A more satisfactory method is to use a clean nipple pail or bottle. This allows you to control intake. The nipple and pail *must be kept very clean.* A different nipple or bottle for each calf is a good practice. A third method is an open bucket. A bucket is easy to clean and use and still allows you to control the amount fed. However, you'll have to make the calf drink without gulping.

5. Can colostrum be frozen?

Yes, extra colostrum can be frozen in any sturdy container that won't split or break when frozen (plastic containers may break). Frozen colostrum is a reserve in case another cow has no colostrum or will not let it down (first calf heifer), has milk fever, or if a cow dies when calving. Colostrum frozen in half-gallon milk cartons will provide the right amount for a newborn calf.

6. Should colostrum from several cows be blended together?

Mixing colostrum from different cows provides a wider range of antibodies to the calf. Even though fresh colostrum from the calf's mother is usually adequate, blending may be helpful if you are having calf disease problems.

7. Can extra colostrum be fed to older calves?

Yes, but you should dilute it in half with warm water (5 pounds of colostrum + 5 pounds of water = 10 pounds of normal whole milk). Colostrum is twice as rich as normal milk. So if you mix it with 50 percent water, older calves won't scour or go off feed as easily.

8. What is fermented or sour colostrum?

Extra colostrum can be stored in large plastic containers and allowed to ferment in the barn (room temperature). The fermenting colostrum produces acid which keeps the milk from spoiling. This colostrum should be stirred daily and can be fed diluted in half (see question 7) with water. Sour colostrum, like fresh colostrum, promotes rapid growth and good health.

Things to do:

1. Make a chart showing how much colostrum you fed your calf. Report the amount fed per feeding, per day, and how long you fed it.
2. Write a short story about how you fed your calf the first week, why, and also tell any problems.
3. Measure the amounts of colostrum produced by your calf's mother. Weigh the milk and plot the amount for 2 weeks. Also note changes in color, odor, taste, and consistency of the milk.
4. Visit three farms and report on how they feed their calves the 1st week after birth. Write a short story on each, and include any pictures. Try to see three different methods and select the one you liked best.
5. Experiment with extra colostrum by letting it sour or ferment. Keep a record of all changes in color, odor, and consistency. Write a short report on your findings.

Calf feeding Unit 3

After your calf has received colostrum, you must decide how you will feed your calf for top growth and least cost.

Whole milk or milk replacer

Whole milk is excellent feed for your calf. It contains ample protein, energy, and minerals. However with high milk prices, it may be cheaper to feed your calf milk replacer. A good milk replacer should contain: (look at the tags on some milk replacers at the feed store)

—a minimum of 22 percent crude protein or 20 percent digestible protein;
—a minimum of 95 percent Total Digestible Nutrients (TDN);
—a minimum of 10 percent fat;
—0 percent fiber.

Example of two milk replacers

FEED TAG
A (Good)

Guaranteed Analysis

Crude protein, min.	24.0 %
Crude fat, min.	20.0 %
Crude fiber, max.	.25%

Ingredients
Skim milk powder, dried whey casein, animal fat, soy lecithin

FEED TAG
B (Poor)

Guaranteed Analysis

Crude protein, min.	21.0 %
Crude fat, min.	10.0 %
Crude fiber, max.	1.00%

Ingredients
Skim milk powder, buttermilk powder, dried whey, animal fat, vegetable fat, soy flour, distillers' dried solubles, wheat flour, dried meat solubles, brewers' dried yeast

Milk replacer must be digested (broken down) by the calf. Most of the nutrients should be from milk or milk by-products. Milk replacers containing large amounts of soybean flour, cereal flour, and meat solubles can slow your calf's growth. In mixing milk replacer:

—measure the water accurately;
—sprinkle powder on top of the water;
—stir well with a wire whip (ask your mother) or stirring stick;
—keep water at body temperature or warmer (be consistent);
—mix only enough to be used at that feeding;
—follow the directions on mixing—usually an 8 to 10 percent solution (1 pound of milk replacer + 9 pounds of water = 10 pounds of whole milk or 10 percent solution).

Milk or milk replacer should be fed at the rate of 8 percent of the calf's body weight. (Example: a 100-pound calf is fed 8 pounds of milk per day.)

Once-a-day feeding

To save time and labor, calves can be fed once a day instead of at morning and night (twice a day). Calves fed this way gain as rapidly as those fed twice a day, and there are no differences in the rate of scours or other health problems. If you switch to once-a-day, follow these instructions:

—fresh water must be available at all times;
—calves must be fed regularly (same time) every day;
—colostrum must be fed the first 3 days after birth;
—a mixture of 13-15 percent milk replacer should be made (1 pound powder + 6 pounds of water).

Dry feed

The sooner your calf begins to eat calf starter and hay, the better. Several reasons for encouraging early dry feed intake are:

—less dependence on milk or a liquid ration (less scour problems and death loss);
—earlier weaning age;
—less cost (dry feed is cheaper than milk or milk replacer);
—development of rumen structure and ability to digest forage.

Calves will begin to eat grain and hay as early as 2 weeks of age. A good calf starter is palatable (tastes good), coarse (rolled or cracked rather than ground finely), and nutritious (16 percent crude protein, 72 percent TDN, and a maximum of 15 percent fiber). Molasses can be added for flavor. Whole oats increase texture and palatability. Following are calf starter rations. Commercial calf starters—already formulated and mixed—are available.

Component	Ration 1	Ration 2	Ration 3
	----------pounds----------		
Corn, coarse, ground, shelled No. 2	40	60	60
Oats, ground, crushed, or rolled	30	15	10
Wheat bran	20	15	10
Soybean meal (44 percent)	10	10	10
Dicalcium phosphate	1	1	1
Trace mineralized salt	1	1	1
Linseed meal	—	—	10
	------units per 100 lbs.------		
Vitamin A*	200,000	200,000	200,000
Vitamin D*	50,000	50,000	50,000

*Vitamins A and D need not be added to the grain mix if calves receive milk replacer which supplies 2,000 units of vitamin A and 500 units of vitamin D per day.

To prevent scouring, use a grass-alfalfa mixed hay instead of an all-alfalfa hay. Calves fed a "complete" calf starter containing fiber do not need hay. Fiber stimulates rumen development and digestion. Whether or not you feed hay depends on the type of calf starter, the available time and labor, and existing hay feeding mangers. Hay silage can be fed instead of hay, but guard against overeating. Corn silage should not be fed at a young age because of its high moisture and low protein levels.

Weaning

Weaning is switching your calf completely away from milk or milk replacer to dry feed (grain and forage) and water. The calf should be eating a *minimum of 1 to 1½ pounds* of a good quality calf starter. The calf should be 4 weeks old. Also, consider your calf's size and health. Wean your calf from milk to water gradually. Allow several days for this switch. Every extra day your calf consumes milk or milk replacer, it costs you additional money. When your calf is consuming a calf starter, wean it.

Cud inoculation

When the calf is very young, few bacteria live in the rumen (one of the four sections). As soon as fibrous feed is fed, your calf will need some bacteria in the rumen ("rumen bugs") so the fiber can be digested. If the calf is in a building with older animals, the rumen will become inoculated (bacteria transferred to the rumen) by itself. The bacteria are small enough to move in the air and on feed. If a calf is isolated, inoculate its rumen by placing a cud (chewed material) from a healthy, older animal in the calf's mouth. This can be done at 2 to 4 weeks of age.

Antibiotics

Antibiotics are not nutrients; they are feed additives. Antibiotics are chemical substances that will destroy or control disease organisms. An example is penicillin. Don't confuse these with *antibodies* which are found in colostrum milk. Antibodies provide immunity or protection while antibiotics destroy the organism that causes the disease. Antibiotics are added in small amounts to calf starters and milk replacers (2-4 pounds per ton), to increase resistance to intestinal bacteria, to lower infections, and to reduce stress. This results in increased appetite, vigor, smoothness of hair coat, and improved feed efficiency. Higher levels are needed to control a serious case of scours or pneumonia. Some veterinarians do not recommend antibiotics in feed because the disease bugs "get used to" the drug. In these cases, antibiotics given to sick animals may not destroy the diseases when control is really needed.

Urea for calves

Urea is a feed that contains nitrogen. Rumen bugs convert this nitrogen into protein. However, urea is a bitter feed containing no energy, minerals, or vitamins. If your calf does not chew its cud (ruminate), it cannot convert the urea to protein. Then, urea can actually slow your calf's growth and result in rough hair and appearance. No urea should be fed to a calf until it is consuming hay and grain.

Gains and goals

Your calf should gain 1 pound a day the 1st month. After this, 1 to 2 pounds per day should be your goal. Heifer calves should not be overly fat because fat may then be deposited in the udder and in the reproductive organs. Overfat heifers are often hard to breed. They may produce less milk because fat is in the udder instead of milk-producing tissue.

When your heifer is 3 to 4 months old, a grain ration with adequate protein is all that is needed with forage, free choice trace mineral salt, and dicalcium phosphate. The level of protein in the grain mix depends on the forage type and quality:

Forage type	Crude protein in the grain mix
Legume	8-10%
Grass	10-12%
Corn silage	12-14%

The total ration (forage and grain) should average 10 percent crude protein (in a dry basis). If you feed 2-5 pounds of grain a day together with good quality forage, your calf should meet the 1½ pound gain per day goal. As forage quality decreases or pasture areas dry up in summer, you will need to adjust grain intake accordingly.

Things to do:

1. Obtain several milk replacer tags and compare the different levels and types of ingredients. Select the one you would buy, and explain why. Does it cost more or less than the others? Explain why.
2. Compare the cost to raise a calf on whole milk vs. milk replacer at current prices.
3. Visit a commercial calf-raising operation. Write a brief story on what you saw, changes you would make, and advantages and disadvantages of different methods.
4. List the ingredients in your calf starter and grower grain rations. Calculate the percent protein, TDN, calcium, and phosphorus in both.
5. Find information on urea and summarize what it is, how it works, precautions to take, and other considerations.
6. Give a short talk at your 4-H meeting on calf feeding. Pick one area rather than discuss all aspects.
7. Study one antibiotic used in cattle feed. Try to find out how it works, its costs, needed precautions, and how it is made. Write a short report about your findings.
8. Keep an accurate and complete feed record of your calf. By weighing your calf, you can tell how fast your calf is growing and how much it costs to raise your calf at various stages. Ask your parents, brothers, sister, or other dairymen if you don't know the prices of various feeds.

If you want to keep a record on more than one project animal, make a copy of these pages on a duplicating machine or copy the parts you find most interesting.

Name of Animal _____ **Date of Birth** _____

I. FEED QUALITY, KIND, AND COSTS

A. Forages

Kind (check appropriate items below)	Quality (check) Ex	Good	Fair	Poor	Value (Feed cost values are to be used to figure total feed costs on back of page)
Hay: _____Alfalfa _____Alfalfa mixed _____Clover _____Grass _____Other_____					$_____ Per ton $_____ Per pound
Silage: _____Corn _____Legume _____Other_____					$_____ Per ton $_____ Per pound
Pasture: _____Alfalfa _____Grass _____Alfalfa-Brome _____Other_____					$_____ Per day

B. Grain and other feeds

CALF STARTER (GRAIN RATION)

Kind of feed	Pounds	Cost/100 pounds feed	Cost
Totals			

Cost per pound of ration $_____ (Total cost ÷ total pounds)

CALF GROWER (GRAIN RATION)

Kind of feed	Pounds	Cost/100 pounds feed	Cost
Totals			

Cost per pound of ration $_____ (Total cost ÷ total pounds)

Other feeds and supplements (such as whole milk, milk replacers, special calf feeds, etc.)

Kind	Value per 100 lbs.	Per lb.	Kind	Value per 100 lbs.	Per lb.

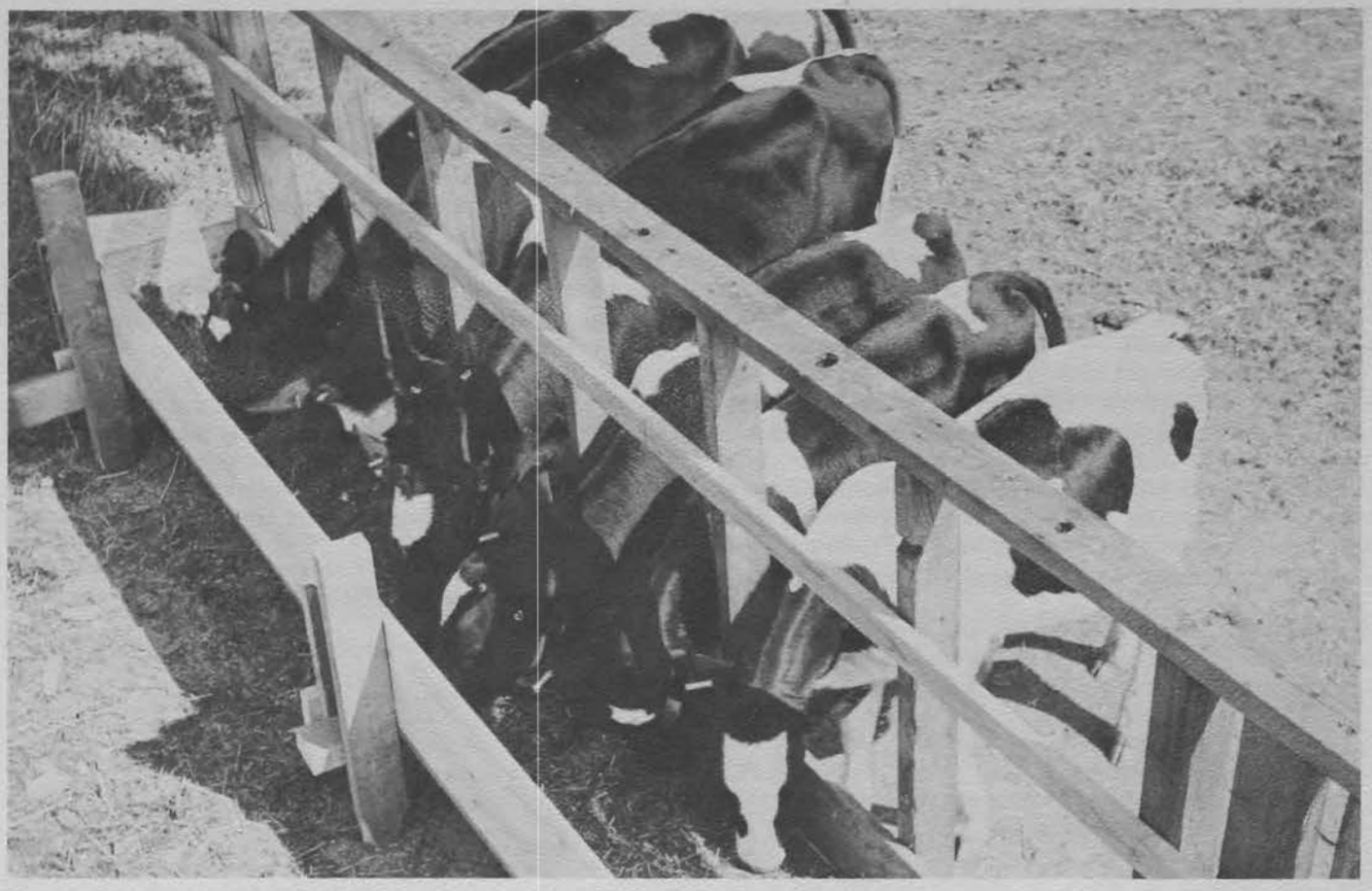
II. FEED RECORD

Month or date	Hay		Silage		Grain (growing)		Calf starter		Milk or replacer)		Other feeds	
	wt.	value	wt.	value	wt.	value	wt.	value	wt.	value	wt.	value
Totals												

Total Cost of Feeds Used in Above Table (Record Feed Costs on Lifetime Financial Summary)		
Total Days on Pasture **Estimated Cost**		
***Total Cost of Feeding Your Dairy Animal(s)**		
*IF feed record is kept for more than one animal (because they are running together or in a pen), keep records for all animals and divde the total by number of animals		

III. GROWTH RECORD

Age of animal (months)	1	3	6	9	12	15	18	21	24
Weight (pounds)									
Chest (inches)									
Avg. wt. for breed									



Plenty of good quality feed will keep your calf growing well.

Feeding your yearling heifer

Unit 4

When your heifer was a calf, you had to take very good care of her. She still must have good care; but her needs are different now.

Let's set some goals:

1. Calving at 24 months;
2. A gain of 1 to 2 pounds per day;
3. Minimum cost with no sacrifice in growth;
4. A growthy, well-developed heifer with desirable breed and dairy character;
5. Avoiding a thick, overconditioned heifer.

These goals may seem "ideal," but a well-balanced ration makes them possible. Many dairymen think heifers can go through a "rough stage" as a yearling. Since a yearling heifer is not producing milk and is not endangered by calfhood death, some dairymen feed heifers poor-quality, weather-damaged feed. However, heifers must have the right kind and amounts of feed to be top milk cows at an early age.

What's needed . . .

Table 1 tells what your heifer needs for good growth. All the nutrients must be in the feed. That's a balanced ration. Here's an example:

Table 1. Daily needs of growing heifers

Body weight lbs	Dry feed intake lbs	Total protein %	Net energy therms (M-cal)
220	6.4	12.8	3.1
440	11.7	9.4	5.9
660	16.5	8.5	8.1
880	20.5	8.6	10.0
1,100	20.9	9.8	11.0

Example: Princess weighs 660 pounds. According to table 1, Princess should eat 16.5 pounds of dry matter (DM) containing 8.5 percent total (crude) protein and 8.1 therms of net energy (N.E.). Feed intake is based on dry matter (not water) because the nutrients are in the dry matter. There is no energy in water, just weight. So to provide Princess with 16.5 pounds of dry matter as corn silage, you must feed her 49.5 pounds of corn silage. That's because corn silage is two-thirds water by weight. Direct comparisons can be made by determining feeds' dry matter basis. Let's look at table 2 for feed alternatives in 16.5 pounds of forage dry matter.

Table 2. Nutrients in 16.5 pounds of forage dry matter combinations.

	Percent total protein	M-cal of N.E.
Alfalfa (midbloom) hay	17.1	7.1
Alfalfa-brome hay	16.2	7.0
Bromegrass hay	11.8	6.8
Oat silage	9.7	7.6
Orchard grass hay	9.7	7.2
Corn silage	8.2	9.5
Corn silage and urea (8 pounds/ton)	12.6	9.5
Corn silage and alfalfa-brome (one-half each)	12.2	8.3

If Princess is fed all corn silage, she will consume more energy than she needs. However, she will be short on protein. If you feed only grass or legume hay, Princess will be short on energy. One M-cal (megacalorie) equals a therm.

Growing heifers need both *protein* and *energy*. A ration of corn silage and alfalfa-brome hay or urea-treated corn silage will meet the nutritional needs of a growing heifer. The only extra ingredients needed are salt and minerals. The quality of the various grass and legume forages listed in table 2 are above average. If your heifer receives lower quality forage, adjust these feed values down. Check a feed table or have the forage analyzed. Also, Princess will eat less low-quality roughage. If you are feeding corn silage, limit the amount to avoid an overconditioned or a fat heifer.

Pasture with caution . . .

Many heifers are on pasture all summer. Pasture usually is abundant and good quality in the spring. Pasture quality declines rapidly, in mid- and late summer, depending on rainfall, number of heifers per acre, and soil fertility. You should supplement the ration with stored forage (hay or silage) and/or grain when pastures get short and begin drying up. Just because your heifer has 20 acres to graze does not insure she will get all the nutrients she needs.

Some dairymen routinely feed 2 to 4 pounds of grain to insure that the energy and protein needs are met. However, this decision should *depend on forage quality and intake, not habit.* Grain will average 0.5 to 0.6 therms of net energy per pound. Protein content can also be adjusted. Normally, a few pounds of grain are adequate.

Pregnancy will increase your heifer's needs, especially during the last 2 to 3 months before calving. Table 1 has not considered this extra need. Two to four pounds of grain will meet this additional requirement of energy, protein, minerals, and vitamins.

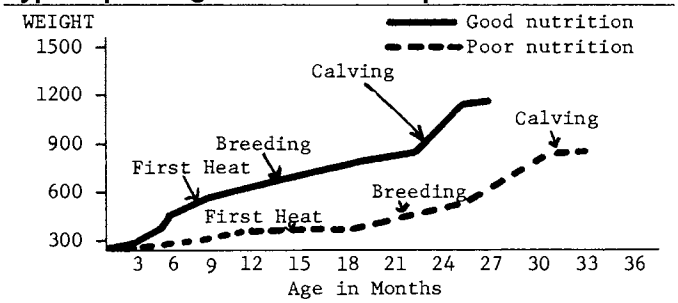
Heifers should not be overconditioned or fat. Fat deposited in the udder can result in less development of milk-secreting tissue and less milk production. She may like that "extra" grain, but it may do her more harm than good!

Include vitamins and minerals . . .

Do not overlook mineral and vitamin needs. The heifer is a growing animal forming bone, muscle, and tissue. Trace-mineral salt and a calcium-phosphorus supplement should be available free-choice. Also, 1 percent (20 pounds per ton) of each should be in the grain. The calcium-phosphorus supplement you feed will depend on the type of forage you are feeding and the price. Normally, good-quality forage is an adequate source of vitamins; however, vitamins can be lost by weather damage, heating, and storage. Adding 2 to 5 pounds of a vitamin A, D, E premix per ton of grain mixture is good insurance.

Good growth doesn't just happen. Watch your heifer closely. Plot the growth of your heifer during the year and compare it to figure 1. The weight of your animal will vary, but remember your animal should continue to grow and develop. Any time the animal stops growing, you are losing money.

Typical plot of growth and development



Weight of heifers for various breeds and ages

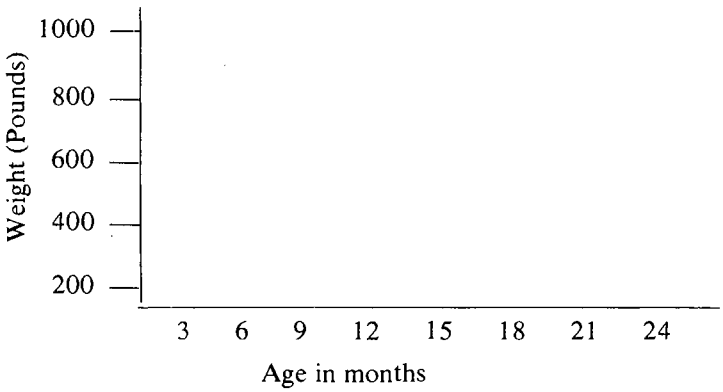
	1 year pounds	15 months (breeding time) pounds	2 years (calving) pounds
Ayrshire and Milking Shorthorn	538	638	902
Guernsey	490	584	818
Holstein and Brown Swiss	632	725	1069
Jersey	450	530	733

Nutrition can and does play a big part in the growth of your heifer. Don't overlook management, including disease prevention and control, parasites, housing, sanitation, equipment, and facilities. Many times it is lack of attention to a few small points that adds up to one big problem. Genetics enter in, too. A well-balanced ration and excellent management only can help a heifer reach her maximum genetic potential and no more.

Things to do:

1. Continue your feed record on the same form you used when your heifer was a calf.

2. Plot your heifer growth on this chart. Compare it to the growth chart in the section entitled "Keeping Your Calf Healthy."



3. Write a short story describing how your heifer grew. Include any problems you had (feeding, management, etc.) and include pictures. (Please use additional paper.)

_____

_____

_____

_____

_____

What's in feed? Unit 5

Feed makes your animal grow. But what is the difference between grass, oats, and corn?

Nutrients are chemicals in feed that the animal converts into body growth and development. The major nutrients are:

1. Carbohydrates

Carbohydrates are the major energy nutrients. There are many carbohydrates. Even the relatively simple ones are complicated chemical compounds. All carbohydrates are made up of carbon, hydrogen, and oxygen. Carbon is the key. There are thousands of possible combinations of carbon, hydrogen, and oxygen.

Sugars and starches are carbohydrates. They are relatively simple. Cellulose is one of the more complex carbohydrates that cows and sheep can use.

Sugars and starches are easy to digest. They have a high "feeding value" because very little of them pass through the body undigested. Grains such as corn and oats contain sugar and starch.

Cellulose makes up part of the fiber in plants. Grass, for example, has much cellulose. Cellulose is hard to digest. Cellulose has a low feeding value for most animals; however, cows and sheep can digest large amounts of cellulose with the aid of bacteria in the rumen.

2. Fats

Another group of energy nutrients include *fats* and *oils*. Fats and oils are chemically alike. However, fats are solid at body temperature; oils are liquid. Both are usually called *fats*.

Like carbohydrates, fats are made up of carbon, hydrogen, and oxygen. They, too, provide energy. Fats contain a higher percentage of carbon and hydrogen atoms than do carbohydrates. So the energy in fats is more concentrated. Fat has 2.25 times more energy value than carbohydrates.

Carbohydrates and fats are used for energy. They are chemically similar to fuels such as gasoline, oil, and coal. The animal "burns" the feed for energy to walk, breathe, grow, and live. At the same time, some energy is needed for body heat, especially in winter.

3. Proteins

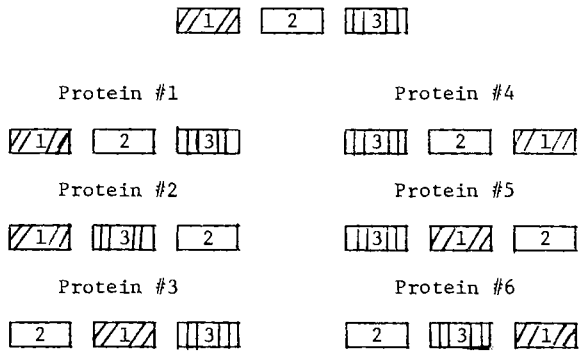
While carbohydrates and fats supply energy, *proteins* supply the material from which body tissue is made. They are the "bricks and mortar" from which bodies are built.

Proteins are highly complex. Proteins contain nitrogen in addition to carbon, hydrogen, and oxygen. Some proteins also contain sulfur. A few contain phosphorus and iron.

Like carbon, nitrogen can be combined with other chemical elements in different ways. The various combinations result in many different proteins. Each protein is made up of several nitrogen compounds called *amino acids*. These amino acids are the "building blocks" from which proteins are made. The chemical arrangement of the amino acids determines the type of the protein.

Proteins are broken down into amino acids during digestion. These are picked up from the intestine into the blood stream and carried to all parts of the animal's body. Then they are put back together to form body tissue.

Here is an example: The three amino acids (1, 2, 3) can be arranged in different orders and amounts of each to form different kinds of proteins.



Proteins can eventually become part of muscle, bone, and blood. Skin, fur, hair, wool, hooves, horns, and many other parts of the body are also made of protein. If extra protein is fed, the nitrogen part of the protein is separated in the animal's body and wasted in the urine. The animal can convert the remaining material into energy.

4. Vitamins

Animals need large amounts of both energy and proteins. Other nutrients are just as important, but they are needed in much smaller amounts. *Vitamins* are such a group.

For a long time, people noticed that certain diseases were caused by the lack of certain foods. Then modern science began analyzing the foods. These foods were found to contain small amounts of certain complex chemicals that other foods lacked.

These nutrients were called vitamins or "life amines." They are essential for living and growing.

Vitamins are not alike. Each one also has a different job. Still, they are all called vitamins. This is because they are organic (they contain carbon) and are needed in small amounts.

Vitamin A keeps eye and body cell linings healthy and working. An animal short of vitamin A has night blindness, is weak, and has a greater chance of infections, colds, and sickness. Carotene is the feed source of vitamin A. Green leafy grass and yellow corn are good sources of carotene.

Vitamin B complex is a group of vitamins that are necessary to change feed into energy. Animals low on B complex vitamins may be paralyzed, lose hair, become sick (have a poor appetite), or become run down. Cereal grains (wheat and oats, for example) and rumen bacteria are good sources of B vitamins. Dairy animals are seldom low on B vitamins because they are ruminants.

Vitamin C is normally produced by ruminant body tissue. A supply in the feed is not necessary. A shortage of vitamin C can result in loosening of teeth, brittle bones, slow growth, and a sore mouth. Green grass and orange juice are rich in vitamin C. Another name for vitamin C is ascorbic acid.

Vitamin D is needed for strong bones. Animals low in vitamin D can have weak bones, swollen joints, and stiffness. They drag their hind feet and are weak. This condition is called rickets. Green leafy suncured feed and fish oils are excellent sources of vitamin D. Your animal can make its own vitamin D if it is exposed to direct sunlight.

Vitamin E is important for muscle tone and development. A shortage of vitamin E results in weak muscles and lack of muscle control. This condition is "white muscle disease." Green leafy feed and soybean meal are good sources of vitamin E.

Vitamin K is needed to stop bleeding; it helps clot blood. Most leafy feed contains adequate amounts of vitamin K.

Vitamins A, D, E, and K are fat-soluble vitamins because they dissolve in fat solvents such as ether and chloroform. Vitamins B complex and C are water-soluble vitamins because they dissolve in water.

5. Minerals

Like vitamins, minerals are needed in small amounts. Unlike vitamins, they are inorganic (they do not contain carbon). Iron, copper, phosphorus, calcium, and magnesium are some minerals. Here are a few things minerals do:

Minerals	*Function*
Calcium and phosphorus	Help build bone
Sodium and chlorine	Helps hold water in cell tissues
Magnesium and phosphorus	Help the body use energy
Potassium	Controls heart function
Potassium and sodium	Help nerves work correctly
Sulphur, iodine, and zinc	Help body make protein
Cobalt, iron, and copper	Help make blood

6. Water as a nutrient

The last nutrient on our list is so common that we may forget it. *Water* is the largest single part of nearly all living things. The body of your animal is three-fourths water.

Water performs many tasks in the body. It makes up most of the blood which carries nutrients to the cells and carries waste products away. Water is necessary in most of the body's chemical reactions. In addition, water is the body's built-in cooling system. It regulates body heat. It acts as a lubricant.

Life on earth would be impossible without water. An animal can live longer without food than without water.

Things to do:

1. Keep track of what you eat for 1 week. Write down each different item. Now, decide what nutrients are in each food in important amounts.
2. Select one mineral and vitamin. Learn more about each and write a short summary.
3. Complete the following matching game. Draw lines to connect the answer to the word.

1. Protein	a. Carotene
2. Minerals	b. Water-soluble vitamin
3. Vitamin A	c. Bone formation
4. Calcium	d. Made up of amino acids
5. Vitamin C	e. Inorganic feed nutrients
6. Carbohydrates	f. Sugar is an example

4. Select one feed your animal eats. Learn the nutrients in that feed, the amount of each nutrient, and other interesting facts about the nutrients.

ANSWERS: 1 = d; 2 = e; 3 = a; 4 = c; 5 = b; 6 = f.

Many animals in your herd may have common ancestry.

Dairy Cattle Families—breeds Unit 1

Do you know these terms?

Registered animals are officially recorded in the breed association herd book. They have met the association's registration qualifications. Rules and procedures for registration can be obtained from the breed associations listed at the back of this section.

Purebred dairy cattle include registered animals and grade animals that have the characteristics of a breed and several generations of ancestors of the same breed.

Grade dairy cattle are not registered in any breed association herd book, but are usually purebreds that have the characteristics of a breed. Grades also include crossbred animals. Grade animals are usually ineligible for registration because their parents were not registered.

Herd book is the official record of registered animals of a breed kept by the breed association. The herd book contains each animal's registration name, number, and birth date as well as the registration name and number of its sire and dam and the name of the breeder.

Closed herd book is the policy of the breed association to restrict registration to offspring of animals already registered.

Open herd book is the policy of the breed association to permit offspring from nonregistered parents (grade purebred) to be registered.

Crossbreds have parents and/or close ancestors of different breeds.

Dairy cattle organizations

Dairy Herd Improvement Associations (DHIA) are organized in all 50 states. DHIA computerized dairy production records for cows and herds help dairymen manage their herds and select the best breeding stock.

The U.S.D.A. (United States Department of Agriculture), the State University Extension Service, and the state and local DHI associations cooperate to provide this service to dairymen.

The national sire-proving program uses DHI records from the daughters of bulls to determine these bulls' genetic transmitting ability. These sire summaries are universally used by breed associations, artificial breeding organizations, and dairymen to select the best sires for their breeding programs.

Details of the DHIA program can be obtained from your county extension agent.

The *Purebred Dairy Cattle Association* (PDCA) is sponsored by the registered dairy breed associations in the United States. It promotes interest in registered dairy cattle. It also helps establish uniform policies and procedures for official production records, the use of artificial breeding, uniform score card judging for fitting and showing contests, showing procedures, and ethics for public and private sales of registered dairy cattle. The address is: The Purebred Dairy Cattle Association, Inc., Peterborough, New Hampshire 03458.

Discovering the cow

Dairy cows did not always produce as much or look like the ones we see today. Long ago, there were cows of many shapes and sizes. Some had long shaggy hair; others were sleek and smooth. Some had humps over their shoulders; others had straight backs. There were cows of many sizes, shapes, and colors. They roamed wild. Man hunted them as they moved around searching for food.

Later, man learned that many wild animals could be kept as pets or to supply food. The animals were used for food and for clothing. Ancient drawings show that people tamed dogs, sheep, and cows. Later, they tamed cats and horses.

As time passed, people learned how good and nutritious milk was. They also discovered how to make butter and cheese from milk. People wanted to learn how to get cows to produce large amounts of milk.

These people found some cows gave more milk than others, and some milked longer than others. They discovered that cows produced more milk when they were fed good pastureland. Cows that gave the least milk were used for meat, and the best milkers were kept. This is how people began to change the cow—those that were kept had the most calves.

Many, many years passed before the present breeds of cattle appeared. Today's dairy breeds in the United States are very young compared to the cattle people kept long before the time of Christ. There have only been about 30 to 40 generations of cattle since the six dairy breeds in the United States began. Compare this to about 1,200 to 1,500 generations since the time when people told of cattle through the pictures they drew.

What is a breed?

Modern dairy breeds are like a large family. All dairy cattle within a breed have a common beginning. Animals of a breed tend to look alike. The animals within a breed include all of the grade animals that possess the characteristics of the breed, even though they are not registered in the breed's herd book. In the early stages of development, animals from the same area were used to begin the breed. This was done by one or more farmers who had similar goals or liked the same kind of animals.

The breed societies established rules and standards for registration. The rules provided farmers with specific details of breed perfection. Rules and standards were means to develop the easily recognized trademarks of breeds, such as color, size, size and shape of horns, and other features.

Each breed association in the United States has its own registration rules. Animals eligible for registration must meet the standards for color or color markings. Parents must also be registered in the breed's herd book. In recent years, some breeds (Brown Swiss, Ayrshire, Guernsey, Jersey, and Milking Shorthorn) have made allowances for a two to three generation step process for outstanding grade animals to be registered. For grade cows to be eligible, these breeds' associations have established special strict standards for production and conformation.

With widespread use of artificial breeding and production records (dairy herd improvement records), milk production of grade and registered animals is nearly equal.

The beginning of breeds

Robert Bakewell (1725 to 1795) lived in England when the 13 American colonies were fighting for independence. He pioneered the development of our modern livestock breeds through selection for utility, through progeny testing of bulls, and through inbreeding. The first to use Bakewell's ideas to develop a breed of cattle was a neighbor, Charles Collings, who started the Shorthorn breed in the early 1800's.

Before this time, laws were passed in England to require people to keep their animals fenced. These laws encouraged people to more carefully plan the matings of their cattle so offspring would be more alike and be better producers of meat or milk.

Popular modern breeds were developed from local varieties and types that established themselves among farmers. Undoubtedly, there were also from time to time crosses from cattle of traders on stock routes.

Farmers in local areas saw animals that they liked. In the case of Shorthorns, area farmers probably went to the Collings farm to buy some.

In 1822, English farmers owning Shorthorn cattle organized a breed association called the Shorthorn Society. They formed the association to keep a herd book (record of the animals' ancestry) and to promote the breeders' interests.

Circumstances usually encouraged farmers to keep and develop the same kind of cattle. For example, the Brown Swiss breed developed in the mountains of Switzerland. Cattle there were isolated from other kinds of cattle by the mountains. Farmers used their cattle as beasts of burden, to supply meat, and to produce milk. Cheese was a favorite food of the Swiss people, so the large, rugged cows that produced 4.0 percent fat milk were highly desirable.

The Jersey and Guernsey breeds were developed on islands off the coast of France in the English Channel—Jersey Island and Guernsey Island. These breeds were both developed from native French cattle. These two islands are only 20 miles apart and about 35 miles from France and 90 miles from England. The warm ocean currents made these islands ideal for producing large amounts of fresh vegetables for England. These island people were proud of their cows which were quite uniform because of the small, isolated land area where they were developed. Laws prevented other kinds of cattle from entering the islands. These animals were developed primarily to produce milk for butter, so a high fat test was desirable.

Ayrshires were developed in County Ayr in southwest Scotland. The breed was started from a mixture of native cattle in Scotland with stock from Holland and the Channel Islands. Milk was used mostly for cheese, so a medium to low fat test (4.0 percent) was desirable.

Holsteins were developed from native cattle in Holland. They are believed to have been bred in their native home for over 2,000 years. Holsteins formed foundation stock for both Shorthorns and Ayrshires.

Cattle in early America

There were no dairy cows in America when Columbus landed in 1492. The only ruminant animals here were the bison (American buffalo), musk ox, mountain sheep, and mountain goats. Millions of bison roamed the American plains. All of the cattle, beef, and dairy—as we know them today— were brought here from Europe. Early explorers and settlers brought cattle with them to provide food in voyage and after arriving.

The greatest numbers of dairy cattle were brought from their native lands about 100 years ago (1860-1880). Our government has stopped animals from entering our country when there was danger of hoof and mouth disease. This stopped direct importations from many countries after the early 1900's. The animals brought from England, Holland, Switzerland, Jersey Isle, and Guernsey Isle had many of the characteristics found in today's common dairy breeds in the United States. The color, size, milk production, and many conformation characteristics of the major United States breeds have many similarities to their ancestors.

AYRSHIRE

U.S. breed association office:
Executive Secretary: Mr. David Gibson

Ayrshire Breeders' Association
Brandon, Vermont 05733

Some breed notes

The Ayrshire breed originated in the county of Ayr, Scotland, before 1800. The breed was developed from native stock through long term selection for hardiness, superior udders, and efficient milk production. Countries in the world where Ayrshires are primarily found today include Scotland, the United States, Canada, and Finland.

H. W. Hills, Windsor, Connecticut, imported the first Ayrshire into the United States. That was in 1822. The number of Ayrshires imported is small compared to those of most breeds. The states having the greatest numbers of Ayrshires include: New York; Pennsylvania; Vermont; Iowa; Ohio; Kansas; Minnesota; and Wisconsin.

Breed characteristics

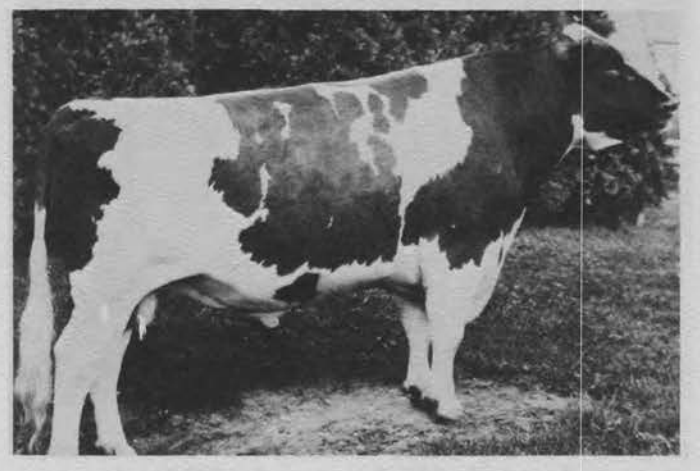
Ayrshires are strong and robust, showing constitution and vigor, symmetry, style, and balance throughout. They are characterized by strongly attached, evenly balanced, well-shaped udders.

Their color is light to deep cherry red, mahogany, brown, or a combination of any of these colors with white, or pure white, distinctive red and white markings preferred, black or brindle objectionable.

A mature cow in milk should weigh at least 1,200 pounds.

Horns incline upward, are refined, medium length, and tapered toward tips. There's no discrimination for absence of horns.

Influential Ayrshire Animals



Selwood Betty's Commander, Imp. 117936
Classified Excellent
Registered offspring: 9970 daus., 832 sons
USDA Sire Summary (9/73)
Predicted Difference:
+1204 lbs. milk + 48 lbs. fat 99% repeatability
5590 Daus. in 628 herds
1420 classified Daus. Ave. 85.5
Bred by: Stansell Bros.; Ontario, Canada
Owned by: Eastern A.I. Coop.; Ithaca, N.Y.
Died at 16 years: cremated and ashes buried at monument at Brandon, Vt.

Ayrshire breed champion for milk

Fairdale Betty Gem 655688
Classified Excellent—90
Breeder: Fairdale Farm, Bennington, Vt.
Owner: Meredith Farm, Topsfield, Mass.

DHIR 2—	**7**	**305**	**13560**	**4.2**	**575**
DHIR 4—	**0**	**305**	**17430**	**4.1**	**712**
DHIR 5—	**5**	**305**	**20980**	**4.2**	**880**
DHIR 6—	**7**	**305**	**32250**	**3.4**	**1109**
					champ record
DHIR 8—	**0**	**305**	**26370**	**3.7**	**972**
DHIR 9—	**2**	**305**	**31571**	**3.7**	**1153**

Lifetime Production: 157,601 M. 3.9% 6185 F.

BROWN SWISS

U.S. breed association office:
Executive Secretary: Mr. Marvin L. Kruse

Brown Swiss Cattle Breeders' Association of America
Box 1038
Beloit, Wis. 53511

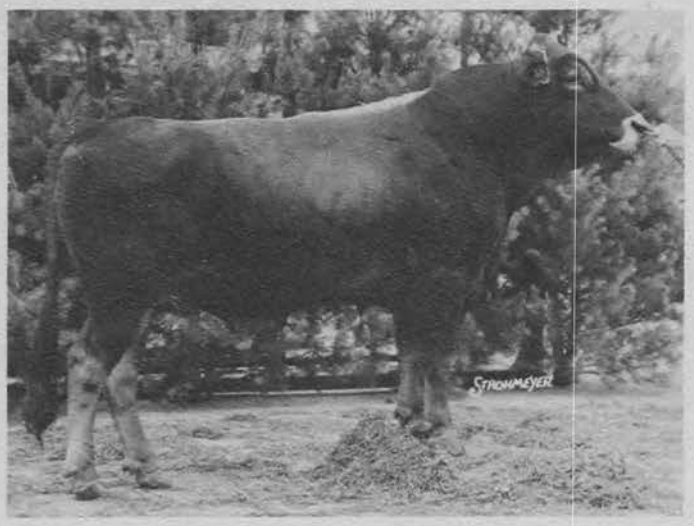
Breed notes

The Brown Swiss, sometimes referred to as the "Big Brown Cow" and the "Farmer's Cow," is probably the oldest dairy breed. The breed has descended from the cattle used in the valleys and mountain slopes of Switzerland before historic records began. The Brown Swiss breed is believed by some to be the purest of all recognized breeds of cattle because there was no apparent crossing with other cattle in the breed's development. The grazing areas in native Switzerland were high above sea level (3,000-8,500 feet), which has probably played an important role in the strength, hardiness, and ruggedness found in the Swiss breed today.

There were probably fewer Brown Swiss than any other breed imported into the United States—only 130 cows and 25 bulls.

The milk produced by Brown Swiss has higher than normal solids-not-fat content (9.2 percent) than regular milk testing about 4 percent.

Influential Brown Swiss Animals

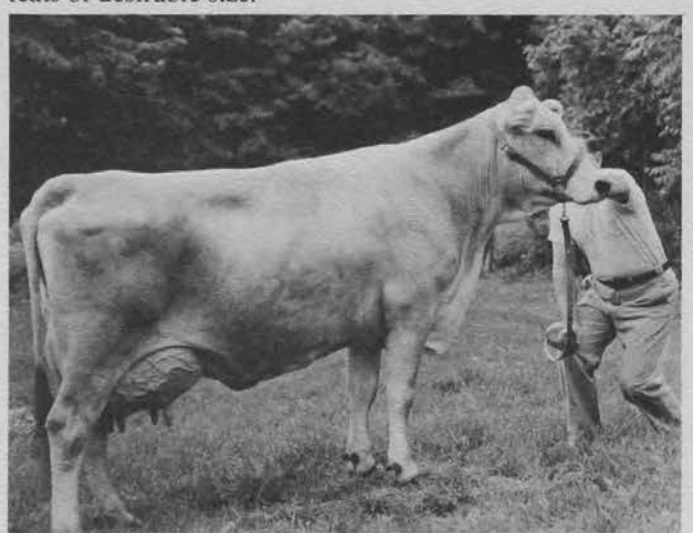


Liaison's Beautician
Registered Offspring: 1000 + Daus.; 200 + Sons
USDA Sire Summary: (9/73)
Predicted Difference:
+667 lbs. milk +8 lbs. fat 95% repeatability
601 Daus.; 202 Herds
374 classified Daus. Ave. 84.4 pts.
A.I. Service; Eastern Artificial Breeding Cooperatives, Ithaca, New York

Breed characteristics

The color of Brown Swiss is a shade of solid brown, varying from light to dark. The nose, switch, and hooves are black. Brown Swiss have a characteristic mealy band around the muzzle and usually a lighter-colored line down the back and around the poll. White or offcolor spots and pink noses are objectionable. Bulls with any white or offcolor markings and females with white or offcolor markings above the underside of the belly or with a white core in the switch do not meet color standards; they are so designated when registered in the official Herdbook.

Brown Swiss are strong and vigorous, but not coarse. Size and ruggedness with quality is desired. Extreme refinement is undesirable. In addition to displaying masculinity or femininity, general appearance of Brown Swiss would be described as individual attractiveness with vigor, stretch, scale, a harmonious blending of parts, and an impressive style and carriage. A front end with smoothly blended shoulders and a strong, wide chest is preferred. Each individual possesses a straight topline, full crops, a long, wide, nearly level rump. Brown Swiss are known for their outstanding feet and legs that wear— squarely placed with a strong, clean, flat bone and strong, well-formed feet—with a proper depth of heel. Cows have well-balanced, quality udders that last and well-placed teats of desirable size.



Ivetta 296971 (1954-1971)
Only cow of any breed to complete 10 consecutive records over 24,000 lbs. m. and 1,000 lbs. f.
She is the all-breed champion for lifetime fat production

2y2m	305d	2x	11,559m	3.88%	449f	HIR
3y2m	365d	3x	26,415m	4.45%	1176f	ROP
5y1m	305d	3x	24,052m	4.49%	1081f	ROP
6y0m	365d	3x	24,759m	4.26%	1054f	ROP
7y2m	305d	3x	24,066m	4.34%	1043f	ROP
8y2m	330d	2x	24,067m	4.30%	1034f	ROP
9y2m	305d	2x	25,601m	4.67%	1196f	ROP
10y2m	305d	2x	27,036m	4.50%	1217f	ROP
11y3m	305d	2x	26,431m	4.83%	1276f	ROP
12y3m	305d	2x	24,960m	4.77%	1190f	DHIR
13y4m	365d	2x	27,389m	4.23%	1158f	DHIR
15y0m	365d	2x	20,407m	4.00%	812f	DHIR
TOTAL: 4515d			x308,569m		13607f	

GUERNSEY

U.S. breed association office:
Executive Secretary: Mr. Max L. Dawdy

The American Guernsey Cattle Club
Peterborough, N.H. 03458

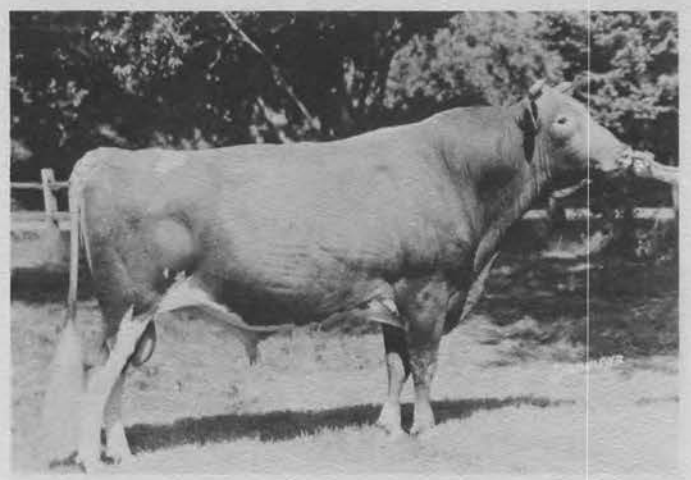
Breed Notes:

The Guernsey breed has been called "The Royal Breed" of dairy cattle. Its history traces back 10 centuries to the tiny (24 square miles) Isle of Guernsey in the English Channel off the coast of France. Monks that were sent to colonize the island crossed two famous French breeds of dairy cattle: Fromont du Leo Brittany and Norman Brindles from Normandy. Captain Prince from Boston, Mass., an American sailing captain, imported the first cow and bull for his brother in New Hampshire in 1831. These were known as the Pillsbury Cow and Bull. The states having the greatest number of Guernsey cattle are Wisconsin, Pennsylvania, California, New York, Ohio, Minnesota, and Indiana.

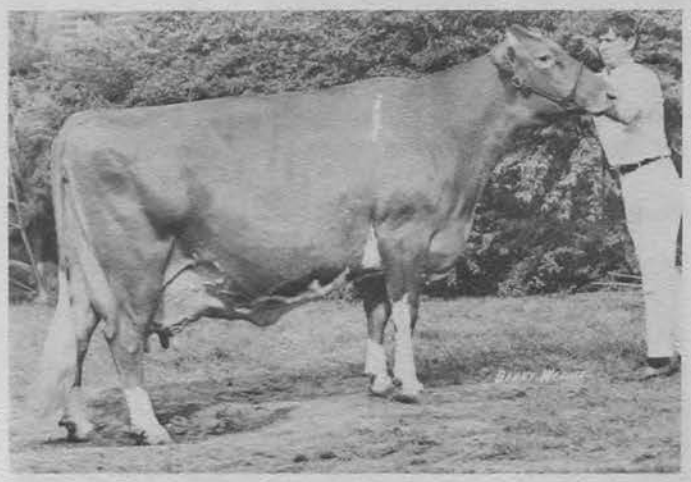
Breed characteristics

The Guernsey is a shade of fawn, either solid or with white markings, with golden yellow pigmentation. The breed is moderate in size; desired mature cows in early lactation average 1,100 pounds and stand approximately 53 inches at the withers. The Guernsey is noted for: the superior flavor of its golden-colored milk—naturally high in all milk solids; its gentleness; early maturity; and efficiency of production. The breed is readily adaptable to all areas.

Influential Guernsey Animals



Norgerts Royal Nance—533769
Registered offspring: 11,229 Daus., 1413 Sons
USDA Sire Summary (1/72)
Predicted Difference:
+530 lbs. milk, +1 lb. fat, 99% repeatability
5231 Daus. in 1187 herds
Bred by: Mrs. Gertrude McNaught, Elgin, Ill.
A.I. Service: Curtiss Breeding Service Inc., Cary, Ill.



Fox Run A.F.C. Faye
Excellent—95
All American Aged Cow 1969
Reserve All American Aged Cow 1971
Breeder: James D. O'Banion, Campbellsville, Ky.
Owner: Gayle Housley, Riceville, Tenn.

Jr2	2X	DHIR	305	13,038m	592f	
3-10	2X	DHIR	305	15,880m	702f	
5- 4	2X	DHIR	365	32,110m	1397f	milk champion record
6- 6	2X	DHIR	365	31,040m	1736f	fat champion record
8- 1	2X	DHIR	305	28,770m	1341f	

HOLSTEIN

U.S. breed association office
Executive Secretary: Mr. Robert H. Rumler

Holstein-Friesian Association of America
P.O. Box 808
Brattleboro, Vt. 05301

Breed notes:

The Holstein-Friesian breed had its beginnings in the kingdom of the Netherlands. It is generally accepted that the Friesians and Batavians brought their cattle with them when they settled the fertile lowlands of the Rhine delta at the beginning of the Christian Era. The intermingling of their cattle finally evolved a black and white breed. It is believed that the generally unmixed breeding of these cattle in Holland contributed to foundations for the Shorthorn, Ayrshire, and Guernsey breeds.

Dutch settlers to New York probably brought the first animals to America in about 1621, but their breeding had no influence on the breed. The beginnings of the breed in America dates to Mr. Winthrop W. Chenery, Belmont, Mass., when he bought some cows imported by a Dutch sailing master. "Dowager," one of the first cows imported, completed a record of 12,681 pounds and 8 ounces of milk.

More than 70 percent of the registered dairy cattle in the U.S. are Holsteins. Grade and registered animals of the breed make up more than 80 percent of the U.S. dairy cattle.

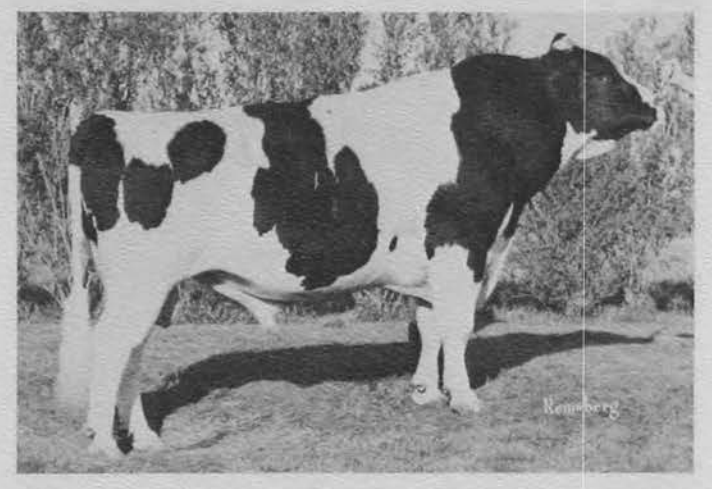
Breed characteristics:

Desired are rugged, feminine qualities in an alert cow possessing Holstein size and vigor.

The breed's black and white markings are clearly defined. Markings which must be labeled "OC" (off color) on the registration certificate are: solid black, solid white, black in switch, black belly, black encircling leg touching hoof head, black from hoof to knee or hock, black and white intermixed to give color other than distinct black and white. Red and white Holsteins are labeled "Red" on their registration certificates.

A mature cow in milk should weigh at least 1,500 pounds.

Most Influential Holstein Animals



Round Oak Rag Apple Elevation, 1491007
Registered Offspring (10/73): 3,085 Daus.; 623 Sons
USDA Sire Summary
Predicted Difference: (5/74)
+1216 lbs. milk, +45 lbs. fat, 97% repeatability
P.D. Type H
+2.59; 88% repeatability
Owned by: Select Sires, Inc.; Columbus, Ohio

Harborcrest Rose Milly
(EX-97-GMD)
8-0 365d 24,941M 1242F
Lifetime 210,090M 8741F
All-Time All-American
Has 5 sons in AI who have achieved a PD of +1000 or more.

JERSEY

U.S. breed association office:
Executive Secretary: J. F. Cavanaugh

The American Jersey Cattle Club
1521 East Broad Street
Columbus, Ohio 43205

Breed notes:

The Jersey breed has a romantic and adventuresome history, as does the Isle of Jersey in the English Channel. Before 709 A.D., this island was connected by a land bridge to the mainland of France. There are many interesting theories of where the original cattle that formed the breed came from; one contends the Jersey originated in India and migrated across the land bridge, another that Jerseys came from the early stock of Brown Swiss of Alpine origin, and a third that they are a refinement of Normandy and Brittany spotted cattle. The precise details of the evolution of the breed before 1800 is unknown.

The earliest record of Jerseys imported to America dates to 1815. Today the states with the largest numbers of Jerseys are: California; Ohio; Vermont; Oregon; Tennessee; Mississippi; New York; and Texas.

Breed characteristics:

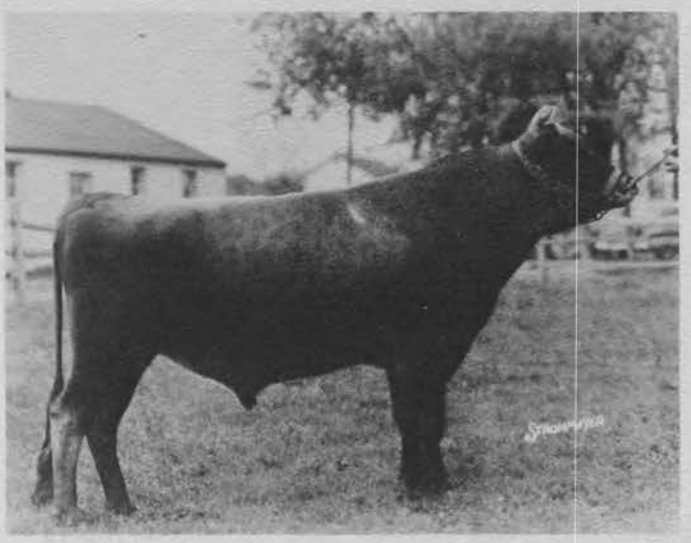
Jerseys should have sharpness and strength, indicating productive efficiency.

Jerseys vary greatly in color, but the characteristic color is some shade of fawn with or without white markings. The muzzle is black encircled by a light-colored ring, and the tongue and switch may be either white or black.

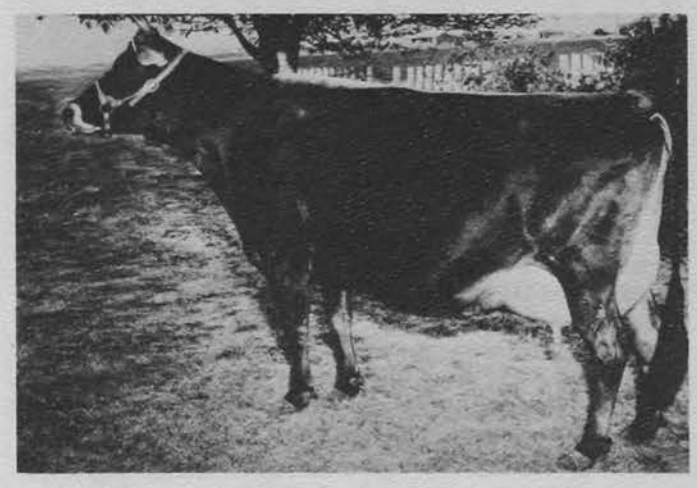
The ideal mature weight for Jersey cows in milk is about 1,000 pounds. Jerseys usually calve for the first time at 24 to 26 months of age. They reach a mature age at about 6 years. Due regard should be given to the condition of the cow and the stage of lactation when weight is considered.

Horns, if present, characteristically incline forward and are incurving. They should be refined, of medium length, and taper toward the tips. No discrimination is made for absence of horns.

Influential Jersey Animals



Marlu Milestone
Registered Offspring: more than 1,000 daus., 490 sons
USDA Sire Summary
Prediced Difference (9/73)
+609 lbs. milk; +35 lbs. fat; 88% repeatability
653 Daus. in 171 herds
566 classified Daus. ave. 88.6 pts.
Bred by: Marlu Farm, Lincroft, N.J.
Owned by: Marlu Farm, Mayfield Dairy Farms, Inc., Walebe Farms and Tymor Farms



The Trademarks Sable Fashion
Bred and Owned: Victory Jersey Farm, Tulia, Texas

2-6	305	11,832	736	2x
	365	14,037	868	2x
3-8	305	17,665	1138	2x
	365	20,910	1315	2x
5-2	305	20,160	1235	2x
	365	23,090	1440	2x
6-9	305	19,470	1179	2x
	365	23,240	1405	2x
8-0	305	25,000	1274	2x
	365	29,320	1550	2x
10-8	305	19,150	1078	2x
	365	21,760	1229	2x

MILKING SHORTHORN

U.S. Breed Association office:
Executive Secretary: Mr. Harry Clampitt

The American Milking Shorthorn Society
313 South Glenstone Avenue
Springfield, Mo. 65802

Breed notes:

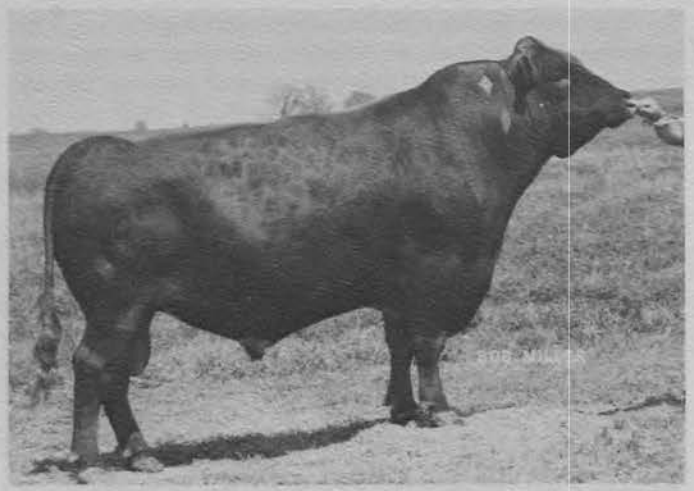
Milking Shorthorns are known by different names in other parts of the world: England Dairy Shorthorns; Canada Dual Purpose Shorthorns; New Zealand Milking Shorthorns; Australia Illawara; Africa Shorthorns; and they were known as Durhams by the early U.S. settlers. The Durhams were favorites of pioneer settlers, furnishing meat, milk, and power.

The first American Shorthorn Breeders' Association was formed in 1882 to promote both Milking and Scotch (Beef) Shorthorns. The Milking Shorthorn Club was formed in 1912, and in 1948, the American Milking Shorthorn Society was incorporated.

Breed characteristics:

Shorthorns are either red, red and white, or roan. Roan is a very close mixture of red and white and is found in no other breed of cattle. Animals may be either horned or polled (without horns). The color and horned condition are indicated on the certificate of registry. The breed is intermediate in size.

Influential Milking Shorthorn Animals



U. of Minn. Majesty Marlin 330838
Registered Offspring: 61 Daus., 22 Sons
USDA Sire Summary
Predicted Difference: (4/74)
+1396m; +11f; 36% repeatability
18 Classified Daus.: 14 very good; 4 good plus
Breeder: University of Minnesota, Rosemount, Minn.
Used by: Eldo Bentley and James Huseby, Twin Valley, Minn.
A.I. Service: American Breeders Service, DeForest, Wis.

Milking Shorthorn breed champion for milk

Hazelbrook Red Jane 8th
Breeder: Geza Szilagyi, Bath, Penn.
Owner: Samuel G. Yoder, Shoemakersville, Penn.

2-10	2x	365	12,448	406	
4-03	2x	323	18,996	664	
5-03	2x	365	23,740	895	Champion record
7-04	2x	365	22,545	880	
9-10	2x	311	13,900	497	
10-09	2x	279	11,810	408	

Summary of breeds in United States

BREED	Origin	First U.S. Imports and Numbers	Number Animals Registered 1974	Estimate No. Living Registered cows in U.S.	% Percent Cows in U.S. (Grade & Registered)	Number DHI Cows (Grade & Registered) 1972 DHI Average (2X-305-M.E.)	Proven Sires Available In A.I. (6/75)					Percent Registered Animals Bred A.I.	U.S. Breed Associations	Herd Book Status
								Production Difference						
							No. Sires	Milk	Fat	$	above +$40			
AYRSHIRE	County Ayr Scotland Before 1800	1822 Small Number	Females 10,372 Males 704	85-90,000	1-2%	22,336 cows 11,610 lb. m. 3.87% B.F. 450 lb. F.	21	+519	+18	+40	9	61%	Organized 1875 Incorporated 1886	Open Herd Book Identity Enrol. for Grades
BROWN SWISS	Switzerland	1869 130 cows 25 Bulls	Females 12,857 Males 2,298	80-90,000	1-2%	27,111 cows 12,743 lb. m. 3.98% B.F. 508 lb. F.	32	+438	+19	+39	16	53%	1880	Open Herd Book Identity Enrollment
JERSEY	Isle of Jersey Before 1800	1815 Not Available	Females 33,759 Males 2,053	270,573	10-15%	103,053 cows 9,497 lb. m. 4.94% B.F. 469 lb. F.	90	+490	+18	+41	47	55%	Organized 1868 Incorporated 1880	Open Herd Book Genetic Recovery Program
GUERNSEY	Isle of Guernsey English Channel About Year 970	1831 12,762	Females 27,418 Males 1,502	265,000	5-9%	93,392 cows 10,285 lb. m. 4.58% B.F. 471 lb. F.	77	+387	+16	+34	31	59%	Organized 1877 Incorporated 1911	Open Herd Book Provisional Reg. for Grades
HOLSTEIN	Kingdom of the Netherlands Early Christian Era	1852 8,000	Females 268,3331 Males 23,458	2,000,000	80-85%	1,721,129 cows 14,712 lb. m. 3.61% B.F. 531 lb. F.	771	+416	+10	+31	316	72%	Organized 1872 Incorporated 1880	Closed Herd Book
MILKING SHORTHORN	North Eastern England Valley of Tees River Early 1800	1783 Not Available	Females 3,503 Males 1,131	50,000	1-2%	3,133 cows 10,458 lb. m. 3.68% B.F. 385 lb. F.	5	+758	+28	+63	4	4%	Organized 1882 American M.S. Soc. 1948	Open Herd Book Grade up Program

Things to do:

Matching words and phrases

1. _____ Domesticated
   _____ Shorthorns
   _____ Robert Bakewell
   _____ Breed
   _____ Brown Swiss
   _____ Herd book
   _____ Grades
   _____ Jersey
   _____ Open herd book
   _____ DHIA
   _____ Bison
   _____ Guernsey
   _____ Ayrshire
   _____ Holstein
   _____ Skagvale Graceful Hattie

a. Record of ancestry
b. 155 imported to U.S.
c. Most grade animals
d. Island in English Channel
e. Tamed
f. Native to America
g. England
h. Scotland
i. Cattle breeding pioneer
j. Nonregistered
k. Large family
l. Name of breed champion
m. Computerized production records
n. Registration of purebred grades

2. Study your breed in detail in relation to other breeds in your area.
   a) What are recent selling prices of animals?
   b) Which breeds are most profitable?
   c) What are the most popular breeds in your county? state?
   d) Does the milk price paid to area dairymen give advantage to some breeds?
   e) How many proven bulls are available through artificial breeding, and what is their average predicted difference (sire's ability to transmit production) for the various breeds?

3. What are the major advantages and disadvantages of your favorite breed?

Breed _____

Advantages	Disadvantages
1)_____	1)_____
2)_____	2)_____
3)_____	3)_____
4)_____	4)_____
5)_____	5)_____

4. What should be done to further improve your favorite breed?

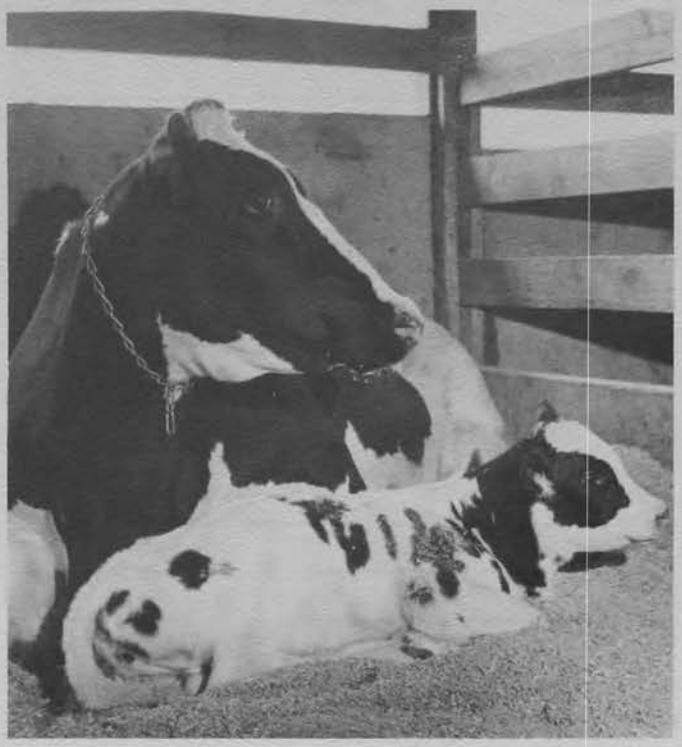
_____

_____

_____

_____

Hows and whys of inheritance
Unit 3



A new generation of calves may improve your herd.

Have you ever wondered why?

All living things pass inherited traits from one generation to the next. The word inherit means to receive something from our relatives or friends. Sometimes this is money or property. But what we receive from our parents when we are born is much more important. Our inheritance was determined before we were born. It will never change.

Scientists have made tremendous discoveries in how we inherit traits from our parents and how cells divide and recombine to form new life. These discoveries have helped dairymen improve their animals—just as they have helped make productive varieties of wheat, corn, soybeans, alfalfa, and other crops.

The study of inheritance is known as the science of genetics.

There is no one just like you

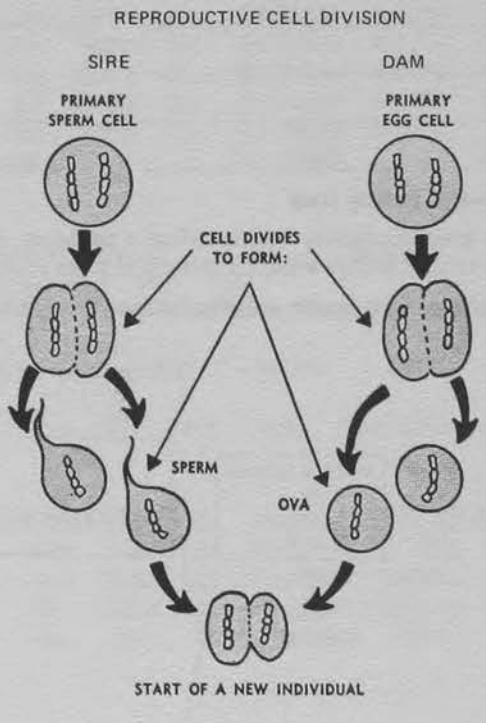
There are more than 3 billion people on earth. Not one of them has the same inheritance you have; everyone is different. There is only one exception: identical twins share the exact same inheritance. They have identical inheritance because they grew from the same tiny cell that was formed by the joining of two cells, the egg and sperm from their mother and father.

In most cases, one individual grows from this tiny single cell that contains all of the mother's and father's contribution to inheritance. Cells from the parents that join to make one cell and to begin an offspring are the only genetic link between parents and their young. These cells are so small they can be seen only through a very powerful microscope.

The smallest units of inheritance inside of these cells are genes. The genes are located on small threadlike structures called chromosomes—like beads on a string. Chromosomes occur in pairs inside the cells of animals. The egg and sperm cells contain only one member of each pair of chromosomes.

The single cell divides into two identical cells, then again into four, eight, sixteen, thirty-two, sixty-four, and continues until millions of cells are formed. As they divide, some become skin cells, others nerve cells, others cells of muscles, the digestive tract, eyes, and so on to form all the parts of an animal's body.

The material inside each of the billions of cells is exactly the same as the material inside the cells from the mother and father. Family likenesses are passed on from one generation to the next through the genetic material.



Family likenesses

Who are you most like in your family—your father, mother, brother, sister, grandmother, or grandfather?

It's fun to compare. With a plus sign (+), mark the ways you are most like your father, mother, brother or sister, and an unrelated friend. If you are very different, mark down a minus sign (−). Add to the list your own ways to make comparisons.

In some ways, you are more like your mother. In other ways, you are more like your father. In some ways, you are not like either of your parents. You are probably least like your friend. The closer the relative, the more you are alike. You can do this with other members of your family —grandparents, aunts and uncles, and cousins. It's also fun to do this with families of animals.

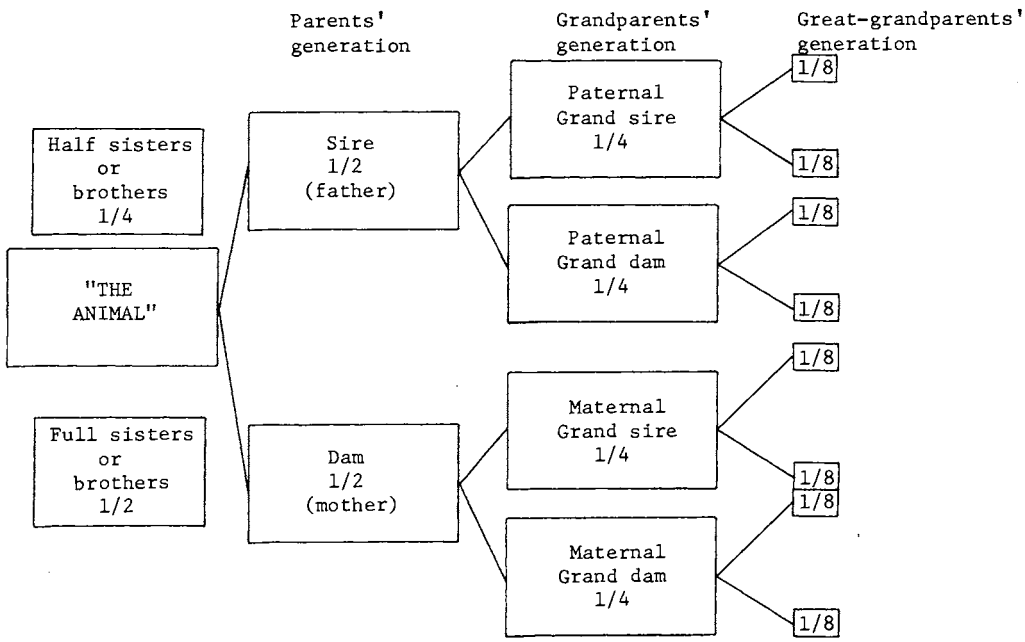
Your family's likenesses and differences

	Father	Mother	Brother or sister	Unrelated friend
Color of hair				
Color of eyes				
Curliness of hair				
Height (tall, medium, short)				
Thinness or fatness for your age				
Shape of nose				
Shape of ears				
Size and shape of ear lobes				
Add your own comparisons:				

Pedigree—the family tree

Your dairy animal's family tree is called a pedigree. A pedigree is a record of an animal's ancestors. It is used to evaluate the calf's potential ability which it inherited from its parents, grandparents, and more distant ancestors.

Pedigree showing genetic relationships of relatives



The preceding pedigree shows the genetic relationships between the animal and each of its ancestors. "The Animal" (left) received one-half of its inheritance from its sire (father) and the other half from its dam (mother). "The Animal" contains one-fourth (25 percent) of each of the grandparents' genetics or inheritance through the parents. "The Animal" contains one-eighth or 12½ percent of the same inheritance as each of the great-grandparents. The animal's full brothers or sisters, who have the same parents, have one-half or 50 percent of the exact same inheritance as the animal. The half brothers or sisters (they have the same sire or dam) have only one-fourth or 25 percent of the same inheritance as the animal.

These genetic relationships tell us why closer relatives tend to be more like each other. It tells us that, when we use the pedigree to evaluate the potential ability of the animal, the parents and full brothers and sisters are more important than the grandparents or great-grandparents.

The pedigree above shows the information that should be included.

NAME WisIIIaMinn 2057634

BORN July 10, 1975

(Minnesota Duke of Iowa) 9252529

USDA, 5/74 PQ 1/74 15,924M 3.66% 583BF
1438 D., 244 R., 579H. 15,026M 3.61% 542BF
Herdmates Avg. +898M +.05% +41BF
Diff.
Rpt. 98%
PD +$73 +920M +.06% 42BF ABA
HFA, 9/73 TQ 9/73 Act. Age Adj. 60%
579 Dtrs. Avg. 80.2 81.1 60%
498 Dtrs. Ave. 80.2 81.1 63%
498 Dams Ave. 82.4 81.6
Rpt. 96%
PDT +0.30

(Wisconsin Queen Illinois) 1974999

2y	2m	305d	2x	18,278M	3.94%	720BF	
5y	0m	305d	2x	41,284M	2.71%	1120BF	
6y	5m	305d	2x	38,631M	2.95%	1142BF	
7y	8m	305d	2x	39,448M	3.37%	1330BF	
9y	9m	171d	2x	27,293M		923BF	Inc.

USDA Cow Index, 5/73
3 Recs. Avg. M.E. 34,736M 2.97% 1031BF
Herdmates Avg. M.E. 18,173M 3.55% 645BF
Diff. +16,563M −.58% +386BF
Rpt. 42%
EATA or Cow Index +$134 +2,215M −.16%

(Duke of Iowa) 8276432

USDA, 9/73
711 D., 1564 R., 420 H. 15,388M 3.5% 550BF
Rpt. 97%
PD +$7 +189M −.05% 0BF
HFA, 1/74 TQ 1/74
233 Dtrs. 84.3 84.6 85% Rpt. 93% PDT +3.07

(Minnesota Princess)

All-Time All-American Aged Cow

3y	9m	305d	2x	17,959M	4.27%	767BF
5y	2m	305d	2x	23,355M	4.12%	963BF
6y	4m	305d	2x	25,579M	4.17%	1066BF
8y	0m	305d	2x	24,941M	4.98%	1242BF
9y	9m	305d	2x	25,630M	4.06%	1040BF
127	1m	305d	2x	23,890M	3.52%	842BF
Lifetime				210,090M		8750BF

(King of Illinois) 7253244

USDA, 5/74 PQ 1/74
6490 D., 10254 R., 2187 H. 16,070M 3.53% 567BF
Rpt. 99%
PD +$31 +589M −.08% +BF
HFA, 1/74
771 Dtrs. 78.8 79.9 43% Rpt. 95% PDT −0.71

(Wisconsin Queen) 1623444

2y	4m	305d	2x	10,532M	3.79%	399BF
3y	4m	305d	2x	13,856M	3.64%	505BF
4y	6m	305d	2x	18,528M	3.73%	691BF
5y	6m-	305d	2x	21,084M	3.53%	745BF

This example pedigree is for a younger animal. If she had a production record of her own, it would be printed at the top near the animal's name and birth date. Good pedigrees contain just the important information. The 305-day production records for cows—with their differences from herdmates and Predicted Differences for bulls—are most important. Type classification information is also helpful.

Study the pedigree example and prepare one for your calf.

Environment

Many things besides inheritance affect an animal. The final outcome depends also on the feed, freedom from disease and sickness, and care the animal receives. A cow may have inherited the ability to produce 30,000 pounds of milk. But if she is fed only enough to produce 12,000 pounds of milk, that's all she will produce. Properly fed animals with much poorer inheritance to produce milk can produce much more than a cow with super inheritance but that has been poorly fed or cared for. All things that affect an animal and that are not inherited are called environment.

Environment is very important; it includes everything that affects the way the animal grows, how healthy it is kept, the food it eats, the air it breathes, the kindness it receives, and many other things.

Mowry Prince Corinne, a Holstein cow, holds the world's record for milk production. She produced 50,759 pounds of milk in a 365-day lactation. That's an average of 139 pounds of milk per day for 365 days. This super pro-

Holstein breed champion for milk

duction was a result of both inheritance and environment. This exceptional cow could not have become a world champion if either super inheritance or environment had been missing.

The table below illustrates how inheritance and environment are both important and work together.

How inheritance and environment work together to determine milk production

Inheritance	+	Environment	=	Results
Super	+	Super	=	Super
Super	+	Average	=	Average + +
Super	+	Low	=	Low + +
Average	+	Super	=	Average + +
Average	+	Average	=	Average
Average	+	Low	=	Low +
Low	+	Super	=	Low + +
Low	+	Average	=	Low +
Low	+	Low	=	Low

Super production cannot be obtained unless the inheritance and environment are both super. The cow with super inheritance fed and cared for in an average way (environment) is above average (average + +), but it cannot make a super production record. The herd average is considered an indication of the level of environment.

Study the table to learn how inheritance and environment are both important for milk production. This is true of traits or characteristics that influence the profitability of animals—such as growth weight, size, and resistance to mastitis.

Some traits are not influenced nearly as much by environment. In general, these traits have little to do with profit. Some of these traits are coat color, horns or polled (no horns), hair swirls, and nose prints (her fingerprints).

Some traits are affected or determined more by environment than heredity. Some of these include long life, type classification of feet and legs, udder attachment, and ability to reproduce regularly.

How do we improve the inheritance of animals?

How do dairymen improve the inherited ability of cattle to produce greater amounts of milk? They make these improvements through selection. Selection is the process of culling (removing from the herd) the poorest animals and allowing the best animals to be the parents of each new generation.

Like tends to beget like. Cows that produce the most milk and bulls that have the best-producing daughters usually have the best offspring.

Good dairymen constantly evaluate the performance of their animals to determine which should produce young. The DHI (Dairy Herd Improvement) program provides accurate computerized records to make genetic evaluations. This is a nationwide program that is available to all dairymen in the United States.

Dairymen make the greatest improvement by selecting only the best bulls through artificial breeding. Artificial breeding has made it possible for every dairyman to breed his cows to only the best proven bulls in the United States or, at least, highly selected young sires.

The U.S.D.A. (United States Department of Agriculture) collects all DHI records from the 50 states and uses them to calculate the sire provings. All records of each sire's daughters are compared to other cows in the herds to obtain a herdmate comparison. These comparisons are used to calculate each sire's "Predicted Difference"—a measure of the average pounds of milk and fat the bull will transmit to his daughters. The following table illustrates the range in sire's Predicted Differences and how they could be grouped on their ability to improve inheritance for milk production.

Predicted difference ratings for milk production

Predicted difference	Sire rating for milk
+ 1600 to + 1200	Extra Super
+ 1200 to + 800	Super
+ 800 to + 400	Good
+ 400 to 0	Fair
0 to − 400	Poor
− 400 to − 800	Poor
− 800 to − 1200	Poor

Milk production is the most important profit trait, but many dairymen also want to improve other traits. This can be done by using only good, super, or extra super sires for production and then picking from those the ones that appear most likely to improve the other traits.

Things to do:

1. Diagram a family tree of both your calf and yourself.
2. Make a list of bulls (sires) used on your farm, arranging the list in order from the top bulls to the average to the poorer bulls and count the number of cows bred to each sire or the number of offspring in your herd.
3. Study the environmental factors that affect milk production, such as feeding program, milking techniques, disease problems, etc. and try to determine if they might be limiting production.
4. Study the cows in your herd and their production and compare with their dams and sires to see if you can explain how they are alike and unalike.

This newborn calf represents a 4-H'er's future in the dairy business.

Baby calves—the miracle of birth
Unit 1

All mammals (warm-blooded animals that give milk) have babies. We don't always call them babies, however. Young cats are called kittens, baby dogs are puppies, and newborn horses are foals. The baby of the dairy cow is a calf.

The miracle of birth is important to all life. Reproduction is the way that all living things remain on this earth. This process is called *reproduction.*

In animals, the miracle of birth begins when two tiny cells from the parents join to form a single cell. This single cell is the beginning of new life. The baby animal grows and develops from this single cell.

The cells from the parents are called the *egg* and the *sperm.* The egg is the cell from the mother, and the sperm is the cell from the father. In dairy cattle, the mother is called the cow or the dam. The father is called the bull or the sire.

When a bull places sperm inside the cow near the egg, he *breeds* the cow. The egg from the cow and the sperm from the bull are joined in a process called *fertilization.* Fertilization is the beginning of the new life.

Some farmers own a bull to *breed* the cows. Most farmers want to use the best bull possible. But most farmers do not keep a bull on their farms. BULLS CAN BE DANGEROUS AND MEAN!

In the 1950's, scientists discovered that sperm from bulls could be frozen. When sperm was thawed—even several years later—it could still fertilize eggs and develop healthy, normal calves. They called the process *artificial insemination.* This was an amazing discovery!

Today nearly 60 percent of dairy calves born in America are from artificial insemination. Frozen semen can be easily transported. Dairymen can now use the best bulls to be sires of their calves.

A fieldman from the artificial insemination service drives to the farm when it is time to breed the cow. He thaws the sperm and puts it into the cow's *reproductive organs* so it can fertilize the egg. The reproductive organs are where the cow produces the egg and where the tiny fertilized cell grows and develops until it is born.

The calf will be born about 280 days after the cow is bred and the egg and sperm are joined. During that time, the calf grows from a tiny cell smaller than a pinpoint into a 70- to 100-pound calf ready to be born.

A cow has a calf almost every year. The cow must have a calf before she can give milk. Therefore, it is important to the dairyman to see that all his cows have calves each year. Sometimes cows have twins or triplets. Usually cows have only one calf.

The newborn calf is able to stand, walk, and see from the time it is born. It is covered with a shiny coat of hair. Soon after birth, it gets to its feet and *nurses* its mother. Somehow, it knows that the milk is in the cow's udder. It won't be long before this calf is running and playing with the rest.

Miracles can happen. One of nature's best miracles is the birth of a baby calf.

Things to do:

1. What do you think a miracle is?

   _____

   _____

   Write a short story about a miracle. You can make up your own miracle.

2. Have you ever seen newborn puppies or kittens? _____. If you have, list some ways they are different from baby calves. (If you haven't, ask your father or mother, your 4-H leader, or teacher—a man in a pet store could help.)
   a. eyes—
   b. hair (fur)—
   c. legs—
   d. number born at one time—
   e. number of times each year they may have young—
3. Visit a dairy farm. Look at the newborn calves. Try to draw a picture of a calf.
4. Ask your 4-H leader or teacher if your club or class could hatch some chicken or duck eggs. Write a report about everything that happens. How is this like the birth of a calf? How is it different?

Managing a reproduction program
Unit 2

The result of a successful breeding program is a healthy calf.

Mammals are warmblooded animals that produce milk to feed their young. A cow, like other mammals, must give birth before she starts making milk.

The birth of a calf is called calving. A cow is "fresh" when she starts producing a fresh supply of milk. The scientific term is "parturition" (par-tur-ishun).

When cattle are bred, an egg (ovum) from the cow and a sperm from the bull join to form one new cell. This tiny cell is the beginning of a calf. The cow provides a place within her body for the calf to grow and to develop until it is ready to be born. This takes about 280 days and is called the gestation period.

If you have properly fed and cared for your calf, she has grown to become a healthy heifer. As she gets older, she reaches sexual maturity (puberty). At this time, she will have estrus (heat periods) and show special interest in a bull. This normally takes place when a heifer is about 1 year old. Have your veterinarian examine your heifer if she doesn't have heat periods when she reaches this age.

The most common way to detect cattle in heat is to look for behavior changes. Signs telling that a heifer or cow is *coming into heat* include:

1. An attempt to mount other animals.
2. Nervousness, restlessness, much bellowing. She may also nuzzle and smell other animals.

An animal is in *standing heat* when she stands still and permits other animals to mount her.

Most heifers and cows come into heat every 21 days. However, some will have heat estrus cycles as short as 18 days or as long as 24 days and still be normal.

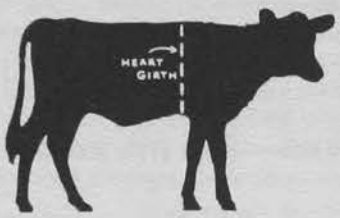
Start recording your heifer's heat periods about 2 to 3 months before she should be bred. These records will tell whether your heifer has normal heat periods. You can also anticipate when she will be in heat so she can be bred at the right time.

Be sure that a bull does not get to your heifer during these early heat periods so that she doesn't get bred before she is the proper size and age.

Size and age to breed heifers

Size is a better measure than age alone for determining when heifers should be bred. There is a difference in growth rates among individuals as well as among breeds. Adequately fed heifers can be bred when they are 15 to 16 months old. Since the gestation period is about 9 months, they will calve when they are 24 to 25 months old. This should be your goal.

You can estimate your heifer's weight by using a measuring tape and the table below if you do not have a large scale. Place the tape snugly around the body just behind the front legs and shoulders. This is called the heart girth.



Minimum age and size of dairy heifers at time of breeding

Breed	Minimum age (months)	Minimum size (pounds)
Ayrshire	13	600
Brown Swiss	15	750
Guernsey	13	550
Holstein	14	700
Jersey	13	500
Milking Shorthorn	14	650

A heifer that is bred too early may be undersized when she is mature. This is because her growth rate tends to slow when she starts producing milk. Therefore, it may be necessary to delay breeding a heifer that is small for her age until she reaches the proper size.

When to breed during heat period

A heifer or cow is not actually in heat until she will allow animals to mount her. The other signs are only suggestions that she might be in heat or that she is near *standing heat.* The average length of standing heat is 18 hours.

Use one of these time-tested rules to select the time to breed your heifer or cow:

1. A cow observed in heat in the morning should be bred the afternoon of the same day. A cow observed in heat during the afternoon or evening should be bred the following morning or early afternoon.
2. Breed your heifer or cow near the end of her standing heat period or within 6 hours after the end of heat.

Use a good bull

Breed your heifer to the best bull available in the same breed. This is especially important if you want her to be the "foundation" for a high-producing herd.

Artificial insemination service is available nearly everywhere. For a reasonable fee, you can breed your heifer to the bull of your choice.

Ask your parents, club leader, or county extension agent to help you select the bull. If possible, look at some daughters of the bull.

Record the breeding date and service sire. Then mark the date 3 weeks later when you would expect your heifer to be in heat again in case she isn't pregnant. If she does come into heat, she must be bred again. Record the new breeding date so you will know when your heifer is due to calve.

Care at calving time

Watch your heifer closely for about 10 days before she is due to calve so you can separate her from other cattle before the calf is born. If it is cold, put her in a clean, well-bedded box stall. In nice, warm weather, she can stay outside in a clean lot that is isolated from other cattle.

Several signs tell that calving time is near. The udder begins to swell as it fills with milk; the vulva becomes swollen, and discharges are noticed around this area. The area around the tailhead appears sunken as the ligaments relax. The heifer will also lie down and strain when the time is near.

Someone should give assistance when and if help is needed.

Record the calving date, and also make notes about any abnormal events. These records will help you select the time to breed the cow and can also provide valuable information for the veterinarian.

When to breed after calving

It usually takes about 60 days after calving for the cow's reproductive tract to return to a normal, healthy condition. Therefore, cows should normally be bred 60 to 90 days after calving. Some cows can be bred earlier than 60 days after calving if a veterinarian has found them to be normal.

Healthy cows that did not have any problems during calving can be expected to have at least one heat period before 60 days after calving. If the first heat does not occur by this time, a veterinarian should examine and treat the cow.

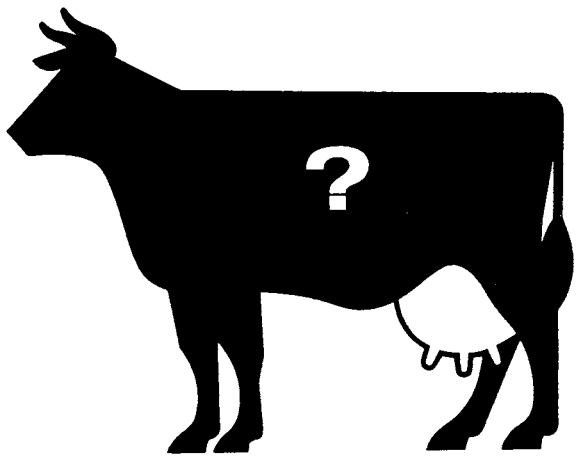
Keep a record of each heat period after your cow calves so you can have her bred after she has milked about 2½ months.

Most dairymen plan their breeding programs so that each cow will have a calf every 12 to 13 months. This results in the highest average production of milk per cow each year and increases profits.

Things to do:

1. Watch a technician breed a cow by artificial insemination. Write a story about his work and the equipment he uses.
2. Help your father keep a record of heat periods and breeding dates of all cows in his herd.
3. Write a story about the bull used to breed your heifer. Include information about his pedigree (his ancestors) and data from his USDA-DHIA Sire Summary Record.
4. Demonstrate how to estimate the body weight of a heifer by using a tape measure.
5. Visit a bull stud.

How do cows give milk? Unit 3



Milk comes from cows. We get the milk from the *udder*—the large "milk bag" which hangs between the cow's rear legs.

For years, cows were milked by hand. In ancient times, farmers milked their cows from behind the cow's rear legs. As dairy cows became more specialized, their udders became larger, and they gave more milk. Soon, farmers moved around to the side to milk. This was a lot safer, cleaner, and more comfortable. Milking from the side made it harder for a cow to kick the farmer, and it surely kept the tail out of the milk pail and out of the farmer's face.

Most modern dairy cows are milked by machines. Many kinds of equipment are used to milk cows. The simplest milking machine is like a pail with a lid. From the lid come four tubes which are attached to the cow's four teats. Electricity runs a pump which makes a gentle *vacuum* inside the milking machine. The vacuum opens the end of each teat and allows the milk to flow into the milking machine.

Converting forage to milk will keep the dairy cow in our future.

When a farmer milks by hand, he begins by squeezing the top of the teat near the udder. This traps the milk inside the teat so it cannot go back into the udder. Then he squeezes the teat with the rest of his fingers. This causes the milk inside the teat to squirt into the pail through the opening at the bottom of the teat. Many cows were milked by hand as late as the 1940's. The first milking machine was invented in 1878, but many farmers still know how to milk by hand.

Cows can also be milked by the calf. Shortly after the calf is born, it gets its first meal from its mother. Calves eat by sucking the milk from the udder. The calf uses its tongue and jaw to get the milk from the teat. The calf's mouth makes a gentle vacuum much like the action of the milking machine.

A modern dairy cow can make several tons of milk each year. The cow's udder is like a factory. The milk is made inside this "factory." The cow gets the raw material from her blood. For every gallon of milk a cow gives, 350 gallons of blood—carrying the raw materials—flow through the udder.

Inside the cow's udder are millions of parts to the factory. Each one can change the raw material into milk. These tiny cells are called *alveoli*. One cell is called an *alveolus*. Each alveolus is shaped like a balloon. As milk is made, it is stored in the hollow part of the balloon. Once this space is full, the alveolus stops making milk. Its work is done until milking time allows the finished product to leave the tiny storage cell in the factory.

The first thing the farmer does at milking time is to wash the cow's teats and udder. Washing the udder is important for two reasons. First, this removes any dirt that may be on the teats or udder. Clean milk can only come from clean cows. Washing the udder also sends a message to the cow's brain. This message tells the brain that it is milking time. The message travels along *nerves*. The nerves are very much like the ones that go from your finger to your brain. When your finger touches a stove, it doesn't take long for your brain to know that the stove is hot.

As soon as the cow gets the message that it is milking time, the brain turns on the *oxytocin*. Oxytocin is a *hormone* that goes into the blood stream and travels back to the udder. When it gets to the udder, it causes each little alveolus to squeeze its drop of milk into small tubes. These small tubes lead to larger ones and finally to the teat. Now the cow is ready for milking. As soon as the cow is milked, the alveoli go back to work. It's milkmaking time in the factory.

Cows are usually milked twice each day. Some farmers may milk high-producing cows three times a day. Cows are put into stanchions or enclosed in a milking parlor when they are milked.

Milk is always kept clean and cold from the moment it leaves the cow's udder. This makes the milk you drink as fresh, safe, and tasty as possible. The cow is really an amazing animal.

Things to do:

1. Visit a dairy farm. Write a short story about the way the dairyman milks his cows.
2. Milk a cow by hand. Could you get any milk? _____

   What did the dairyman do to the cow's udder before he started milking? Why? _____

   _____

   _____

   _____
3. Put your fingers in a baby calf's mouth. The calf will not bite you. What did it do? _____

   _____

   _____

   _____

   _____
4. Unscramble these words. If you have trouble, go back through the story and look for the *underlined* words. Do you know what most of them mean:

a. rdude _____

c. reenvs _____

e. solveual _____

g. ehmnoro _____

b. umvuca _____

d. lovelai _____

f. cinootxy _____

DOLLARS AND DAIRYING

How dairymen make money

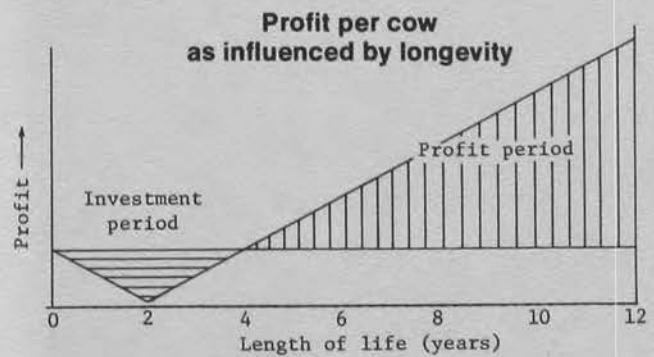
Profit is necessary for a dairy enterprise to thrive.

The success of a dairyman is based on his ability to do everything well: calf raising; feeding the herd; milking the herd; having a good breeding program; maintaining herd health; marketing the milk; and many other challenges. The better the management, the better the returns.

Most of the dairyman's income comes from selling milk. However, the sale of dairy beef is also important. Approxi mately 30 to 40 percent of the beef eaten in the U.S. comes from dairy herds. Income from the sale of breeding stock to some dairymen is significant, but most dairymen want to keep young stock for their own herd replacements.

Some dairymen figure it takes two lactations for a first-calf heifer to pay for her rearing cost plus her continuous keep. Even this is efficient since you have the cow as an asset and payment for your labor. The better the management, the more likely a cow will stay in the milking herd—reducing the average rearing cost of the herd. Fortunately in most instances, a cow's beef value will offset a good share of the cost to raise her if she has to go to market prematurely.

The importance of good cows staying in the herd can be shown by this figure.



Should you buy a calf?

The sooner you get started with a dairy project, the more you can learn. Dairy calves are popular for the first dairy project. The initial cost is usually cheaper, and raising and managing the calf is valuable experience. Budgeting the cost to raise a calf is good business. Going over your esti-mated cost with your parents or banker can convince them of your business ability.

The number of calves or the scope of the project depends mainly on resources such as time, facilities, and finance. Generally, money is available if time and facilities are available.

One animal may be best under some circumstances, but more animals may be more practical in other instances. The principle of diminishing returns may come into play raising calves. For example, if you can spare ½ hour each morning and night, but one calf only takes 15 minutes, then 2 calves would bring more returns for labor than would in-vesting more time than is needed on one. By the same token, trying to manage 10 calves when there are only re-sources to properly manage five calves may result in less net profit. The principle of diminishing returns says that each added increment of a resource returns less than the previous increment of the resource; at a given point, there is no advantage of adding more resources. Generally, there is one most profitable combination of production factors.

An example of the costs to raise a dairy heifer is shown in the following table. Your estimate of current costs can be filled in for your proposed dairy project. How does your cost estimates compare with the example? Costs are ex-pected to vary under each situation or plan.

The cost or the chance of a calf dying is considered in the example. The danger of this happening can be prorated or included in each calf's cost. Otherwise, one project will show all the risk of raising calves if and when a calf dies. Figuring the death risk as part of the cost to raise each calf will spread this cost over the whole calf-raising enterprise. With good management and some luck, this possible cost set-aside can be a bonus for above average success.

An auction sale is one of the many ways calves may be purchases.

Estimated cost to raise a dairy heifer

	Cost example per heifer	My estimate or actual cost
0 to 3 months		
Milk—1 gal./day; 6 wks. @ $7 cwt.	$ 24.00	
Calf starter: 3 lbs. per day; 8 wks. @ $6 cwt.	10.00	
Alfalfa hay: 1 lb. per day; 6 wks. @ $2 cwt.	1.00	
Total feed cost 0-3 months	$ 35.00	
Original cost of calf	$125.00	
Labor: 9 hrs. @ $2/hr.	18.00	
Vet. and medicine	5.00	
Building pens and equipment	3.00	
Bedding & miscellaneous	1.00	
Interest on investment @ 8%	3.00	
Death loss risk 10% of average cost values for 3 months	16.00	
Total cost to 3 months	$205.00	
Estimated value of heifer at 3 months	**(220.00)**	
3 TO 12 MONTHS		
Grain mix: 4 lbs./day @ $5 cwt.	$ 41.00	
Alfalfa hay: 7 lbs./day @ $2 cwt.	44.00	
Pasture: 1½ months @ 20c/day	9.00	
Total feed cost 3-12 months	$ 94.00	
Labor: 4½ hrs. @ $2/hr.	$ 9.00	
Housing and equipment	6.00	
Bedding & miscellaneous	5.00	
Interest on investment @ 8%		
(Est.—205.30 plus ½ of 98.20, for 9 months)	15.00	
Death loss 1% of average cost values at 3 and 12 months	3.00	
Total cost 3-12 months	$132.00	
Total cost to 12 months	$337.00	
Estimated value of heifer at 1 year	**(360.00)**	
12 TO 24 MONTHS		
Hay: 22 lbs./day for 6 months @ $35/ton	$ 70.00	
Pasture: 6 months @ 25c/day	46.00	
Total feed costs 12-24 months	$116.00	
Labor: 4 hrs. @ $2/hr.	$ 8.00	
Housing & equipment	3.00	
Breeding	15.00	
Interest 8%	33.00	
Death loss 1%	4.00	
Total cost 12-24 months	$179.00	
Total cost to 24 months	$516.00	
Estimated value of heifer at 2 years	**(550.00)**	

Written agreement for dairy project

A written agreement is businesslike, regardless of the amount of money involved. A record is important to record who is going to do what.

The agreement must be signed by those who are involved with the project. The agreement is a reminder of what was actually agreed upon when the project was being established.

Important items or areas to consider in a livestock agreement are:

1. Inclusive dates.
2. Financial arrangements.
3. Feed, housing, and equipment arrangements.
4. Labor and management responsibility.
5. Other areas unique to projects and individuals involved.
6. A copy for each party involved is good business.

Financial Agreement (Example A)

On this _____ day of _____, 19 _____, (1st party) _____ and (2nd party) _____, agree to the following: (1st party) _____ _____ can have a project of up to five dairy calves. The initial cost of calves shall be financed by the parents at _____ percent simple interest. The principal and interest shall be paid back to the lenders (or 2nd party) as each project is dispersed.

The feed, bedding, housing, and equipment will be provided by the 2nd party as payment for labor in assisting with the total farm chores by the 1st party. A record of the amount and current cost of all feed and bedding used shall be kept by the 1st party. All other expenses of the project will be the 1st party's responsibility. Marketing the project shall be mutually agreed upon by both the 1st and 2nd party. Marketing consultation with resource persons is suggested.

We understand and subscribe to the above agreement.

1st Party _____

2nd Party _____

Financial Agreement (Example B)

Period of time _____

Between whom _____

Feed and bedding _____

Housing and equipment _____

Breeding service _____

Health costs _____

Exhibiting _____

Registration and transfer _____

Milk value _____

Offspring _____

Dissolution of agreement _____

Miscellaneous _____

_____

We understand and subscribe to the above agreement.

_____
(Signature) (Date)

_____
(Signature) (Date)

Financial Agreement (Example C)

The financial agreement I have with my parent on this project animal is _____

_____

_____

_____

_____

_____

Member's signature _____

Parent's signature _____

Feeding the calves may be part of your agreement.

Points to ponder

1. Some costs can be reduced by good management.
2. Some costs may not apply to a particular situation.
3. Raising dairy calves increases your inventory (forced savings).
4. Family labor can be utilized to a good advantage.
5. Good animals can be developed for future herd replacements.
6. There is much satisfaction in hard work.
7. Some dairymen can buy replacements cheaper than by raising replacements.
8. There is a risk associated with raising calves; average losses are prorated.

Things To Do

a. Go to sales to find out what animals are selling for and what buyers look for.
b. Keep a financial record of your animal.
c. Consult with resource people.
d. Evaluate changes for the future.
e. Give a presentation on preventing death loss in dairy calves.
f. Give a presentation on importance of a business agreement.
g. Check with an insurance company concerning insuring dairy calves.

LEADERSHIP AND CAREERS

If you ask a 4-H'er what he liked most about 4-H, he will generally say making friends; enjoying companionship; helping others. That is what 4-H leadership is—it's a chance to develop your abilities as a leader while helping others, generally younger than you, to plan and carry out a project or experience that they will remember and cherish. Many of these experiences have led young men and women to consider lifelong careers in areas they have worked on or developed an interest in through 4-H. In this section, we suggest you choose, plan, and carry out two or more of the listed leadership and career activities. If you are repeating this section, at least one of the two should be one you have never done before. You may find the planning form in the "Do Your Own Thing" section useful in planning your activities:

Suggested activities:

1. Prepare and present a dairy demonstration at your local club meeting.
2. Participate in dairy judging activities.
3. Assist another member plan his dairy project for the year.
4. Invite another member to a dairy judging session.
5. List the businesses that provide goods or services for dairymen in your community.
6. Participate in dairy events such as a dairy sale or dairy educational meeting.
7. Visit a milk or cheese processing plant.
8. Assist another member complete his records for the year.
9. Assist another member prepare an exhibit for county fair or Dairy Day.
10. Prepare and present a dairy demonstration at your county demonstration day or at county fair.
11. Assist another member to prepare and present a dairy demonstration.
12. Arrange for a dairy industry tour for other dairy members in your club.
13. Visit with a veterinarian, county extension agent, or vocational agriculture instructor about agribusiness career opportunities in dairying.
14. Visit with a dairy farmer or a manager or employees of a dairy-related industry about production-related careers in dairying.
15. Attend an annual meeting of a dairy-related industry in your community.
16. Assist an adult dairy project leader in conducting a project meeting in dairy.
17. Assist another member prepare a "minute talk" or a demonstration on dairying.
18. Participate in State Junior Breed Association activities.
19. Visit an artificial breeding association office.
20. Plan and conduct a dairy project meeting for other members.
21. Assist another member plan and carry out a self-designed project.
22. Report your leadership activities on the reverse side of this sheet.

Suggested demonstrations

1. "How to prepare a demonstration"
2. "Planning the dairy project for the year"
3. "Evaluating the year's effort in the dairy project"

Suggested references:

Dairy magazines
Dairymen or businessmen in your community
County extension agents
Vocational agriculture instructors

Above: Giving an illustrated talk can be fun and educational. Left: Showing dairy cattle teaches sportsmanship.

1. Describe any help you have given other dairy members

Year	Description of activity	Whom did you help?

2. Describe any dairy committees you have served on:

Year	Kind of committee	Duties performed

3. Describe any club or county dairy activities you have helped to organize or conduct:

Year	Description of activity

4. Describe any dairy career activities participated in:

Year	Description

Lifetime dairy record

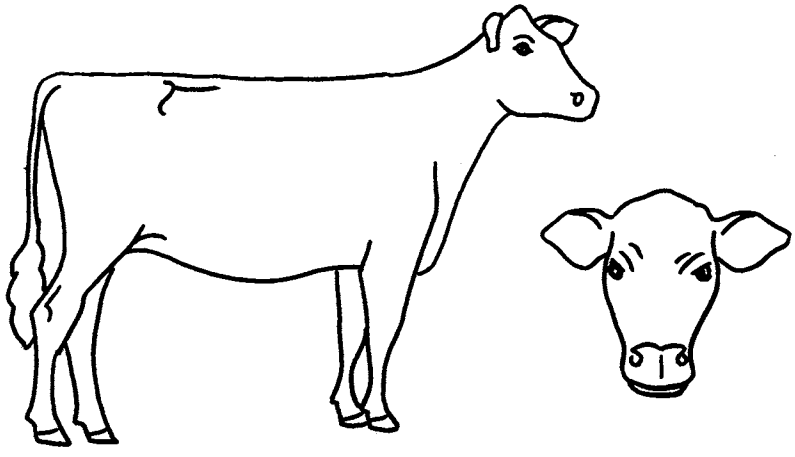
Name _____

Address _____

Club _____ **County** _____

One of these summary forms is needed for each 4-H dairy project animal. It contains permanent identification, production, and financial records.

I. IDENTIFICATION



Name _____ Breed _____

Date born _____ Date project started _____

Ear tag no. _____ Tattoo no. _____

If registered, registration no. _____

Sire's name _____ Registration no. _____

Dam's name _____ Registration no. _____
or ear tag no.

II. HEALTH RECORD

Date	Item	Cost	Date	Item	Cost

III. PRODUCTION SUMMARY

Age	Date Fresh	Total production				Value of Product	Estimated Feed Cost	Income Over Feed Cost	Cow Index*
		Days	Milk	%	Fat				

*Cow's rank in herd (EATA, Relative Merit, etc.) for milk.

IV. BREEDING AND CALVING RECORD

Breeding history for:	Date bred	Date bred	Date bred	Date bred	Settled to: (sire)	Calving date	Sex of calf	Calf's ear tag number and/or Record of disposal	Value
1st Calving									
2nd Calving									
3rd Calving									
4th Calving									
5th Calving									
6th Calving									

V. CERTIFICATION

The above animal was my project animal this year (update and sign year year).

Year	Parent's Signature	Member's Signature

Name _____ **County** _____

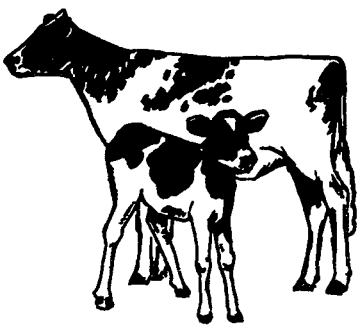
Address _____

Club Name _____

Birthdate: Day _____ **Month** _____ **Year** _____

Section and unit	Age level	Date completed	Date verified*
SELECTING A DAIRY PROJECT	Beginning		
MILK AND DAIRY PRODUCTS			
Milk	Beginning		
Ice cream	Beginning		
Cheese	Beginning		
Butter	Beginning		
Man and the dairy cow	Intermediate		
All about the dairy industry	Intermediate		
How milk is processed	Intermediate		
ANIMAL CARE			
Keeping your calf healthy	Intermediate		
Keeping your heifer healthy	Advanced		
DAIRY NUTRITION			
Feeding your calf	Beginning		
Colostrum	Intermediate		
Calf feeding	Intermediate		
Feeding your yearling	Intermediate		
What's in feed?	Advanced		
SELECTION AND BREEDING			
Dairy cattle families	Beginning		
Know the breeds	Intermediate		
Inheritance	Advanced		
REPRODUCTION			
Miracle of birth	Beginning		
A reproduction program	Intermediate		
How cows give milk	Intermediate		
DOLLARS AND DAIRYING	Advanced		
CAREERS AND LEADERSHIP	All Age Levels		

*Leaders or parents may wish to initial this column when members have satisfactorily completed each section or unit (this is only a guideline—not a requirement).



University of Minnesota
Agricultural Extension Service

4-H B-10 – Revised 1975