

Chapter 9

Meat, Poultry & Fish



Meat, poultry, and fish are important sources of protein, iron, thiamin, riboflavin, niacin, and other B complex vitamins. The iron in meat, poultry, and fish is primarily **heme iron**, a form of iron which is more easily absorbed by the human body than the **nonheme** form found in plant foods and fortified grain foods. Pairing vitamin C food sources with nonheme iron-rich foods during snacks and meals can improve iron absorption.

While meat is a significant component of most American's diets, some people do not consume meat for religious, cultural, and/or personal reasons. Individuals who do not consume meat, poultry, or fish need to ensure an adequate intake of alternative sources of nutrients such as iron, zinc, vitamin D, and vitamin B₁₂. Individuals who do consume meat should examine the fat content of meat products and learn how to select leaner cuts of meat. Low fat preparation techniques should be encouraged along with proper serving sizes. In order to be effective in promoting a healthful diet, you need to be knowledgeable about meat, poultry, and fish products. You should be familiar with their nutrient composition, their cost, common preparation techniques, and ways to incorporate them into a balanced diet.

 THINK ABOUT IT

◆ List a few suggestions for decreasing the fat content of meat, poultry, and fish products.

◆ List 3 things you would like to know about meat, poultry, and fish or 3 questions you have relating to meat, poultry, and fish.

1.

2.

3.

LAB ASSIGNMENT:

Meat, Poultry & Fish

There are many different food science principles to be explored with meat, poultry, and fish. This laboratory exercise will focus on various preparation techniques for meat, poultry, and fish.

Overview:

Each group of students will broil steaks and prepare chicken and fish according to their assigned techniques.

Kitchen 1: Broiled steak

Fried chicken, Baked chicken
Poached fish, Steamed fish

Kitchen 2: Broiled steak

Poached chicken, Steamed chicken
Fried fish, Baked fish

Kitchen 3: Broiled steak

Fried chicken, Baked chicken
Poached fish, Steamed fish

Kitchen 4: Broiled steak

Poached chicken, Steamed chicken
Fried fish, Baked fish

Kitchen 5: Broiled steak

Fried chicken, Baked chicken
Poached fish, Steamed fish

Kitchen 6: Broiled steak

Poached chicken, Steamed chicken
Fried fish, Baked fish

Kitchen 7: Broiled steak

Fried chicken, Baked chicken
Poached fish, Steamed fish

Kitchen 8: Broiled steak

Poached chicken, Steamed chicken

Fried fish, Baked fish

Evaluation Tools:

- Evaluation of Broiled Steak
- Evaluation of Poultry and Fish

Directions:

1. Always begin by washing your hands and thoroughly cleaning/sanitizing work surfaces.
2. Gather ingredients needed for assigned steak, chicken, and fish recipes.
3. Calibrate your thermometer in an ice bath (see the Food Safety lab for instructions).
4. Complete all assigned recipes.
5. When your steaks are cooked, taste a sample of each and complete the “Evaluation of Broiled Steak.”
6. While waiting for your chicken or fish to cook, read “Meat, Poultry & Fish Science,” and “Meat, Poultry & Fish Tips for Consumers.” Complete the “Meat, Poultry & Fish Questions.”
7. Students in odd numbered kitchens will need to partner with students working in even numbered kitchens for taste testing the chicken and fish. When the chicken and fish are cooked, taste a sample of each variety and complete the “Evaluation of Poultry and Fish.”
8. Clean your work station and check out before leaving.

RECIPES:

Cooking Methods for Meat, Poultry & Fish

Broiled Steak

Ingredients:

- 1/4 teaspoon meat tenderizer, powder form
- 2, 3-ounce portions round steak, 1-inch thick
- 3 ounces sirloin steak, 1-inch thick

Method:

1. Rub one of the 3-ounce portions of round steak with the meat tenderizer. Pierce the meat a few times on each side with a fork and place on a baking sheet.
2. Add the second portion of round steak and the sirloin steak to the baking sheet.
3. Adjust an oven rack, if needed, so it is 3-5 inches below the heat source.
4. Set the oven to broil and place the baking sheet on the rack. Keep the oven door ajar if using an electric range.
5. Broil for about 2-3 minutes or until the top side is brown. Carefully, turn the meat over with tongs and broil until the other side browns. Check the internal temperature using a thermometer to ensure the steak has reached 145° Fahrenheit.

Fried Chicken

Ingredients:

1 chicken breast	2 tablespoons flour, all-purpose
1/4 teaspoon salt	Pinch pepper
Pinch paprika	1 tablespoon vegetable oil

Method:

1. Remove excess moisture from the chicken breast by patting it with a paper towel. For large breasts, filet them by cutting in half lengthwise.
2. Combine the flour, salt, pepper, and paprika in a pie pan.
3. Coat the chicken with the seasoned flour. Shake off the excess.
4. Heat the oil in a small, heavy sauté pan over medium heat.
5. Carefully place the chicken in the sauté pan.
6. Brown both sides of the chicken. Reduce the heat.
7. Continue cooking until the chicken reaches an internal temperature of 165° Fahrenheit.

Baked Chicken

Ingredients:

1 chicken breast	2 tablespoons flour, all-purpose
1/4 teaspoon salt	Pinch pepper
Pinch paprika	1 tablespoon margarine

Method:

1. Preheat oven to 425° Fahrenheit.
2. Remove excess moisture from the chicken breast by patting it with a paper towel. For large breasts, filet them by cutting in half lengthwise.
3. Combine the flour, salt, pepper, and paprika in a pie pan.
4. Melt the margarine.
5. Dip the chicken breast in the melted margarine. Dredge in the flour mixture.
6. Place on a baking sheet.
7. Bake for 30 minutes or until the chicken reaches an internal temperature of 165° Fahrenheit.

Poached Chicken

Ingredients:

1 medium carrot, fresh	1 stalk celery, fresh
1 chicken breast	1/8 teaspoon peppercorns
1 cup chicken stock	

Method:

1. Wash the carrot and the celery. Peel the carrot.
2. Quarter the carrot and the celery stalk. Place in the bottom of a small, flat pan.
3. For large breasts, filet them by cutting in half lengthwise. Place the chicken breast on top of the vegetables. Add the peppercorns. Then, add enough chicken stock to cover the chicken breast.
4. Cover the chicken with a pan lid (use parchment paper or foil to cover if no lids are available).
5. Place the pan on a burner. Heat the chicken on the stove over medium-low heat until bubbles appear around the edge of the pan.
6. Reduce the heat. Simmer for about 15 to 20 minutes until the chicken reaches an internal temperature of 165° Fahrenheit.

Steamed Chicken

Ingredients:

1 chicken breast	1/4 teaspoon salt
Dash pepper	2 cups water

Method:

1. For large breasts, filet them by cutting in half lengthwise.
2. Season chicken by rubbing with salt and pepper.
3. Pour the water into a medium pot. Fit a steamer basket into the pot. The water should not touch the basket.
4. Place the chicken in the steamer basket. Cover the pot and bring the water to a boil.
5. Steam for 25 minutes or until chicken reaches an internal temperature of 165° Fahrenheit.

Fried Fish

Ingredients:

1 fish filet	1 tablespoon flour, all-purpose
1/8 teaspoon salt	Dash pepper
Dash paprika	2 tablespoons margarine
1 tablespoon vegetable oil	

Method:

1. Remove excess moisture from the fish filet by patting with a paper towel.
2. Combine the flour, salt, pepper, and paprika in a pie pan.
3. Melt the margarine. Dip the fish filet in the margarine and then in the seasoned flour.
4. Heat the oil in a small sauté pan over medium-low heat.
5. Carefully place the fish in the sauté pan.
6. Fry until the filet is brown on both sides and reaches an internal temperature of 145° Fahrenheit.

Baked Fish

Ingredients:

1 fish filet	1/4 cup half and half
1/4 teaspoon salt	Dash pepper
Dash paprika	1 tablespoon margarine
1/2 cup breadcrumbs	

Method:

1. Preheat oven to 500° Fahrenheit.
2. Remove excess moisture from the fish filet by patting with a paper towel.
3. Pour the half and half into a small bowl. Add the salt, pepper, and paprika.
4. Melt the margarine. In a pie plate, mix the margarine and the breadcrumbs.
5. Dip the fish in the half and half.
6. Coat the fish with the breadcrumbs and place on a baking sheet.
7. Bake the fish until it is golden and flakes easily with a fork. The fish should reach an internal temperature of 145° Fahrenheit.

Poached Fish

Ingredients:

1 medium carrot	1 stalk celery
1 fish filet	1/8 teaspoon peppercorns
1 cup fish stock or water	

Method:

1. Wash the carrot and the celery. Peel the carrot.
2. Quarter the carrot and the celery stalk. Place in the bottom of a small, flat pan.
3. Place the fish on top of the vegetables. Add the peppercorns. Then, add enough fish stock or water to cover the fish filet.
4. Cover the fish with a pan lid (use parchment paper or foil to cover if no lids are available).
5. Place the pan on a burner. Heat the fish over medium-low heat until bubbles appear around the edge of the pan.
6. Reduce the heat. Cover with the lid and simmer for 8 to 12 minutes or until the fish flakes easily with a fork and reaches an internal temperature of 145° Fahrenheit. (Note: Do not let the water boil.)

Steamed Fish

Ingredients:

1 fish filet	1/4 teaspoon salt
Dash pepper	Dash paprika
2 cups water	

Method:

1. Season the fish by rubbing with salt, pepper, and paprika.
2. Pour the water into a medium pot. Fit a steamer basket into the pot. The water should not touch the basket.
3. Place fish in the steamer basket. Cover the pan and bring the water to a boil.
4. Steam for 10 minutes or until tender and flakes easily with a fork. The fish should reach an internal temperature of 145° Fahrenheit.

EVALUATION OF BROILED STEAK

1. Taste each variation and place the numerical score for each characteristic in the upper left hand corner of each box. (Score System: 1=very poor; 2=poor; 3=fair; 4=medium; 5=good; 6=very good; 7=excellent)
2. Provide comments/descriptions to justify the numerical score.

VARIETY	APPEARANCE	TEXTURE/ TENDERNESS	FLAVOR	OVERALL QUALITY
ROUND STEAK WITH MEAT TENDERIZER				
ROUND STEAK				
SIRLOIN STEAK				

EVALUATION OF POULTRY AND FISH

1. Taste each variation and place the numerical score for each characteristic in the upper left hand corner of each box. (Score System: 1=very poor; 2=poor; 3=fair; 4=medium; 5=good; 6=very good; 7=excellent)
2. Provide comments/descriptions to justify the numerical score.

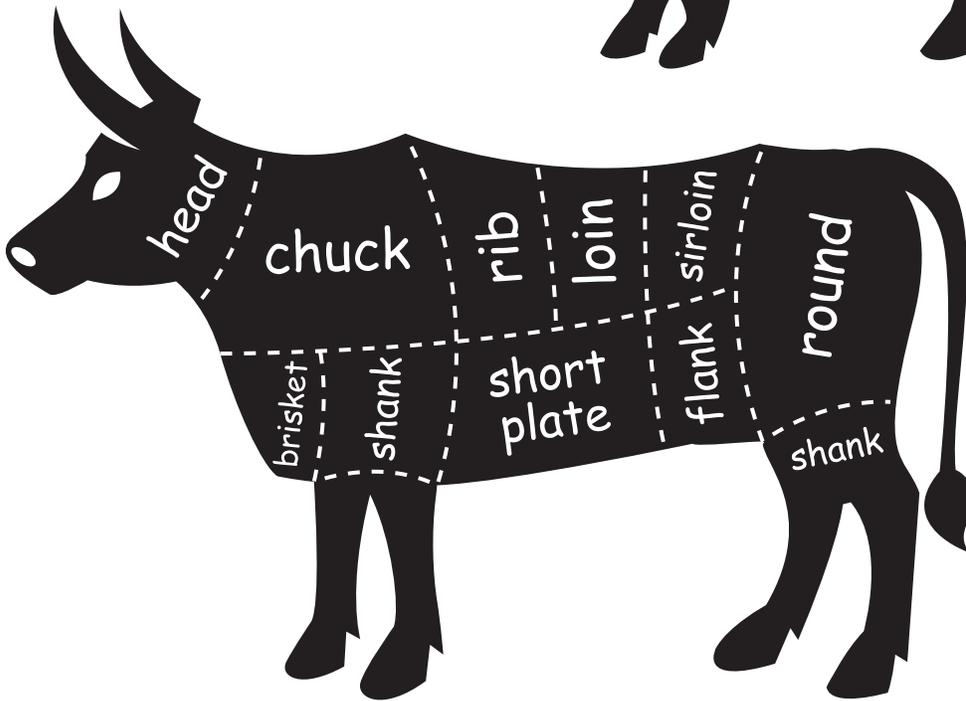
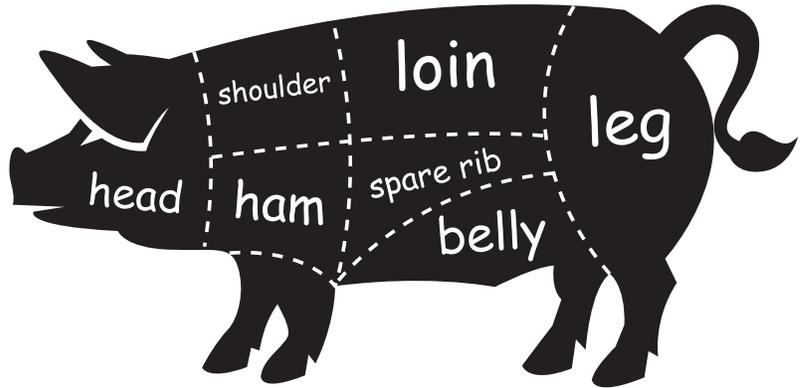
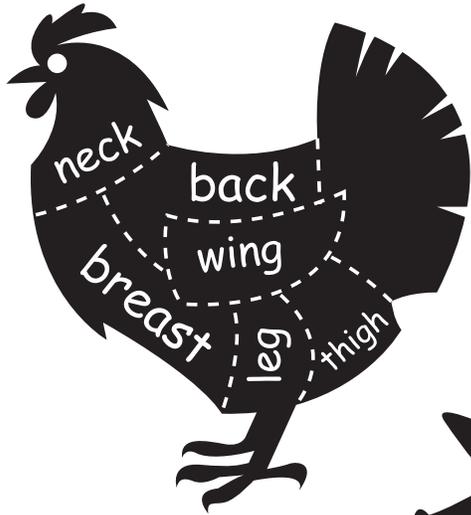
VARIETY	APPEARANCE	CONSISTENCY/ TEXTURE	TENDERNESS	FLAVOR	OVERALL QUALITY
FRIED CHICKEN					
BAKED CHICKEN					
POACHED CHICKEN					
STEAMED CHICKEN					
FRIED FISH					
BAKED FISH					
POACHED FISH					
STEAMED FISH					

LEARN MORE:

Meat, Poultry & Fish Science

- ◆ Meat is the edible flesh and organs of animals and fowl. “Red” meat comes from animals such as cows, pigs, and sheep, while “white” meat comes from fowl such as chickens, turkeys, and ducks. Meat is a good source of high-quality protein, various B vitamins, iron, phosphorus, zinc, and magnesium.
- ◆ Muscle tissue is the main component of meat and is made up of bundles of muscle fibers held together by connective tissue. The size of the muscle fiber bundles and amounts of connective tissue vary depending on the cut of meat. Muscles with small bundles and less connective tissue are tender and juicy.
- ◆ **Collagen** is the most abundant type of connective tissue. It is fibrous and stringy. Cuts of meat from parts of the animal that do a lot of moving have higher collagen contents and therefore, are less tender. Chuck, round, flank, and shoulder cuts have more collagen; while rib and loin cuts have the least collagen. Cuts of meat from older animals are often tougher because age influences collagen content.
- ◆ Cooking with moist heat methods (braising and stewing) over an extended period of time converts collagen to gelatin, rendering high-collagen meats tender.
- ◆ Dry heat methods of cooking that are appropriate for rib and loin cuts include broiling, roasting, and frying.
- ◆ **Marbling** is the amount of fat within the muscle. As fat melts with cooking, it lubricates the muscle fibers and helps lock in moisture. The degree of marbling is associated with tenderness, juiciness, and flavor. The same cuts that tend to be lower in collagen also tend to be more marbled.
- ◆ Other methods of tenderizing less tender cuts of meat involve grinding or cubing to break up the connective tissue. Products containing enzymes such as tenderizing powders or marinades can be used to tenderize meats too. Enzymes include papain from papaya, bromelain from pineapple, ficin from figs, and actinidin from kiwi.
- ◆ Fish muscle is unique. It contains a more delicate type of connective tissue, and the muscle fibers are much shorter. Fish lack marbling (solid fat); instead oil is distributed more evenly throughout the flesh.
- ◆ Fish are also unique because, as cold-blooded creatures, their bodily enzymes are able to function at cooler temperatures than those of mammals. Continued enzyme activity helps explain the relatively short shelf-life of fresh fish and shellfish.

APPROXIMATION OF POULTRY, PORK & BEEF CUTS



Meat, Poultry & Fish Tips for Consumers

- ◆ Americans consuming a 2,000 kilocalorie diet should eat 5 1/2 ounces from the Protein Foods group every day. Low-fat or lean meats, poultry, and fish should be chosen more often than higher fat meats.
- ◆ Nutritionists recommend eating fish at least two times a week. Fish is a great source of high quality protein, is low in saturated fat, and can be a good source of heart-healthy **omega-3 fatty acids**. Salmon, sardines, herring, lake trout, and albacore tuna are especially rich sources of omega-3 fatty acids.
- ◆ Despite their healthful qualities, some fish are contaminated with mercury. Shark, swordfish, king mackerel, and tilefish have the highest mercury contents and should be avoided by pregnant women, women who might become pregnant, nursing mothers, and young children. For most people, the risks associated with consuming mercury from other fish are minimal, but pregnant women and young children should take special care in choosing their fish.
- ◆ Fresh fish is relatively expensive and among the most perishable of foods, so it pays to select and store fish correctly. First, be sure to buy fish from a trusted supplier. Next, check that the skin springs back when touched and there isn't a fishy smell. If buying whole fish, check for clear eyes, shiny skin, and red gills. Then, store the fish on ice. Even in the refrigerator, fish is best stored on ice. Wrap fish well in plastic wrap and drain off melting water often, replacing ice as needed. Cook the fish as soon as possible, at least within 2 days, or freeze. Fish may be stored for 3 to 6 months in the freezer.
- ◆ When shopping for meat, any cut that has "loin" in the name will be among the leanest meat that can be bought. Sirloin, tenderloin, round, and chuck tend to be lower in fat. Make meat selections at the end of the grocery trip to minimize the time it is held at room temperature. On hot days, bring a cooler with ice packs to store meat safely on the way home.
- ◆ Meat and poultry may be stored in their original store packaging for a day or two. For freezing, or for longer refrigerator storage, overwrap non-vacuum sealed packages in plastic film, freezer paper, or foil.
- ◆ Fresh whole meats (beef, lamb and pork roasts, and steaks or chops) may be stored in the coldest part of the refrigerator for 3-5 days, and ground meats and poultry for 1-2 days before cooking. Be sure to store meats so that fluids cannot leak and contaminate other foods. For longer storage periods, store meat in the freezer.

- ◆ Different types of meat have different recommended freezer storage times to retain optimal quality.
- ◆ Ground beef is one of the most commonly purchased forms of meat. It is composed of chopped beef from primal cuts (round, loin, etc.) and trimmings. The following chart shows the calories, protein, and fat in a 3-ounce broiled serving of various selections of ground beef, cooked well-done:

	73% Lean	80% Lean	85% Lean	90% Lean	95% Lean
Calories	248	230	213	185	145
Fat (g)	18	15	13	10	6

Source: <http://www.extension.iastate.edu/NR/rdonlyres/CDC66BB1-E8D5-49A9-8DE9-BBBD3573C086/0/groundbeef.pdf>

- ◆ Reduce the amount of fat in ground beef crumbles (used for chili, sloppy Joes, tacos, etc.) by up to 50% by following these steps: (1) Remove the cooked crumbles from the skillet to a plate lined with 3 layers of white paper towels, blot the top with more paper towels, and let sit for 1 minute. (2) Place beef in a mesh strainer/colander and pour very hot (150-160° Fahrenheit) water over it to rinse off more fat. Drain for 5 minutes.
- ◆ Much of the fat found in chicken and other poultry lies just under the skin. Leave the skin on during cooking for juicier, more flavorful chicken, but remove it before eating for a healthier meal.
- ◆ Some research suggests that grilling meats can cause the formation of cancer-causing substances. Reduce these carcinogens by grilling lean cuts of meat and marinating meats before grilling to prevent charring. Removing charred or burned sections may also help to reduce consumption of carcinogens.
- ◆ Processed meats, such as deli meats, sausages, and hotdogs contain added sodium. Even whole muscle meats, such as turkeys and roasts, sometimes have a sodium solution injected into it in order to prevent the meat from drying out during cooking. Read the nutrition facts label to reduce sodium intake.
- ◆ Pregnant women should cook their deli meats and all processed meats to steaming hot (160° Fahrenheit) to prevent contracting Listeriosis; a bacteria that can lead to a miscarriage or premature birth.
- ◆ Cook meats to proper internal temperatures. To determine what the internal temperature of meats, poultry, or fish is, use a bimetallic stemmed meat thermometer. Insert the meat thermometer in the thickest part of the meat without allowing the sensing area to touch bone, which may be at a higher temperature and give a false reading. For thin foods such as hamburgers or thin chicken breasts, insert the thermometer horizontally so the sensing area is fully covered.

Meat, Poultry & Fish Questions

1. You prepared sirloin steak and round steak by broiling. Was this an appropriate cooking method for both cuts of meat? Why or why not? What other techniques would you recommend for cooking each type of steak?
2. Describe the effects of using a tenderizer on the round steak. Which cuts of meat may benefit from a tenderizer?
3. Which ingredient in the tenderizer was responsible for tenderizing the meat? Where does this ingredient naturally occur?

Meat, Poultry & Fish Teacher Tips

Overview

This is an expensive laboratory. If budget is limited, review the principles demonstrated and select those recipes that are most important to your course. You may re-size the recipes to match the needs of the number of students in class.

- ◆ This lab experience will take a full class period of 2 ¼ hours to complete.
- ◆ Students will experiment with different methods of cooking foods including steaming, stir frying, microwaving, poaching, baking, grilling, roasting, boiling, pan browning, stewing, and broiling to see the effects on tenderness.
- ◆ Students will experiment with chemical and mechanical tenderizing techniques.
- ◆ Students will experience the sensory characteristics of different meats, poultry, and plant proteins.
- ◆ Be sure to tell students the type of fish that was purchased (e.g. Tilapia).

Lab Management

Demonstrations

- ◆ This is a good opportunity to demonstrate and review knife selection, care, storage, and safety.
- ◆ A video or live demonstration of the preparation of sushi may be of interest to students.
- ◆ Discuss the purpose of using a meat tenderizer, how they work (i.e. enzymes), and what meats would benefit from tenderizers. Example enzymes that may be used in tenderizers are papain from papaya or bromelain from pineapple.
- ◆ Have students calibrate their meat thermometers. Demonstrate how to use a meat thermometer on thin foods.
- ◆ Demonstrate the use of a pressure cooker for a less tender cut of meat.
- ◆ Prepare a chicken breast on a George Foreman (or similar) grill. Observe and measure the fat drippings.
- ◆ If students are not familiar with frying, deep fat fry chicken tenders in a fry baby or other fryer.

Time Management

- ◆ Seafood is cooked at higher temperatures for shorter time than meat to prevent falling apart.
- ◆ Prevention of excess shrinkage and toughening of proteins during cooking not only enhances the palatability of protein foods, but assures more value for money spent.

Sensory Evaluation

- ◆ If there are people who do not eat meat, they do not have to try it, but they can talk to others about the sensory characteristics. Even though they do not eat meat, they still must learn how meats are prepared in order for them to be able to communicate with their patients or clients who do eat meat.
- ◆ Instruct the students on how to display and when to evaluate the products. As time allows, a student from each kitchen should comment about the preparation of the dish and the final product.
- ◆ Evaluate at the same time, side by side: flank steaks and cube steak; and ground beef patties.

Nutrition Points for Discussion:

- ◆ The Dietary Guidelines for Americans recommend decreasing the amount of fat in the diet. This laboratory used very little added fat in the preparation of protein foods.
- ◆ The Dietary Guidelines for Americans recommend decreasing the amount of saturated fat in the diet. Saturated fat is found in animal products. This laboratory includes several recipes where smaller amounts of meat or poultry are used.
- ◆ Beans and peas could be discussed in this lab since they are unique foods in that they are excellent sources of protein and also provide nutrients similar to those found in meat, poultry, and seafood such as iron and zinc.
- ◆ Eggs could be discussed in this lab since they are an excellent and affordable source of protein.
- ◆ Eating approaches like the Mediterranean Diet and the DASH (Dietary Approaches to Stop Hypertension) Diet recommend more plant proteins and less meat and poultry than the USDA dietary pattern.
- ◆ Discuss the function of fat in each of the recipes where it is used.
 - Frying is a fast way to transfer heat and cook meat. How would the chicken thighs (baked in this lab) be different if they were breaded and fried?

- ◆ Salt has either been eliminated from the traditional recipe or listed as optional. Discuss with the students the function of salt in these recipes. What other spices could be used if the students find them lacking in flavor?
- ◆ Select a nutrition tip for each of the recipes. For example:
 - For the steamed fish filet, how would this fish be different if it had been either pan or deep fat fried?
 - Stir-frying is a technique that uses high heat and minimal fat.

SHOPPING LIST: (8 SECTIONS)

Item	Utilized Unit/Lab Section	Purchased Unit
Carrots	8	8
Celery stalks	8	1 bunch
Chicken stock	4 cups	1 cont.
Fish stock	4 cups	1 quart
Meat tenderizer	2 tsp.	1 cont.
Vegetable oil	8 TBSP	1 sml. cont.
Flour, all-purpose	10 oz	1 bag
Salt	2 TBSP	1 cont.
Pepper	TT	1 cont.
Pepper corns	1 tsp.	1 cont.
Paprika	TT	1 cont.
Bread Crumbs	2 cups	1 cont.
Margarine	8 oz	1 box
Half and Half	½ cup	1 pint
Chicken breast	16	16
White fish filets	16	16
Sirloin steak	8, 3 oz	24 oz
Round steak	16, 3 oz	48 oz