There is a lot of confusion among the public on antioxidants. For the most part, this is for good reason. Many food companies put antioxidant numbers on the packages that sound good to consumers, who have no idea how to interpret them. Thus, it is increasingly important to have an understanding of what a meaningful antioxidant actually is.

A meaningful antioxidant has two characteristics:

1. There is a sufficient amount of the antioxidant at the right location
2. It is not redundant

What do these mean? Let's consider the example of lycopene and vitamin E (alpha-tocopherol), which are both fat-soluble antioxidants. *In vitro* antioxidant assays have found that lycopene is 10-fold more effective in quenching singlet oxygen than alpha-tocopherol\(^1\). However, when you look at the concentrations found in the body, there is far more alpha-tocopherol than lycopene. For example:

LDL on average contain 11.6 molecules of alpha tocopherol and 0.9 molecules of lycopene. Thus, if we divide alpha tocopherol by lycopene 11.6/0.9 we find that there is on average 12.9 times more alpha-tocopherol than lycopene\(^1\).

Other examples in the body:

- Prostate - 162-fold higher alpha-tocopherol than lycopene concentrations
- Skin - 17 to 269-fold higher alpha-tocopherol than lycopene concentrations
- Plasma - 53-fold higher alpha tocopherol than lycopene concentrations\(^1\)

Thus, despite the fact that lycopene is a better antioxidant *in vitro*, since the concentration of alpha-tocopherol is so much higher in tissues (locations of need), it is likely the more meaningful antioxidant. In addition, if lycopene and alpha-tocopherol have similar antioxidant functions (fat-soluble antioxidants), lycopene’s potential antioxidant action is redundant to alpha-tocopherol’s antioxidant function and thus, also less likely to be a meaningful antioxidant. Indeed, further examination of the literature has not suggested that lycopene can act as an antioxidant *in vivo*, even though it is a good one *in vitro*\(^1\).

You may be wondering “What about the in vitro antioxidant assays, like the oxygen radical absorbance capacity (ORAC) assay that some food and supplement companies are including on their labels?” The first link below is the official website containing the ORAC values of all tested foods. The second is similar to the end of the ‘How antioxidants work’ video in section 8.41 except this link compares the ORAC values of coffeeberry. This is an example of how some companies/businesses use ORAC values to market their product(s).
However, going back to the two characteristics of meaningful antioxidants, there really isn't evidence that shows that a high ORAC score leads to any benefit *in vivo*. This is because the measure also doesn't take into account characteristics such as bioavailability. Bioavailability is the amount of a compound that is absorbed or reaches circulation. Many of these purported super antioxidants haven't been shown to be absorbed or maintained in the body in a way that would suggest that they would be meaningful antioxidants.

**References & Links**

**Links**
- ORAC Values - http://oracvalues.com/
- Sozo Coffeee ORAC Comparison - http://www.sozolife.com/Products/what-is-orac.aspx