Name: _____ Date: _____

Why a Seared Steak Beats a Boiled One

Circle group

Put meat in boiling water, and it turns gray and plain. Put the same meat in a hot, dry pan, and it gets a deep brown crust and a rich smell. The reason is chemistry and heat.

The browning comes from the Maillard reaction. It is named for the French scientist who first described it. It happens when amino acids meet some sugars in heat. Amino acids are the building blocks of protein. The reaction makes hundreds of new flavors and smells. It also makes brown color. That is why toast, roasted coffee, bread crust, and fried potatoes taste richer than the raw foods.

The reaction goes faster as it gets hotter. It also works best when the food is dry on the outside. Water in a pot cannot get hotter than its boiling point. So boiled food never gets hot enough to brown. In a hot pan, the outside dries fast and gets hot enough.

Cooks use this. They pat meat dry first, because wet meat must dry before it can brown. They do not crowd the pan. Too much food makes steam, and steam cools the pan. Browning is not the same as caramelization. Caramelization is sugar heated alone.

Questions

1. What makes the brown crust on meat in a hot, dry pan?

_____

_____

2. What two kinds of things meet in the Maillard reaction?

_____

_____

3. Why does boiled meat stay gray?

_____

_____

4. Why do cooks pat meat dry first?

_____

_____

5. Why does a crowded pan make pale food?

_____

_____

6. Why does toast taste richer than plain bread?

_____

_____

Words to know

reaction: a chemical change that makes new substances
amino acids: the small building blocks that make up proteins
caramelization: the browning of sugar when it is heated

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

Why a Seared Steak Beats a Boiled One

Triangle group

Put a piece of meat in boiling water and it turns gray and bland. Put the same piece in a hot, dry pan and it develops a deep brown crust with a rich smell. The difference comes down to chemistry, and to temperature.

The browning is caused by the Maillard reaction, named for the French scientist who first described it. It happens when amino acids, the building blocks of protein, meet certain sugars in the presence of heat. The reaction creates hundreds of new flavor and aroma molecules, and also brown pigments. It is the reason toast, roasted coffee, bread crust, and fried potatoes all taste richer than their raw ingredients.

The reaction speeds up as the temperature rises, and it works best on surfaces that are dry. This explains the boiling puzzle. Water in a pot cannot get hotter than its boiling point, so the surface of boiled food never gets hot enough to brown well. In a hot pan, by contrast, the surface dries out quickly and the temperature climbs high enough for browning to begin.

Cooks use this knowledge. They pat meat dry before searing it, because moisture on the surface would have to boil away first. They avoid crowding the pan, since too much food gives off steam that cools the pan and keeps everything pale. Browning is not the same as caramelization, which involves only sugar heated by itself, although the two can happen together in a pan of cooking onions.

Questions

1. What causes the brown crust on meat cooked in a hot, dry pan?

_____

_____

2. Which two kinds of ingredients meet in the Maillard reaction?

_____

_____

3. Why does boiled meat stay gray?

_____

_____

4. Why do cooks pat meat dry before searing it?

_____

_____

5. Why does a crowded pan produce pale food?

_____

_____

6. Why does toast taste richer than plain bread?

_____

_____

Words to know

reaction: a chemical change that makes new substances
amino acids: the small building blocks that make up proteins
aroma: a pleasant smell
pigments: substances that give something its color
caramelization: the browning of sugar when it is heated

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

Why a Seared Steak Beats a Boiled One

Square group

Place a piece of meat in boiling water and it turns gray and bland; place the identical piece in a hot, dry pan and it develops a deep brown crust and a rich, appealing aroma. The explanation lies in chemistry, and in temperature.

The browning is produced by the Maillard reaction, which is named for the French scientist who first described it. It occurs when amino acids, the building blocks of protein, encounter certain sugars in the presence of heat. The reaction generates hundreds of new flavor and aroma molecules, along with brown pigments, and it is the reason toast, roasted coffee, bread crust, and fried potatoes all taste considerably richer than their raw ingredients.

The reaction accelerates as the temperature climbs, and it proceeds most effectively on dry surfaces. This resolves the puzzle of the boiled meat. Water in a pot cannot become hotter than its boiling point, so the surface of boiled food never reaches a temperature high enough for proper browning. In a hot pan, by contrast, the surface dries out quickly and the temperature rises far enough for browning to begin.

Cooks take advantage of this knowledge. They pat meat dry before searing it, because any moisture on the surface must boil away first, and they avoid crowding the pan, since too much food releases steam that cools the pan and leaves everything pale. Browning should not be confused with caramelization, which involves only sugar heated by itself, although the two can occur together in a pan of cooking onions.

Questions

1. What causes the brown crust that forms on meat in a hot, dry pan?

_____

_____

2. Which two kinds of ingredients take part in the Maillard reaction?

_____

_____

3. Why does boiled meat remain gray?

_____

_____

4. Why do cooks pat meat dry before searing it?

_____

_____

5. Why does a crowded pan leave food pale?

_____

_____

6. What explains why toast tastes richer than plain bread?

_____

_____

Words to know

reaction: a chemical change that makes new substances
amino acids: the small building blocks that make up proteins
aroma: a pleasant smell
pigments: substances that give something its color
caramelization: the browning of sugar when it is heated

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

For the teacher: Why a Seared Steak Beats a Boiled One

Each student sheet carries a shape, not a level. The same topic and facts, written three ways.

Circle: Why a Seared Steak Beats a Boiled One

Easier · 201 words · Flesch-Kincaid grade 3.5

1. The Maillard reaction.
2. Amino acids and some sugars.
3. Boiling water cannot get hotter than its boiling point, so the meat never gets hot enough to brown.
4. Wet meat has to dry before it can brown.
5. The food makes steam, and the steam cools the pan.
6. Heat starts the browning reaction, which makes new flavors.

Triangle: Why a Seared Steak Beats a Boiled One

This passage · 246 words · Flesch-Kincaid grade 7.5

1. The Maillard reaction.
2. Amino acids and certain sugars.
3. Water cannot get hotter than its boiling point, so the surface never gets hot enough to brown.
4. Surface moisture would have to boil away first, which delays browning.
5. The food gives off steam that cools the pan.
6. Heat starts the browning reaction, which makes new flavors.

Square: Why a Seared Steak Beats a Boiled One

Harder · 254 words · Flesch-Kincaid grade 10.8

1. The Maillard reaction.
2. Amino acids and certain sugars.
3. Water cannot exceed its boiling point, so the surface never gets hot enough to brown.
4. Surface moisture must boil away first, which would delay the browning.
5. The food releases steam, which cools the pan.
6. Heat starts the browning reaction, which creates new flavors.