



ASEV 2020 Merit Award

Presented at the 2021 Virtual 72nd ASEV National Conference
Merit Award Presentation Summary

HILDEGARDE HEYMANN

Professor, University of California, Davis



Forty Years of Wine and Sensory Science

I would like to thank the board of the American Society for Enology and Viticulture for this great honor. I was born and raised in the Jacaranda city, Pretoria, South Africa.

My experience with wine growing up was minimal. My maternal grandmother would make a fortified 'wine' by crushing the Catawba grapes growing on the pergola over the driveway and then adding brandy which my grandfather (who was a teetotaler when I knew him) had been given as Christmas gifts. This wine was then doled out on special occasions in small sherry glasses to the entire family, including the under ten-year-olds. I remember it being intensely sweet and hot – I very much preferred eating the slip skin grapes to drinking this concoction. After high school, I chose to study a BSc in Agriculture with Enology, Viticulture, and Chemistry. This degree appealed because it had many different facets and I would not need to choose between my chemistry, microbiology, and plant interests. I did not know this when I enrolled but I was to be the first female graduate of the program! I loved my undergraduate program and my student cohort, however, some of the faculty was not too enthralled with me, but others were very happy that the program finally had a woman enrolled.


In my senior year, I interviewed for 17 positions, as enologist or assistant winemaker, and invariably the outcome was that I was perfect for the position but that they did not hire women for these positions. In one case, at the end of the interview the interviewer said that they would have loved to hire me but I would probably get married and thus they did not want to take the chance. At the last moment, I found employment at the Oude Meester Group at the Rupert International Research Facility. This was a tobacco and wine research group that owned the Bergkelder, a large winery, in Stellenbosch. My boss, Piet Vos and one of his colleagues, Rodney Gray, had just published a paper (Vos and Gray 1979) on the production of hydrogen sulfide during must fermentations. They wanted to study the effects of using di-ammonium phosphate on hydrogen sulfite production. My job was to manage the multitude of fermentations, and these fermentations led to my first publication (Vos

et al. 1980). This publication paved the way to all the nutrient additions we do during fermentation today. I found the work very interesting but I wanted to be a winemaker, not a laboratory rat! I decided, probably naively, that if I had a Master's degree it would overcome my gender disadvantage and someone would employ me as a winemaker.

I enrolled in the Food Science master's degree with an emphasis in Enology at the University of California, Davis and nearly immediately landed in Roger Boulton's laboratory. There I studied succinic acid production in red wine fermentations. By January 1980, I had taken most of the required courses for the degree and on a whim enrolled in Rose Marie Pangborn's Sensory Evaluation of Foods course, which was not a requirement for my degree. I had no expectations going into the class and I fell in love. I vividly remember about five weeks into the quarter realizing that what I wanted to do for the rest of my career was to teach and do research in the area of sensory science. This was a major life change and it took a few years, including a return to South Africa to make it happen, but eventually I landed in Ann Noble's laboratory where my PhD involved flavor chemistry and sensory science. The three publications from that work covered my lifelong interests: flavor chemistry (Heymann et al. 1986), sensory science (Heymann and Noble 1987) and statistics (Heymann and Noble 1989). Probably the most interesting piece of information from my PhD dissertation is that I was the first to determine that 2-isobutyl-3-methoxypyrazine was light sensitive.

After completing the PhD degree I was immediately employed as an assistant professor of Food Science at the University of Missouri – Columbia. I did not do a post-doctoral experience and went from being a graduate student to a professor in about two weeks – it was a breathtaking change. I was very lucky to find great colleagues and excellent students at Mizzou and want to highlight a few of my publications from that era. The first is a study on whether expectoration or swallowing changes the sensory perception of samples (Kelly and Heymann 1989). We used canned beans with and without salt added, and milk with and without added fat. The result of the

study was that we found no significant differences in the thresholds when the panelists swallowed versus expectorated. When I wrote this manuscript I had had two years of statistics as an undergraduate, two quarters as a graduate student, and I had read numerous statistics books but it was not until about two years later that I first heard of statistical power! I frequently use this paper as an example of very poor experimental design and point out that with nine panelists there was not nearly enough statistical power to find a difference in the thresholds even if there was one!

**It is always interesting to see how a small project makes a big difference many years later.**

HILDEGARDE HEYMANN

In the mid- to late-1980s the state of Missouri was a new but growing wine area and my background made working on Missouri wine an ideal match. However, I only did one study on wine during my stint in Missouri (Andrews et al. 1990). The reason for this was that it took nine months to be authorized to buy wine using a university account. It took meetings with my Chair, my Dean, the Provost and, eventually, the Chancellor to get permission. As a young, untenured, assistant professor, this was problematic and I never worked on wine or alcohol again at Mizzou. However, times change and today the University of Missouri Food Science department hosts the Missouri Grape and Wine Institute.

The suggested end-point temperature for cooked pork was set in the 1950s at 180°F, however, by the late 1980s pigs had been bred to have significantly less fat and this end-point temperature led to dry, unappetizing meat. The pork producers funded me to do a large sensory descriptive analysis study on all pork cuts, cooked to one of the following end-point temperatures: 150, 160, 170, and 180°F (Siemens et al. 1990). (Heymann et al. 1990) The data showed clearly that pork cooked to 150°F was the most moist and flavorful but the pork producers thought that this was too large a drop in suggested end-point temperatures, since the cooked meat was tinged pink. They thus set the new suggested end-point at 160°F. In 2010, they funded a second, very similar study, and currently the suggested end-point temperature for pork is 150°F.

The next publication on cat litter was the result of a laboratory joke – I had two spoiled cats and I cleaned the cat boxes daily, removing and discarding all of the litter – the result was that I spent a small fortune on cat litter. Margaret Cliff, at the time a PhD student, was curious why I bought the brand of litter I did. My answer was that it was the cheapest. She sug-

gested that we do a descriptive analysis on cat litter. I thought she was joking but she worked with the veterinarians at the Mizzou veterinary hospital to freeze cat urine and eventually we had enough composite urine to do the study. We created small litter boxes using yogurt containers and the panelists evaluated the dry litter, the litter immediately after use (they poured urine into the litter and immediately smelled it), and litter one week after use. It was very interesting, one litter had such a high pH that once the urine was poured onto it, waves of ammonia were released – we could hear the coughing in the booths. The study did not change my litter buying habits but it is usually the one publication that is mentioned by whoever is introducing me as a speaker to a new audience.

Dr. Fu-hung Hsieh was a food engineer working on extruded products and my laboratory did all of his sensory work. In 1995, he was trying to mimic the texture of chicken breast meat using corn meal extrudates (Hu et al. 1996). Dr. Hsieh and Harold Huff, his laboratory manager, were pioneers of high moisture extrusion to produce meat analogs. Eventually, the patent originating from this and other work was licensed to the Beyond Meat plant-based meat company. It is always interesting to see how a small project makes a big difference many years later.

In 1994, Harry Lawless, professor of sensory science at Cornell University in Ithaca, NY, had called me to tell me that I was the only sensory scientist that he could stand to write a book with. Despite the backhanded compliment, I agreed to be a co-author on a new sensory science textbook. The book eventually came out in 1997 (Lawless and Heymann 1997). Writing a textbook was fascinating, exhausting, and, at some level, exhilarating. The book sold very well and became the most prescribed sensory text worldwide. We wrote a second edition (Lawless and Heymann 2010), which in my mind was a much better book – we learned a lot from the first one. A third edition will be published in 2022, but this one will have two additional authors, both at Pennsylvania State University: Helene Hopfer, who had been a post-doctoral fellow in my laboratory, and John Hayes, who had worked in Harry's laboratory as an undergraduate – a nice circle. After the second edition of the Lawless book I swore never to write another book but somehow an acquisitions editor at Wiley convinced me that I had another book in me. This book (Heymann and Ebeler 2017) was a joy to write since my co-author was on-campus and my good friend Sue Ebeler. I believed that was the last book but recently I have had the idea for another...

Ann Noble, my PhD advisor, decided at the end of 2001, that she was retiring the following year. I thought that she was too young but she stood by the decision. Through a Target of Excellence hiring process I was appointed a Professor in the Department of Viticulture and Enology with a start date of January 2003. I was sad to leave the University of Missouri but I was also elated at the idea of a new challenge in a familiar place. My return to UC Davis has been everything that I had hoped it to be – it re-invigorated my research, gave me a great group of new colleagues to work with and some amazing students and post-doctoral fellows.

One of my earliest studies at Davis was on food and wine pairing. At the time, there were three publications on this topic, all from Tobias Nygren's PhD dissertation (Nygren et al. 2001, 2002, 2003). We found that tasting wine after eating cheese significantly decreased a number of sensory attributes. These changes were consistent and the trained panel perceived them, but the absolute changes were small enough that it is likely that a consumer would not notice (Madrigal-Galan and Heymann 2006). When the article came out I dealt with a storm of press – in the space of a week I spoke to about 20 journalists from around the world – and most of them had no idea what the work said or meant – even after extensive discussions. It was one of the most frustrating weeks of my life and has made me quite mistrustful of newspaper headlines!

The next publication, with my favorite co-author, Sue Ebeler, was a return to the bell pepper years of my dissertation. In conjunction with Karen Hein (now Lusk) we looked at the masking effects of aromas on one another (Hein et al. 2009). We showed that the addition of fruity aromas decreased the perception of bell pepper aromas but the same did not happen when fruity aromas were added to mint or canned corn aromas.

The next few publications were all firsts for me. The publication with Jessi Kennedy (Kennedy and Heymann 2009) on chocolate is my personal unicorn. This is the only publication that was accepted with no revisions – a true rarity. The publication on simulated shipping conditions (Robinson, et al., 2010) was my first American Journal of Enology and Viticulture Best Enology Paper of the year. Followed by a second Best Enology Paper of the year for the same journal seven years later (Sherman et al. 2017). The article of the appearance and flavor profiles of fig cultivars was my first journal cover (King et al. 2012), this one for the Journal of Food Science. My second journal cover was for the ACS Omega journal (Lafontaine et al. 2020) and the topic was non-alcoholic beers.

The last publication I want to mention was the most problematic one to write (Heymann 2019). It is a history of sensory science from my perspective and I was asked to write it for the Journal of Food, Culture and Society by Jake Lahne, who had been a post-doctoral fellow in my laboratory. This manuscript was difficult to write because it was not a scientific, data driven article, but it was a very personal historical retrospective. I probably wrote 10 to 12 drafts before a friend, John Slater, then a professor in the department of Spanish at UC Davis, gave me the introductory paragraph. Once I had that, the rest of the article flowed easily and it was a joy to write – it is rare that a scientist can get this personal. In many ways the Merit Award article has a similar feel. I would like to conclude with thank yous to a number of people who meant a great deal to me throughout my career.

First and foremost, I need to thank the 11 doctoral students, the 40 master's students, the 11 post-doctoral fellows, the 31 visiting scholars, and the about 100 undergraduate helpers – without you none of this would have been possible. I would like to thank my 'fairy godfather', Jerry Lohr, who gave me money to hire post-doctoral fellows at a very dark time of my career –

he made an enormous impact on my career and on the careers of those post-doctoral fellows. The publications from this era then led to me receiving the Ray Rossi Endowed chair in Viticulture and Enology! Even though I never met her, I would like to thank Louise Rossi for her generosity in willing the Rossi Ranch to the University – the money from that endowment made a huge difference to me and to many others in the department.

The next group of thank yous go to my laboratory managers. Mary Eggeman, Dana Craig, Denise Taylor, and Marianne Swaney-Stueve at the University of Missouri. At Davis, Kevin Scott and Annegret Cantu have been my rocks in good times and bad. Mike Ramsey has been the teaching laboratory manager since 2005 and I truly would not have survived pandemic zoom teaching without him.

Next I would like to thank my mentors in more or less chronological order. My Father (Ferdinand Heymann) believed that a woman was capable of anything she set her mind to, and in 1970s South Africa that was not the norm. Joel van Wyk, Professor of Enology at the University of Stellenbosch, was my champion and supporter throughout my undergraduate career and he also believed in empowering woman as did Duimpie Bayly – the best boss I ever had! Roger Boulton, my MS major professor, became a friend and colleague – I cannot thank him enough for all the kindnesses and conversations throughout the years. Rose Marie Pangborn and Ann Noble showed me the path to sensory science and my life has never been the same. Bill Stringer, Harold Hedrick, and Roger Mitchell showed me how to be a faculty member and a teacher – I will be forever thankful. Ruth MacDonald, Doug Holt, Harry Lawless, and Sue Ebeler were fantastic colleagues – without them my life would have been less. I also want to thank my my beloved husband (Bill Matthews) – you make my world.

References

1. Andrews J, Heymann H and Ellersieck M. 1990. Sensory and chemical analyses of Missouri Seyval blanc wines. *Am J Enol Vitic* 116-120.
2. Hein K, Ebeler SE and Heymann H. 2009. Perception of fruity and vegetative aromas in red wine. *J Sensory Studies* 24:441-455.
3. Heymann H. 2019. A personal history of sensory science. *Food, Culture & Society* 22:203-223.
4. Heymann H and Noble AC. 1987. Descriptive analysis of commercial Cabernet Sauvignon wines from California. *Am J Enol Vitic* 38:41-44.
5. Heymann H and Noble AC. 1989. Comparison of canonical variate and principal component analyses of wine descriptive analysis data. *J Food Sci* 54:1355-1358.
6. Heymann H and Ebeler SE. 2017. *Sensory and Instrumental Evaluation of Alcoholic Beverages*. Wiley, New York.

7. Heymann H, Noble AC and Boulton RB. 1986. Analysis of methoxy-pyrazines in wines. 1. Development of a quantitative procedure. *J Agric Food Chem* 34:268-271.
8. Heymann H, Hedrick HB, Karrasch MA, Eggeman MK and Ellersick MR. 1990. Sensory and chemical characteristics of fresh pork roasts cooked to different endpoint temperatures. *J Food Sci* 55:613-617.
9. Hu L, Huff HE, Heymann H and Hsieh F. 1996. Effects of emulsifier and soy fiber addition on sensory properties of corn meal extrudate. *J Food Qual* 19:57-77.
10. Kelly FB and Heymann H. 1989. Contrasting the effects of ingestion and expectoration in sensory difference tests. *J Sensory Studies* 3:249-255.
11. Kennedy J and Heymann H. 2009. Projective mapping and descriptive analysis of milk and dark chocolates. *J Sensory Studies* 24:220-233.
12. King ES, Hopfer H, Haug MT, Orsi JD, Heymann H, Crisostos GM and Crisostos CH. 2012. Describing the appearance and flavor profiles of fresh fig (*Ficus carica* L.) cultivars. *J Food Sci* 77:S419-S429.
13. Lafontaine S, Senn K, Dennenlöhner J, Schubert C, Knoke L, Maxminer J, Cantu A, Rettberg N and Heymann H. 2020. Characterizing volatile and nonvolatile factors influencing flavor and American consumer preference toward nonalcoholic beer. *ACS Omega* 5:23308-23321.
14. Lawless HT and Heymann H. 1997. *Sensory Evaluation of Food: Principles and Practices*. Springer, New York.
15. Lawless HT and Heymann H. 2010. *Sensory Evaluation of Food: Principles and Practices*. Springer, New York.
16. Madrigal-Galan B and Heymann H. 2006. Sensory effects of consuming cheese prior to evaluating red wine flavor. *Am J Enol Vitic* 57:12-22.
17. Nygren IT, Gustafsson I-B, Haglund Å, Johansson L and Noble AC. 2001. Flavor changes produced by wine and food interactions: Chardonnay wine and hollandaise sauce. *J Sensory Studies* 16:461-470.
18. Nygren IT, Gustafsson I-B and Johansson L. 2002. Perceived flavor changes in white wine after tasting blue mould cheese. *Food Serv Tech* 2:163-171.
19. Nygren IT, Gustafsson I-B and Johansson L. 2003. Perceived flavour changes in blue mould cheese after tasting white wine. *Food Serv Tech* 3:143-150.
20. Robinson AL, Mueller M, Heymann H, Ebeler SE, Boss PK, Solomon PS and Trengove RD. 2010. Effect of simulated shipping conditions on sensory attributes and volatile composition of commercial white and red wines. *Am J Enol Vitic* 61:337-347.
21. Sherman E, Greenwood DR, Villas-Boas SG, Heymann H and Harbertson JF. 2017. Impact of grape maturity and ethanol concentration on sensory properties of Washington state Merlot wines. *Am J Enol Vitic* 68:344-356.
22. Siemens A, Heymann H, Hedrick HB, Karrasch MA, Ellersieck M and Eggeman MK. 1990. Effects of external fat cover, bone removal and endpoint cooking temperature on sensory attributes and composition of pork center loin chops and roasts. *J Sensory Studies* 4:179-188.
23. Vos PJA and Gray RS. 1979. The origin and control of hydrogen sulfide during fermentation of grape must. *Am J Enol Vitic* 30:187-197.
24. Vos PJA, Zeeman W and Heymann H. 1980. The effect on wine quality of di-ammonium phosphate additions to musts. *S Afr J Enol Vitic* 87-104.