## Part I — Selective Breeding

Farmers work with artificial insemination companies that have a vast array of bulls they can choose from, and they often work with someone who trait mates their cows to find the perfect match for their genetic make-up. Through using this process of genetic selection, farmers have been able to dramatically improve both the productivity and longevity of cows in the past 50 years.

In this lab exercise, students should compare and contrast traits of three dairy cows and evaluate the list of six bulls on page 2 of this exercise. Identify the best dairy bull to balance each dairy cow's traits. Each cow and each bull has a "PTA Score" for milk, fat, protein, production life (a measurement of longevity), type (a measurement of their overall appearance), udder score, and feet and legs. The "PTA Score" compares the bull or cow's evaluation to the breed average for that trait.

Look for the traits that are negative in the cow and try to improve upon those with bulls that are positive in those traits. Make sure negative traits in the bull do not pull the cows' positive traits down. Try to choose the bull that balances all the cow's traits the best. The individual cows are listed below, and descriptions of the bulls are listed on Page 2. You may only use each bull once.

### Cow No. 1    Gracistate Rubens Tessie

**PTA Scores:**     -320 Milk    - 9 Fat    +4 Protein    +1.3 Production Life
+1.93 Type    +2.22 Udder Composite    +.95 Feet & Leg Composite

First Bull Choice for Tessie: _____

Explain Bull Choice: _____

_____

### Cow No. 2    R-S-F Prestar Revlon

**PTA Scores:**     -2351 Milk    - 59 Fat    - 52 Protein    +.1 Production Life
- .13 Type    +.03 Udder Composite    -.30 Feet & Leg Composite

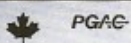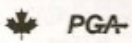First Bull Choice for Revlon: _____

Explain Bull Choice: _____

_____
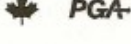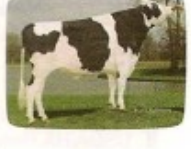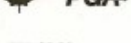
### Cow No. 3    Richdale Igniter Deanna

**PTA Scores:**     +148 Milk    +10 Fat    +2 Protein    +0.0 Production Life
+1.28 Type    +1.2 Udder Composite    +.14 Feet & Leg Composite

First Bull Choice for Deanna: _____

Explain Bull Choice: _____

_____

**RE DESIGN** ✿ PGAC

7H07514 REGANCREST DESIGN-ET EX (93)
USA60540176 100% RHA-NA TR TV TL TD
Eland x Encore x Mark

**USDA PTA Score:**

| | |
|---|---|
| -26 Milk | -.04 Protein |
| +.07 Fat | +1.8 Productive Life |
| +2.23 Type | +1.61 Udder Composite |
| +1.63 Foot & Leg Composite | |

**RELIABLE** ✿ PGA-

7H07901 SILMARILLION DN RELIABLE-ET VG (88)
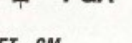USA60641700 100% RHA-NA TR TV TL TD
Dane x Terry x Barlo

**USDA PTA Score:**

| | |
|---|---|
| +1,166 Milk | -.03 Protein |
| -.01 Fat | +1.7 Productive Life |
| +0.68 Type | +0.72 Udder Composite |

**BUTCH** ✿ PGA-

7H08625 MR SCHULTZ OMAN BUTCH-ET VG (88)
USA135872035 100% RHA-NA TV TL TD
O Man x BW Marshall x Addison

**USDA PTA Score:**

| | |
|---|---|
| +746 Milk | -.09 Protein |
| -.05 Fat | +1.6 Productive Life |
| +0.08 Type | +0.94 Udder Composite |

**SILVA** ✿ PGA-

7H08659 GLEN-D-HAVEN OMAN SILVA-ET EX (93)
USA52323649 100% RHA-NA TR TV TL TD
O Man x Aaron x Elton

**USDA PTA Score:**

| | |
|---|---|
| +1,556 Milk | -.03 Protein |
| -.10 Fat | +0.7 Productive Life |
| +1.06 Type | +0.37 Udder Composite |

**MR SAM** ✿ PGA-

7H06758 REGANCREST-MR DRHAM SAM-ET GM
USA207184639 100% RHA-NA TR TV TL
Durham x Emory x Prelude

**USDA PTA Score:**

| | |
|---|---|
| +146 Milk | +.01 Protein |
| +.10 Fat | +1.2 Productive Life |
| +1.61 Type | +1.52 Udder Composite |

**MUFFIN** ✿ PGA-

7H08398 FAR-O-LA FIN MUFFIN-ET
USA61196049 100% RHA-NA TV TL TD
Finley x Convincer x Bellwood

**USDA PTA Score:**

| | |
|---|---|
| +442 Milk | +.04 Protein |
| +.00 Fat | +1.2 Productive Life |
| +1.89 Type | +2.22 Udder Composite |

**Additional Lab Questions:**

1. Which bulls did you not use? _____
   Why not? _____
   _____

2. Name one other species in which selective breeding may be used? _____

3. As selective breeding improves the genetics of dairy cows, do you think the scores of existing bulls get higher or lower? _____ Why? _____
   _____

## Part II Lab Component:

*Needed for exercise (per student or group)*

 - *3 cups spinach*                     - *Baby or whole carrots*

 - *1 cheese stick*                     - *One 12 oz. cup of orange juice*

A healthy, well-cared-for cow will give more milk. The way farmers care for their cows and how they feed them has helped to increase the amount of milk cows give over the past 50 years.

♦ Just like our diets, a cow's diet must be balanced based on her stage of life. For instance, a baby calf requires higher energy foods to fuel her rapid growth.

♦ A cow that has just given birth requires higher levels of certain nutrients to replenish her body. Farmers must adjust feed rations to accommodate those needs.

♦ To balance cows' diets to meet their precise nutrient needs, farmers work closely with a nutritionist and use a variety of feed products.

♦ Farmers ensure cows have a fresh, clean supply of water throughout their life cycle. Cows have constant access to fresh, clean water.

Students should use carrots, spinach, cheese and orange juice to make a snack of a spinach salad and orange juice that meets the required nutrients listed on the page. They should use a weight scale to measure the right amount of each feed. Measuring cups can be used in place of the scale if necessary. This exercise is designed to simulate how farmers use a large feeding scale to balance and weigh each feed to meet the cow's precise nutrient needs

## Steps to Lab Exercise:

1. Weigh each of the foods and record. If you are using measuring cups, here are translations:
    ♦ 1 cup of Spinach weighs 30 grams.
    ♦ 2 baby carrots weigh about 15 grams.
    ♦ 1 stick of string weighs about 24 grams.

2. Divide carrots, spinach and orange juice into serving sizes. A serving size for each is as follows:
    ♦ Carrots — 15 grams
    ♦ Spinach — 30 grams
    ♦ Orange Juice — 8 ounces

3. Use the table on the back of this page to balance the four foods to make a snack of spinach salad and orange juice with the following total nutrient content:
    ♦ 299 total calories
    ♦ 13 grams of protein
    ♦ 370 mg of Calcium
    ♦ 2.65 mg of Iron

**4.** Use the table on page 2 of this exercise to determine what percentage of the total salad each food represents in weight.

Use a piece of scrap paper to balance the four foods to meet the nutrient requirements for the snack. Blend the ingredients together once you have determined the right amounts of each. Write the correct answers below and include amount of each nutrient provided by food. Calculate what percentage of the salad's total weight each food is.

|  | Weight (in grams) | Calories | Protein (grams) | Calcium (mgs) | Iron (mgs) | Percent of Total Weight |
|---|---|---|---|---|---|---|
| **Spinach** |  |  |  |  |  |  |
| **String Cheese** |  |  |  |  |  |  |
| **Carrots** |  |  |  |  |  |  |
| **Orange Juice** |  |  |  |  |  |  |

*Total Amount Required for Snack: 299 calories, 13 g Protein, 370 mg Calcium & 2.65 mg Iron. Nutrients found in one serving size of each food are listed below.*

| String Cheese | Spinach | Carrots | Orange Juice |
|---|---|---|---|
| 1 stick (24 grams) | 30 grams | 15 grams | 8 ounces (226 grams) |
| 100 calories | 7 calories | 5 calories | 112 calories |
| 7.2 grams protein | 1 grams protein | 0 grams protein | 2 grams protein |
| 214 mg Calcium | 39 mg calcium | 0 mg calcium | 26 mg calcium |
| 0 mg Iron | ½ mg iron | ½ mg iron | 0.1 mg iron |

4. Review lab exercise.

♦ What nutrient was the hardest to balance? Why? _____

_____

♦ What happened if you tried to add more than one serving of string cheese? _____

_____

_____

♦ What happened when you added too much orange juice? _____

_____

♦ Our bodies need 18 essential nutrients for good health. How do you think adding 10 more nutrients to the equation would change this exercise? _____

_____

_____