# 2011 Annual Meeting Abstracts

## Lipid Oxidation and Quality

## MONDAY

### MORNING

### LOQ 1: A Re-examination of the Antioxidant "Polar Paradox" Paradigm

Chair(s): A. Richards, CSIRO, Food and Nutritional Sciences, Australia; E. Decker, University of Massachusetts, USA; and P. Villeneuve, CIRAF, France

**The Many Facets of How Antioxidants can Impact Lipid Oxidation Reactions in Foods.**
E.A. Decker, University of Massachusetts, Amherst, Amherst, MA, USA

It is extremely difficult to predict when an antioxidant will be effective in different food products meaning that taking a rational approach to developing effective antioxidants systems is challenging. Numerous compounds can inhibit lipid oxidation by a variety of mechanisms including metal chelation, free radical scavenging and singlet oxygen quenching. The effectiveness of an antioxidant is dependent on factors such as metal binding constants, redox potential, antioxidant radical stability and solubility. For example, chelators can inhibit metal-promoted lipid oxidation by preventing redox cycling and inhibiting metal-lipid interactions but can increase prooxidant activity by increasing metal solubility. Likewise, free radical scavengers can inhibit lipid oxidation by producing low energy free radical but can promote lipid oxidation when their redox potential is high enough to reduce metals into their more prooxidative states. The oxidative stability of a food is also dependent on interaction between antioxidants as one free radical scavengers can regenerate another. Since antioxidants have such a broad array of pathways in which they can impact oxidative reactions, it is not surprising that their ability to prevent lipid oxidation in foods is difficult to predict.

**Effect of Emulsifier and Related Factors on the Antioxidant Activity in Emulsion.** Naoko Kimura, Goki Azuma, Masashi Hosokawa, Kazuo Miyashita, Faculty of Fisheries Sciences, Hokkaido University, Hakodate, Hokkaido, Japan

Membranes surrounding the emulsion droplets consist of lipids, water, and surface-active substances such as emulsifiers and proteins. They provide a protective barrier to the penetration and diffusion of metals or radicals that initiate lipid oxidation. The different behavior of antioxidants in or out of the interface has been also reported; that is called polar paradox. On the other hand, it is true that emulsions are complex, multi-component, and heterogeneous systems, in which lipids are present with various types of other components in aqueous medium. To understand the true significance of antioxidants on lipid oxidation in an emulsion, we should pay much attention to other factors such as substrate (degree of unsaturation), emulsifier, particle size et al. When the stability of ethyl linoleate (LA) and ethyl DHA (DHA) were compared in oil in water emulsion with tocopherol and trolox, trolox showed the higher antioxidant activity on DHA than LA. This is due to the difference in polarity of LA and DHA. Emulsifier also showed

a strong impact on the effect of different kinds of antioxidants. The activity of antioxidant was affected by the interaction with emulsifier.

**Evaluation of the Polar Paradox Based on Antioxidant Functionality in Various Food Systems.** R. Nahas, Kalsec USA, Kalamazoo, MI, USA

The concept of "Polar Paradox" has been useful in explaining several observations regarding functionality of polar antioxidants in non-polar systems, and less polar antioxidants in polar systems. Several cases however, contradict the concept. Experimental data on lipid oxidation, using natural, plant extract antioxidants in comparison to pure antioxidant standards revealed a large correlation between the mode of action of antioxidants and their corresponding efficacy in certain food systems, but not necessarily according to their polarity. Hence, the conclusions might present a more generalized view on the applicability of the polar paradox in complex food systems.

**Phenolics and Lipophilized Phenolics as Antioxidants in Fish Oil Enriched Emulsions.** A.-D.M. Sørensen, N.S. Nielsen, C. Jacobsen, Technical University of Denmark, National Food Institute (DTU Food), Denmark

Emulsions containing omega-3 LC PUFA are highly susceptible to oxidation. This causes formation of undesirable flavors and loss of health beneficial fatty acids. Many omega-3 enriched food products on the market are oil-in-water emulsions. According to the so called "polar paradox", polar compounds work better as antioxidants in bulk oil, whereas lipophilic compounds are better antioxidants in emulsions.This presentation is an overview of our previous work in the area of fish oil enriched emulsions with antioxidants. Our studies have shown that the lipophilicity of the compounds is not the only factor determining their efficacy as antioxidants in simple model systems. Interactions between the antioxidants, emulsifier and pH also influence the antioxidant behavior. Moreover, studies with lipophilized phenolics in a food emulsion showed that there is no linear increase of antioxidant activity with increased lipophilicity. Instead a cut-off effect was observed in relation to the alkyl chain length lipophilized to the phenolic compound. Furthermore, the efficacy of lipophilic antioxidants is influenced by the type of food system. Thus, our results show that the antioxidant behavior may not be as simple as stated by the "polar paradox" hypothesis. According to our research results in this area, this hypothesis deserves reconsideration.

**Hydroxytyrosol Fatty Acid Esters as Relevant Surfactants: a Potential Explanation for the Nonlinear Antioxidant Activity found in Oil-in-Water Emulsions.** Ricardo Lucas[1], Francesc Comelles[2], Salomé Lois[3], David Alcántara[1], Olivia Maldonado[1], Melanie Curcuroze[1], Jose Luis Parra[2], Isabel Medina[3], Juan Carlos Morales[1], [1]Instituto de Investigaciones Químicas, CSIC ? Universidad de Sevilla, Sevilla, Spain , [2]Institut de Química Avançada de Catalunya, CSIC, Barcelona, Spain, [3]Instituto de Investigaciones Marinas, CSIC, Vigo, Spain

Several groups have found results with different lipophilic phenolic antioxidants that disagree with the polar paradox paradigm. We observed a nonlinear tendency in antioxidant capacity of hydroxytyrosol fatty acid esters (HTFA) in fish oil-in-water emulsions, with a maximum for hydroxytyrosol octanoate. It has been postulated that an important factor in explaining this

behaviour maybe the physical location of the antioxidants in an oil-water interface. We prepared a series of HTFA with different chain length and studied their surface active properties in water since these parameters could be related to the preferential placement at the interface. We found that HTFA are remarkable surfactants when the right hydrophilic-lipophilic balance is attained and as efficient as emulsifiers commonly used in industry, such as Brij 30® or Tween 20®. Furthermore, a nonlinear dependence of surfactant effectiveness is observed with the increase in chain length of the lipophilic antioxidants. This tendency seems to fit quite well with the reported antioxidant activity in emulsions for HTFA. This potential explanation of the nonlinear hypothesis will help in the rational design of antioxidants for oil-in-water emulsions.

**Cut Off Effect of Phenolipids in Emulsified, Cellular or Microbiological Systems.** C. Bayrasy[1], M. Laguerre[1], C. Wrutniak-Cabello[2], J. Lecomte[1], J. Weiss[3], S. Suriyarak[3], B. Chabi[2], G. Cabello[2], E.A. Decker[4], P. Villeneuve[1], [1]CIRAD UMR IATE, Montpellier, France, [2]INRA UMR DCC, Montpellier, France, [3]University of Hohenheim, Stuttgart, Germany, [4]University of Massachusetts, Food Science Dept, Amherst, PA, USA

It is generally admitted in drug research that antioxidant capacity increases with lipophilicity and that the most lipophilic compounds will have the highest activity. Using emulsified and cellular systems, we have recently demonstrated that this concept is false, and that highly lipophilic compounds display an unexpected low antioxidant capacity. Specifically, we have reported in oil-in-water emulsion and in human dermal fibroblasts, that antioxidant capacity of a homologous series increases as the alkyl chain is lengthened, with a threshold for a medium chain, after which further chain extension leads to a drastic decrease in antioxidant capacity. This nonlinear or parabolic relationship between hydrophobicity and antioxidant capacity is termed as "cutoff effect" and has been observed with two complete homologous series (chlorogenate and rosmarinate esters). Surprisingly, we have also demonstrated that the same nonlinear phenomenon dictates the antimicrobial activity of chlorogenate and rosmarinate esters. Accordingly, the best antioxidants (dodecyl chlorogenate/octyl rosmarinate) are also the best antimicrobials.Taken together, these results suggest that the cut-off effect may dictate both antioxidant, antimicrobial, and emulsifying effectiveness of phenolics and phenolipids in heterogeneous systems involving lipids as emulsified droplets, or membrane.

## LOQ 1.1: Lipid Oxidation Challenges and Potential Solutions in Food Systems I

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Chair(s): X. Pan, Solae LLC, USA; and U. Nienaber, Kraft Foods Inc., USA

**Model Emulsions as a Tool for Studying Antioxidant or Prooxidant Activities of Foods and Food Ingredients.** C. Genot[1], A. Meynier[1], C. Dufour[2], M Viau[1], L. Ribourg[1], O. Dangles[2], [1]INRA UR1268 Biopolymers Interactions Assemblies, Nantes, France, [2]INRA, University of Avignon, UMR408 Safety and Quality of Plant Products, Avignon, France

According to food safety agencies, it is of utmost importance that Western consumers readjust their lipid intake and that consumers opt for polyunsaturated fats. However, these fats are prone to oxidation during technological operations and during digestion. The resulting lipid oxidation products led to the development of off-flavours that decrease the acceptability of the products. They also could contribute to the development of several pathologies such as cardiovascular

disease and colon cancer. It is therefore of interest to be able to predict development of oxidation in complex food formulations. Model emulsions were developed to assess the susceptibity to oxidation of milk fat as modulated by its composition and several formulation parameters, the pro-oxidant activity of foods or food components or the antioxidant efficiency of phenolic compounds in conditions that mimic the physico-chemical environment of lipids under gastric conditions.

**Effect of Plant-derived Extracts on Oxidative Stability of Food Emulsions.** S.P. Janaka Namal Senanayake, Jerry Erdmann, Cathy Dorko, Danisco USA Inc., New Century, KS, USA

Oxidation of lipids in food emulsions is a serious concern since oxidation produces undesirable flavors and aromas. Lipid oxidation may also negatively affect the nutritional quality of food products. The large surface areas of droplets in the non-continuous phase of food emulsions present particular oxidative challenges to food manufacturers. Although synthetic antioxidants have been widely used in food emulsions to inhibit lipid oxidation, the trend is to decrease their use because of the growing consumer concerns over the use of such chemical additives. Consequently, the search for natural additives, especially of plant origin, has notably increased in recent years. Plant-derived extracts, such as rosemary extract, green tea extract and natural mixed tocopherols may be as effective as synthetic antioxidants in various food emulsions. This study presents results from different food emulsions containing plant-derived extracts. Models chosen for experimentation were salad dressings and mayonnaise representing oil-in-water emulsions, and margarines and spreads representing water-in-oil emulsions. The efficacy of natural additives, such as rosemary extract, green tea extract and natural mixed tocopherols in food emulsions will be evaluated.

**Antioxidant Activity of Fish Protein Hydrolysates in in vitro Assays and in Oil-in-Water Emulsions.** K.H. Sabeena Farvin, Lisa Lystbæk Andersen, Charlotte Jacobsen, Henrick Hauch Nielsen, Flemming Jessen, Section for Seafood Research,National Food Institute (DTU-Food),Technical University of Denmark,, B. 221, Søltofts Plads, DK-2800 Kgs, Lyngby, Copenhagen, Denmark

The aim of this study was to screen different protein hydrolysates with respect to their antioxidative properties in order to select the most promising extracts for further evaluation in oil-in-water emulsions. Three fractions of protein hydrolysates (Crude, >5kDa and 5kDa, 3-5kDa and

**Antioxidative Properties of Ergothioneine in the Fruiting Body and Spent Culture Medium of *Flammulina velutipes*: Application to Fish Aquaculture.** Toshiaki Ohshima, Huynh Bao, Tokyo University of Marine Science and Technology, Tokyo, Japan

Effects of feeding the extract prepared from the fruiting body and spent culture medium of *Flammulina velutipesas*as a supplement on color stability and lipid oxidation of the dark muscle of yellowtail fish *Seriola quinqueladiata* rich in myoglobin during postharvest storage of the dark muscle were evaluated. The fish of control group was fed on commercial diet on every other day for 1 week after beginning of feeding. The fish of 1% and 10% groups were fed on 5 g of the commercial diet containing 1% and 10% of the extract solution (= 0.36 g and 3.6 g of the

extract dry materials per 100 g of diet, respectively), respectively, on every other day. After 4 weeks of feeding, the fish were starved for 5 days without any feeding. There was no mortality during the feeding period for 4 weeks and the fish grew normally. Browning development in dark muscle of the yellowtail fed with 1% and 10% of the extract in diet was remarkably suppressed during 4 days of storage at 0-2°C. These results clearly showed that the extract is a promising source of natural antioxidant which can be used for aquaculture to improve quality of fish meat during post-harvest storage at lower temperature.

**Influence of Cultivar on Antioxidant Profile and Content in Olive Leaves.** M. Syrpas[1,3], V. Van Hoed[1], C. Van Poucke[2], S. De Saeger [2], A. Kiritsakis[3], R. Verhé[1], [1]Ghent University, Faculty of Bioscience Engineering, Department of Sustainable Organic Chemistry and Technology, Ghent, Belgium, [2]Ghent University, Faculty of Pharmaceutical Sciences, Ghent, Belgium, [3]Technological Educational Institution (TEI) of Thessaloniki, Tessaloniki, Greece

Olive leaves are considered to be a rich source of phenolic compounds known for their multifunctional bioactive properties. The concentration of phenolic compounds is subject to the influence of many factors, such as cultivar, environment and phenological stage during sampling. The purpose of this research was to analyze and compare the phenolic compounds in olive leaves of twenty one different cultivars. All the samples were harvested at the same time from the same orchard and were grown under the same cultivation treatment and climatic conditions. Olive leaves were characterized by the presence of phenolic acids like ferulic acid or salicylic acid, phenolic alcohols like tyrosol, flavonoids and their glycosylated forms and secoiridoids (typical group of the Olea family). Oleuropein (usually the main component reported) was not always the main constituent of olive leaves. The various cultivars did not exhibit significant differences in the composition of their phenolic profile but differences were noted in the level of phenolic compounds. Antioxidant activity was correlated with the free radical scavenging ability of the various cultivars. Moreover, the stability of two edible oils was increased by adding phenolic extract of the olive leaves.

## AFTERNOON

## LOQ 2: Lipid Oxidation Challenges and Potential Solutions in Food Systems II

Chair(s): X. Pan, Solae LLC, USA; and U. Nienaber, Kraft Foods Inc., USA

**Role of Reverse Micelles on Lipid Oxidation: Impact of Phospholipids on Antioxidant Activity of α-tocopherol and Trolox in Stripped Soybean Oil.** B.C. Chen, D.J. McClements, E.A. Decker, Department of Food Science, University of Massachusetts, Amherst, MA, USA

Phospholipids self-assemble in bulk oils to form reverse micelles that can alter the microenvironment where chemical degradation reactions occur. In this study, we examined the influence of phospholipid reverse micelles on the activity of non-polar (α-tocopherol) and polar(Trolox) antioxidants in stripped soybean oil (SSO). Reverse micelles were formed by adding 1000 μM 1,2-dioleoyl-sn-glycero-3-phosphocholine (DOPC) to SSO. The addition of DOPC reverse micelles had an prooxidant effect, shortening the lag phase of SSO at 55°C.

Incorporation of low antioxidant concentrations (10 μM α-tocopherol or Trolox) improved the oxidative stability of SSO containing DOPC. However, addition of high antioxidant levels (100 μM α-tocopherol or Trolox) slightly decreased the oxidative stability of SSO containing DOPC. Hydrophilic Trolox had a better antioxidative activity than hydrophobic α-tocopherol. Small angle X-ray scattering (SAXS) did not show any structure transitions when antioxidants were incorporated into the reverse micelles. Fluorescence steady state and lifetime decay measurements indicated that changes in the microenvironment of the fluorescent probe depended on antioxidant type and concentration.

**Factors Affecting Generation and Fate of Hydrogen Peroxide in Polyphenol-rich Food Emulsions.** L. Zhou, R. Elias, The Pennsylvania State University, University Park, PA, USA

Polyphenols are often referred to as antioxidants. However, recent studies have shown that polyphenol oxidation yields reactive oxygen species in foods, which may account for the observed prooxidant effects of these compounds under some conditions. In the present study, factors affecting the rate of hydrogen peroxide generation resulting from (-)-epigallocatechin gallate (EGCG) oxidation in oil-in-water emulsions were investigated. Peroxide production in surfactant-stabilized emulsions was dependent on EGCG concentration, and the addition of Fe or Cu increased observed peroxide concentrations, thus confirming that the overall reaction is metal-catalyzed. In protein-stabilized emulsions, peroxide concentrations were significantly lower across all treatments, and increased levels of protein carbonyls were also observed, suggesting that peroxide was scavenged by the protein. To further explore this possibility, hydrogen peroxide was added to solutions containing varying concentrations of casein or whey protein. Both proteins showed concentration dependent peroxide scavenging with casein displaying higher scavenging abilities compared to whey protein. We hypothesize that methionine accessibility to the solvent phase in these proteins may play a role in the varied peroxide scavenging capacities, as methionine is known to quench peroxide species.

**Evaluation of Natural Rosemary and Green Tea Extracts on Frying Performance of RBD Palm Oil.** S. Sumankeerthi, N. Waize, S. Sabari Rajan, W. Schroeder, Kemin Food Technologies, Des Moines, IA, USA

Physico-chemical changes in refined, bleached and deodorized (RBD) palm oil during deep-fat frying and on sensory acceptability of French fries was studied for various additives. Deep-fat frying of French fries was carried at 185±20C for 5 consecutive days (10 frying cycles per day). The treatments included RBD palm oil without antioxidant (control negative), with 200 ppm TBHQ (positive control), 1000 ppm of proprietary rosemary and 500 ppm of proprietary green tea. The effectiveness of the treatments were measured as the efficiency to prevent oxidation of oil by lowering the rate of increase in PV, FFA content, AV, absorbance at 233 nm and improving the induction time over the 50 frying cycle period. The results of the parameters analyzed revealed that all the treated oil samples were significantly different from the control negative ($p < 0.05$) and TBHQ > rosemary. The sensory evaluation of French fries showed that there was no significant ($p>0.05$) difference between treatments except for the negative control. The current study demonstrates that the green tea extract performed significantly ($p <$

**Increased Oleic Vegetable Oils for Improved Frying Performance: Comparative Stability**

**of High Oleic Canola, High Oleic Sunflower, Mid-Oleic Sunflower, and High Oleic Soybean Oil.** Michelle Peitz, Archer Daniels Midland, Decatur, IL USA

This laboratory study looks at the frying stability of High Oleic Canola, High Oleic Sunflower, and Mid-Oleic Sunflower, and High Oleic Soybean Oil over a 10 day period. Forty-six kg of potatoes were fried per 6.8 kg fryer over the period of time and the potatoes were analyzed for sensory properties. The oils were analyzed for degradation products and changes in quality. Results showed that the oils with higher levels of oleic and lower levels of polyunsaturated fatty acids had excellent frying performance. Sensory results showed very little difference between the oils and eating quality was maintained through 10 days of oil use. Results from this study further emphasize the benefits of using high stability oils in frying applications.

**Oxidative Stability and Physical Properties of the Interesterified Hard Fat from Soybean Oil, Palm Stearin and Conjugated Linoleic Acid through Lipase-Catalyzed Reaction.** Prakash Adhikari[1], Peng Hu[1], Xuebing Xu[1,2], [1]Wilmar Biotechnology Research and Development Center, Gaodong Road, Pudong New District, Shanghai,China, [2]University of Aarhus, Denmark

Interesterified hard fat (IEHF) was produced from soybean oil (SBO) and palm stearin (PS) using two different ratios of substrates. Lipozyme TL IM (10%) was used as a biocatalyst. Conjugated linoleic acid (CLA; 10 wt%) was used as a functional fatty acid. Comparative study was carried out between IEHF and physical blends for the quantification of physical properties, (i.e., solid fat content, melting and crystallization behavior). From NMR results, physical blends showed higher solid fat content than IEHF at each measured temperatures. The Rancimat test was performed for the oxidative stability where the IEHF showed significantly lower induction time than physical blends. When the antioxidants (BHT, BHA, rosemary, TBHQ, PG, AP, 100 and 200 ppm) were added to the IEHF, the induction time was significantly increased. In this study, IEHF that may have a potential functionality for the margarines and shortenings were produced and their oxidative stability was observed.

**Effect of the Oxidative Stability and Nutritional Property of Rice Bran Oil Blended with Other Oils.** Prachi Srivastava , R.P. Singh, H.B.T.I., KANPUR, Kanpur, India

The objective of this study was to work out different blends of oils amongst rice bran oil (RBO), soybean oil (SBO), and mustard oil (MO) to obtain a unique blend of oil having better shelf life on the basis of induction time with the help of Rancimat 743 (Swiss made) as well as better SMP ratio and omega-6/omega-3 ratio. The results of experiment show that if RBO, SBO and MO are blended in proportion of 3:1:1, it results in maximum oxidative stability up to 9.31h at 110 C without adding any antioxidants in comparison to other blends. From nutritional point of view the study of SMP ratio and omega-6/omega-3 ratio were also evaluated on the basis of fatty acid composition of blends with the help of GLC. The results show that SMP ratio and omega-6/omega-3 ratio of this blend was approximately 1:2.6:2.2 and 7:1 respectively. This study concludes that the blend of RBO, SBO and MO in proportion of 3:1:1 resulted in proper ratio of omega-6/omega-3, however, there is variation in SMP ratio from the one recommended by WHO
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## TUESDAY

## AFTERNOON

### ANA 3.1 / LOQ 3: Antioxidants and Oxidation Control: Analytical Methodologies and Efficacies

Chair(s): D. Luthria, USDA, ARS, USA; and F. Shahidi, Memorial University of Newfoundland, Canada

**Efficacy and Measurement of Antioxidants.** F. Shahidi, Department of Biochemistry, Memorial University of Newfoundland, St. John's, NL, Canada

Antioxidants in food and biological systems have received increasing attention in recent years due to better appreciation of their role in food preservation as well as in health promotion and disease risk reduction. The efficacy of antioxidants from natural origin in foods depends on the source material, activity of the relevant phytochemicals related to their structural characteristics and lipophilicity/hydrophilicity. In addition, concentration of antioxidants, presence of other food constituents and storage conditions, among others, are important factors affecting antioxidant activity. The mechanism of action of antioxidants may be quite varied and testing of their efficacy should include several assays that are complementary to one another. In addition, sampling techniques as well as release of bound antioxidants from food matrix is essential when correlating in-vitro data with in-vivo results.

**Comparison of Extraction Solvents on Assay of Phenolics Form Foods.** Devanand Luthria, USDA, ARS, ERRC, USA

Increased interest in bioactive food components and phytochemicals has arisen from numerous epidemiological studies that suggest that certain phytochemicals can reduce risk of chronic diseases. This presentation will illustrates with examples the significance of optimization of extraction procedures in developing analytical methodologies for accurate estimation of bioactive compounds present in foods and dietary supplements. It will discuss the importance of different sample preparation parameters such as extraction solvent composition, solid-to-solvent ratio, temperature, and particle size for the accurate assay of phenolic compounds in different food matrices. Furthermore, effect of drying and grinding procedures on the assay of phenolic compounds from plant and food samples will also be presented. A comparison of current (pressurized-liquid, ultrasonic irradiation, and microwave-assisted) and classical (stirring, Soxhlet, shaker, vortex) extraction procedures on the assay of phenolic phytochemicals will also be discussed. A systematic protocol for optimizing sample preparation procedure for extraction and assay of phytochemicals from different plant matrices will also be presented. Accurate analysis of bioactive compounds is critical for their precise and reproducible quantification in different foods, establishing appropriate dietary intake and safety guidelines, and understanding their role in human health and nutrition.

**Extraction and Analysis of Soluble and Bound Fruit Polyphenols.** L. Howard, B. White, University of Arkansas, Dept. Food Science, Fayetteville, AR, USA

Polyphenols in fruits and their co-products are typically extracted with aqueous-organic solvent mixtures prior to HPLC analysis or determination of antioxidant capacity. Evidence is increasing that significant quantities of polyphenols in fruits, especially hydrolysable and condensed tannins are entrapped or bound to cell wall polysaccharides and resist extraction using conventional extraction techniques, suggesting levels of fruit polyphenols reported in the literature have been vastly underestimated. The release of bound polyphenols from fruits following conventional extraction can be performed using acid or alkaline hydrolysis methods, but both methods have limitations due to the lability of polyphenols and formation of side products under harsh chemical conditions, and lack of authentic standards for quantification. These methods along with their advantages and disadvantages will be discussed as well as the potential implication of bound polyphenols on gastrointestinal health.

**Challenges with Antioxidant Analysis: Strengths and Weaknesses.** W. Ellefson, D. Sullivan, Covance Laboratories, Madison, WI, USA

Today?s marketplace reflects consumers demand for healthy products. Products that are high in antioxidant content are one area of major interest. There are a variety of general methods (ORAC, DPPH, Folin-C, FRAP, etc.) to measure antioxidant potential. In addition there are many methods that assess the level of individual categories (e.g., catechins, isoflavones, etc.) or individual compounds. All methods have strengths and weaknesses. This presentation will focus primarily on these strengths and weaknesses. An overview of the application of a selected number of these methods will be presented along with estimates of what compounds each test is capable of measuring. Specific examples will be highlighted, including the stability indicating nature of some of these test methods. This discussion will provide an overview of many of the analytical techniques and highlight the need for harmonized methods of analysis. Some of these methods have more specific applications with selected matrices, while others have a broader application. When there are numerous methods for the same analyte there is significant room for disagreement. We will highlight a process to come together, discuss common methods, agree on an approach, and complete a study to develop