# Quantifying isotopic enrichment

## UC Davis Stable Isotope Facility

* [link](http://stableisotopefacility.ucdavis.edu/)
* 5 atom-% is the upper limit of isotopic enrichment
* total carbon in sample must be in range: 200-2000 ug C
* Analytical accuracy: 0.2 permil for 13C

## DNA

### Notes

* Using glucose for a natural abundance carbon source
* 200-2000 ug C of glucose requires 500-5000 ug total weight
* MW of dsDNA nucleotides: (# nucleotides x 607.4) + 157.9
* average % C in dsDNA: ~46% (see DNA carbon % notes)
* (5 + 224.7) / (95 + 19775)
* (X / 0.0112372 - 1) \* 1000 = 40 permil
* 1 ug DNA-C in 200 ug total C
  + dilution = 1:200
  + Accuracy: 0.2 permil \* 200 = +/-40 permil
  + If using Vienna Pee Dee Belemnite (V-PDB) as standard:
    - (Rsample / Rstandard - 1) \* 1000
    - Rstandard = 0.0112372
    - (X / 0.0112372 - 1) \* 1000 = 40 permil
    - X = (40/1000 + 1) \* 0.0112372 = 0.0112372
      * Rsample must be > ~0.0112 to exceed noise

## References

El Zahar Haichar F, Achouak W, Christen R, Heulin T, Marol C, Marais M-F, et al. (2007). Identification of cellulolytic bacteria in soil by stable isotope probing. Environmental Microbiology 9:625–634.

\* 2 ug of gradient fraction added to tin capsule and dried for 2 hr at 60<sup>o</sup>C

## DNA carbon % notes

Adenine: C5H5N5 \* 44.4% C

Guanine: C5H5N5O \* 39.7% C

Cytosine: C4H5N3O \* 43.2% C

Thymine: C5H5N2O2 \* 48.0% C

Phosphate: PO4 \* 0% C

2-deoxyribose: C5H9O4 \* 45.1%

deoxyribose + phosphate + base:

\* C5H9O + PO4 + base  
  
\* 180 + base  
 \* 60 C  
  
Adenine:   
 \* 135  
 \* 60 C  
 \* Total: 215, 120 C, 55.8% C  
   
Guanine:  
 \* 151  
 \* 60 C  
 \* Total: 231, 120 C, 51.9% C  
  
Cytosine:  
 \* 111  
 \* 48 C  
 \* Total: 291, 108, 37.1% C  
  
Thymine:   
 \* 125  
 \* 60 C  
 \* Total: 305, 120, 39.3% C