



An Antioxidant Classification System *Getting a Handle on Antioxidant Names*



Now we're on to the 3rd and last essay of the series on berries as antioxidant foods. This part is more technical but a needed step toward becoming familiar with the various types of antioxidants in our bodies and foods.

Let me know what you think of this nomenclature -- it's the first time it has been given to the public.

How to Apply the Color Code

Here is a general breakdown (alphabetical order) of which color groups have body-derived or food-derived chemicals with antioxidant qualities:

1. Enzymes (Body and "Brown/Gray" Foods)

Normally resident in cells, enzymes catalyze chemical reactions and cellular responses.

Members of this class of antioxidants include:

- * Superoxide dismutase
- * Catalases
- * Reductases
- * Peroxidases
- * Transferases

2. Vitamins (Body and "Brown/Gray" Foods)

Most consumers would already recognize the three main antioxidant vitamins -- A, C and E -- that derive from food and supplements common to the public. Vitamins A and E are fat-soluble providing antioxidant protection in cell structures like the outer membrane and inner nuclear organelles. Vitamin C dissolves readily in body water compartments so is universally distributed in the body. One important role of vitamin C is to protect vitamins A and E from damaging oxygen radicals!

3. Phenolics ("Blue, Red, Purple, Black - BRPB" Foods)

With more than 8,000 individual chemicals that serve plants as pigments, the phenolics (also called phenols or polyphenols) are water-soluble acids that not only give plants colors, but also differentiate scents, tastes, and bitterness.

The large subclass of *phenolics called flavonoids* is often mentioned in current public media. Quercetin, kaempferol, ellagic acid and peonidin are examples of flavonoids that have been in the news recently.

4. Carotenoids ("Orange/Yellow, Red" Foods)

A fat-soluble group of more than 600 individual chemicals, the carotenoids (e.g., beta-carotene, lycopene, lutein and zeaxanthin ("zee-a-zan-thin") are especially powerful antioxidants. Due to their chemical structure predominant with double-bonds between carbon atoms, they are an excellent source of electrons aggressively sought by oxidative free radicals. A carotenoid molecule donates electrons to a free radical, sacrificing itself in antioxidant defense. Terpenes and xanthophylls are included in this class.

5. Hormones (Body and "Brown/Gray" Foods)

A growing field of medical research is identifying normal hormones typically described with cell-to-cell messaging roles in the body as having antioxidant functions. Presently only a few hormones have this identified property such as melatonin, estradiol and insulin, but future research will likely unravel similar functions for the dozens of hormones known in human physiology.

6. Minerals (All Colors of Foods)

Minerals are adjunct elements that enable enzyme activity. Selenium, zinc, manganese, magnesium and copper are minerals involved in hundreds of antioxidant roles in the body.

7. Glutathione (Body and "Brown/Gray" Foods)

Probably the body's single most important native antioxidant, glutathione is a water-soluble molecule synthesized from food-derived amino acids. It also depends on lipoic acid (below) for synthesis.

8. Lipid effectors ("Orange/Yellow" Foods)

Lipoic acid is perhaps the "perfect" antioxidant because it is a small powerful molecule that dissolves readily both in fatty layers of cells and in water - *the only antioxidant to do this*.

Other lipid oriented antioxidants include omega fatty acids, tocopherols (like vitamin E), phytosterols, perillyl alcohol and essential oils such as limonene.

9. Saponins, steroids and stilbenes ("Green, BRPB" Foods)

Related in this discussion only by their common first letter "s", this group has established antioxidant functions and includes some well-known chemicals such as resveratrol (a stilbene of red wine and dark grapes), brassinosteroid (the growth regulator of plants) and saponin (the waxy covering on plant leaves).

10. Sulfur-containing chemicals ("Green, White" Foods)

Including organosulfides, tri- and diallyl sulfides and sulforaphane, this group from plants like broccoli and cabbage has been shown to have properties affecting antioxidant enzyme activity, inflammatory mediators and tumor growth.

Proposing an Antioxidant Nomenclature

Just as the class of vitamins have been given a nominal identity (Vitamin A, B, C...etc) so too could we refer to antioxidants.

This is a new system not yet formally proposed to any regulatory authority or scientific body. Classification of antioxidants must undergo the scrutiny, revision and adoption by scientists, industry and government to be acceptable for food label use in the public.

Here is the proposed breakdown:

1. Antioxidant C - carotenoids
2. Antioxidant E - enzymes
3. Antioxidant G - glutathione
4. Antioxidant H - hormones
5. Antioxidant L - lipid-associated chemicals
6. Antioxidant M - minerals
7. Antioxidant P - phenolics
8. Antioxidant S - saponins, steroids, stilbenes, sulfurs
9. Antioxidant V - vitamins

Over time, the public must feel these proposed antioxidant classes are informative and practical for understanding antioxidants and choosing preferred foods.

Time will tell, but this list **gives us a simple working structure to get a handle on naming antioxidants.**

Introduced in this essay were several technical terms possibly new to you. *This is as technical as reports from the Journal are likely to get.* Be patient. It takes time to learn and associate this food chemistry language, and we will gradually introduce

more examples from different foods in the future.

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