

Who Ever Heard of the Maillard-Hodge Reaction?

Ask most chefs and even many home cooks and they will probably tell you they have heard of the *Maillard* reaction, and that it has something to do with the flavor of food. Press them for more details and they will likely tell you it's also responsible for browning in cooked food, and perhaps even that more browning means more flavor.

Today the role of the Maillard reaction in creating important flavors and browning in cooked food is undisputed. The reaction is now well recognized to be responsible for creating the flavors and color of freshly baked bread, roasted meats, roasted coffee beans, chocolate, and dark beer. The reaction was named after the French scientist Louis-Camille Maillard (1878-1936), who published his research into the reaction of amino acids with sugars in 1912 (*Comp. rend.*, 154, 66-68). Maillard discovered that when amino acids are heated with simple sugars, such as glucose, brown colors are created. Knowing that food contains proteins (which break down to amino acids) and sugars, he correctly concluded that this reaction was the source of brown color in many cooked foods, such as the crust of baked bread or roasted meat. Today, this form of browning is known as "*non-enzymatic browning*" because it occurs without the presence of enzymes. The browning that we see when sliced apples or potatoes turn brown is due to natural enzymes located within the plant cells.

But that's about as far as Maillard went with his discovery, yet it was important enough that the reaction was named after him. Following Maillard's discovery other scientists occasionally studied the reaction in order to understand the chemistry of what occurred when amino acids reacted with certain types of sugars known as reducing sugars. But many of these scientists focused on the chemical reactions of a few amino acids with specific sugars without looking at the bigger significance of their studies to cooking and food.

It wasn't until John Edward Hodge (1914-1996) published his extensive review and analysis of the Maillard reaction in 1953 (*J. Food Agric. Chem.*, 1, 928-943) that food scientists and chemists began to appreciate the role of the Maillard reaction in creating the flavors of certain cooked foods. Following the publication of Hodge's paper the attention to the Maillard reaction as a source of flavors in food started to explode. Hodge's publication is now the most cited paper in the entire fields of food science and food chemistry, and reportedly the most cited paper published by the Journal of Agricultural and Food Chemistry (published by the American Chemical Society).

Granted, when Hodge wrote his paper he also focused on the chemistry of browning reactions in dehydrated foods. But he went well beyond the previous researchers by gathering and organizing all of the prior research into a well-organized coherent grand picture of the chemistry that was occurring when foods undergo non-enzymatic browning. It was Hodge's sweeping overview that made

it possible for so many chemists and food scientists that followed in Hodge's footsteps to realize the true importance of the Maillard reaction in creating the flavor of cooked foods.

John Hodge was an African-American chemist educated at the University of Kansas (B. A. and M. S. degrees, Phi Beta Kappa) who went on to spend 40 years of his life working at the United States Department of Agriculture's laboratories in Peoria, IL. Surely he deserves as much credit for discovering the significance of the Maillard reaction as Maillard himself. There is precedent for naming chemical reactions after more than one scientist involved in discovering a new reaction, although I haven't checked to see if there are any examples where the contributions of two scientists have been separated by 40 years. Still, I think it would be appropriate to rename the reaction that is so influential in the chemistry of food as the Maillard-Hodge Reaction.

