

Nutritional biomarkers – strengths and limitations

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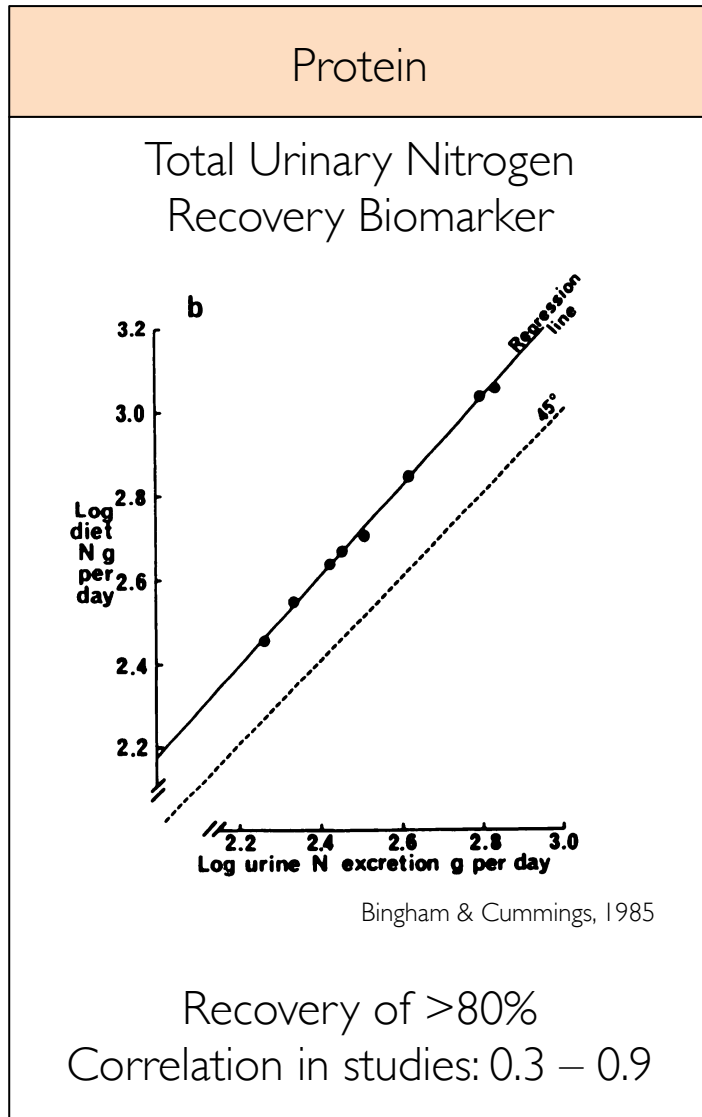
University of Reading

Strengths and limitations of biomarker - summary

- Objective measure of intake
 - Not affected by recall bias
- Reduce measurement error
- Improve self-reported data
 - Independent method
 - Can be used for measurement error correction
- Retrospective application
 - Can be analysed for biomarkers unknown at time of collection
- Does not require access to individual
- Relies on relationship intake ~ biomarker
 - Often very variable
 - Insufficient data
 - What is measured?
- Variable quality of analytical methods
- Validation difficult (and labourious)
- Sample storage and stability
- Cost

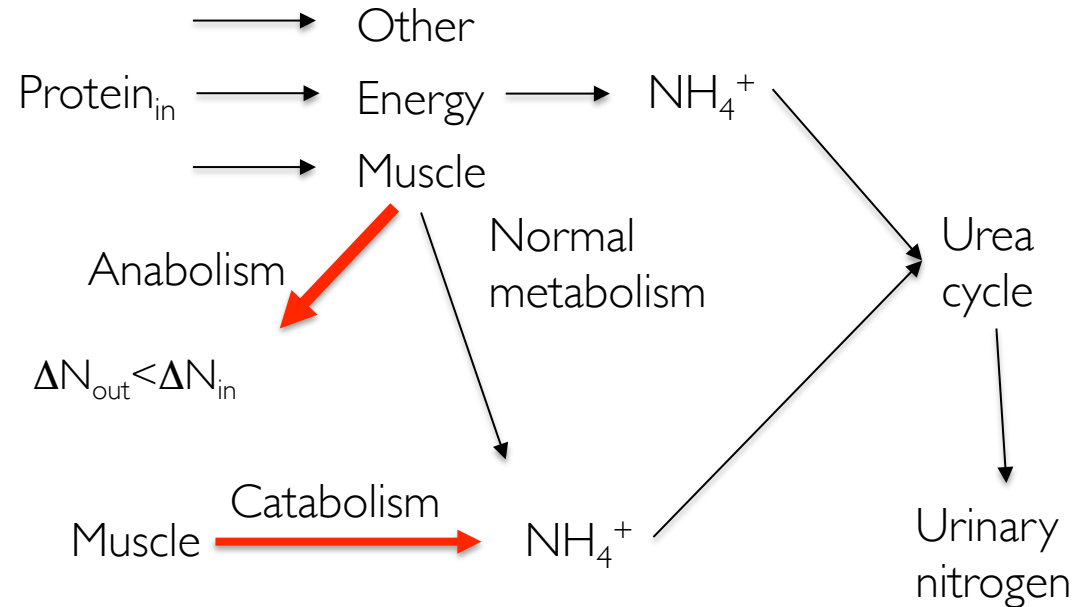
Relationship between intake and biomarker

Dietary reconstruction with recovery markers

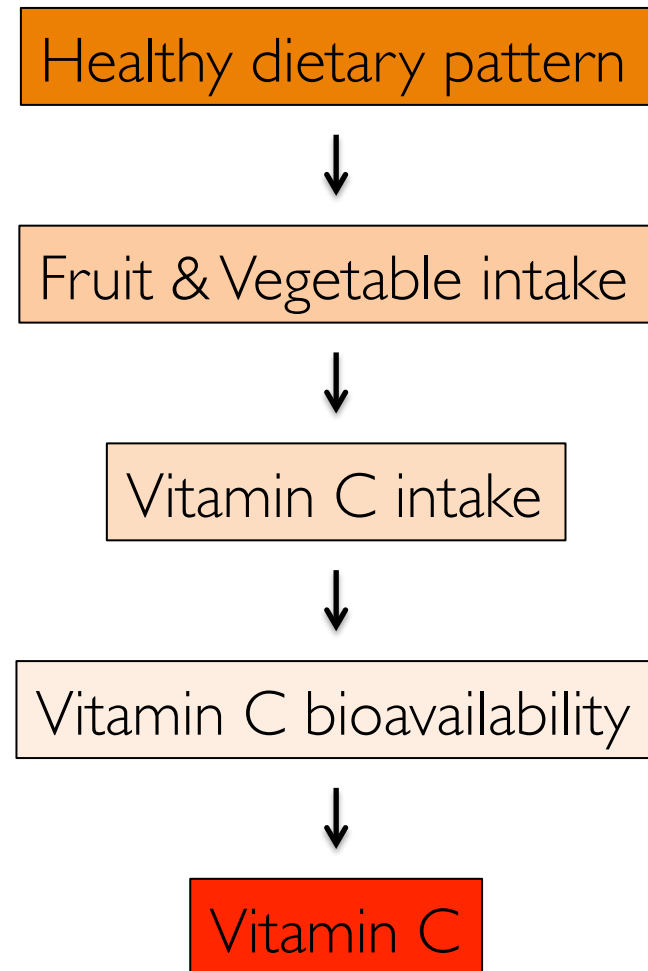


Estimate of protein intake
Reliable reconstruction

No information on type of protein
Requires steady-state condition



What do we measure?

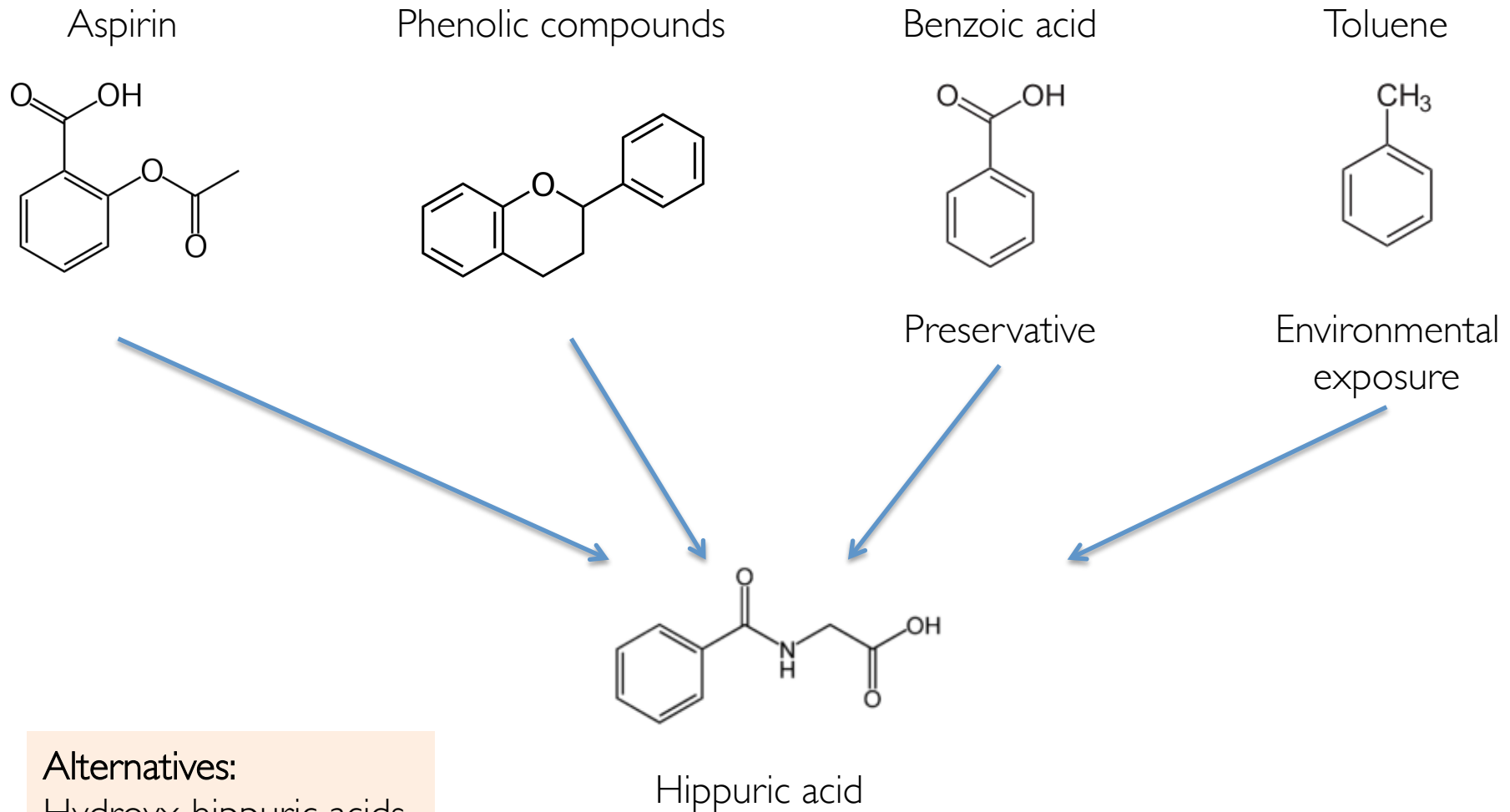


	Vitamin C (mg/100g)
Apple	6
Banana	11
Beetroot	5
Carrots	6
Cucumber	2
Kiwi	59
Onion	10
Orange	54
Pepper (green)	120
Pepper (red)	140
Potato	11
Strawberry	77

What do we measure?

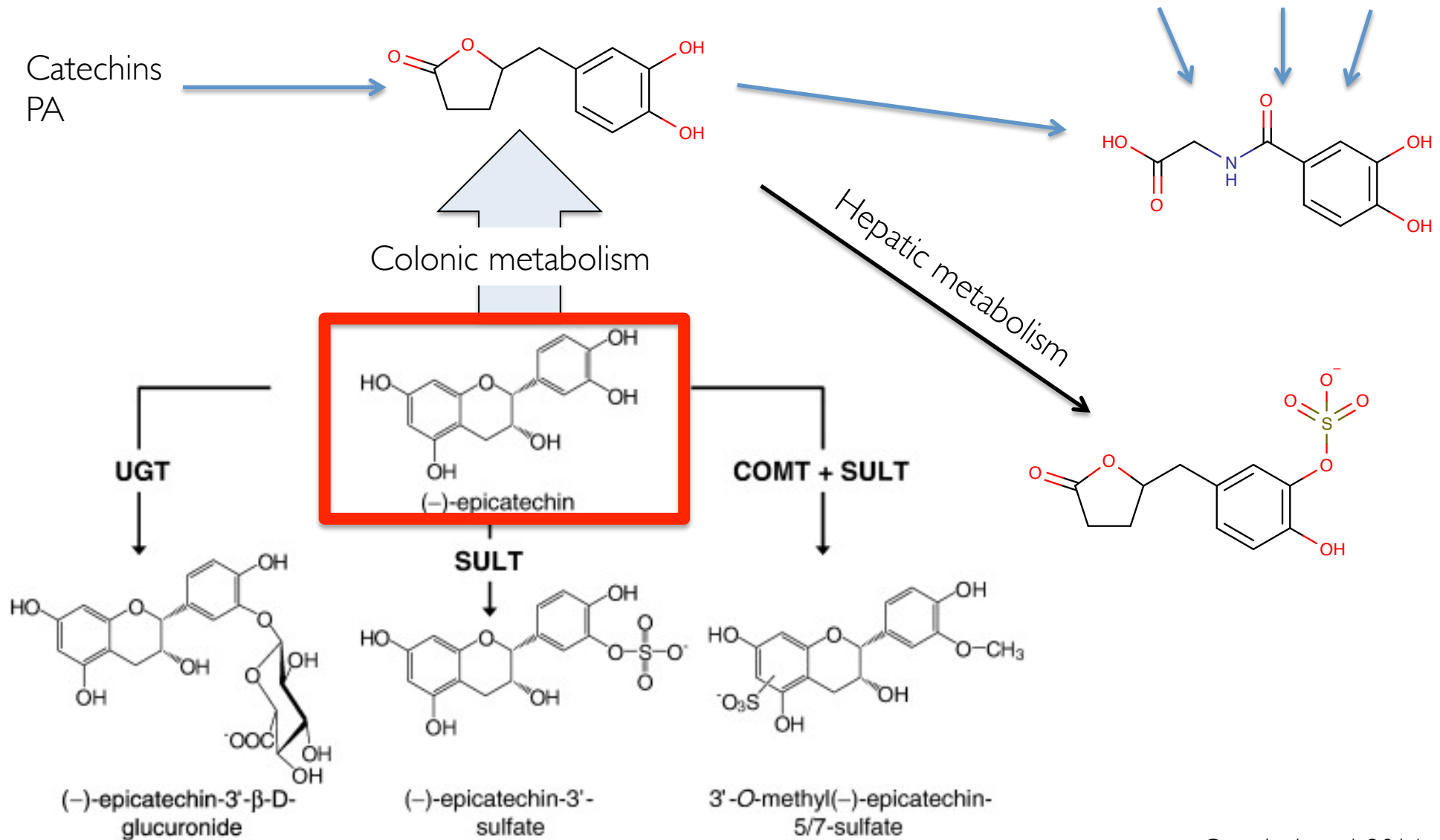
	Vitamin C	Carotenoids	Polyphenols
Apple	17	6	0.5
Banana	9	5	1
Beetroot	20	4	1
Carrots	17	0.01	2
Cucumber	50	2	5
Kiwi	2	3	1
Onion	10	20	1
Orange	2	2	0.4
Pepper (green)	1	0.4	0.4
Pepper (red)	1	0.03	1
Potato	9	∞	2
Strawberry	1	13	0.4

What do we measure?



Alternatives:
Hydroxy-hippuric acids

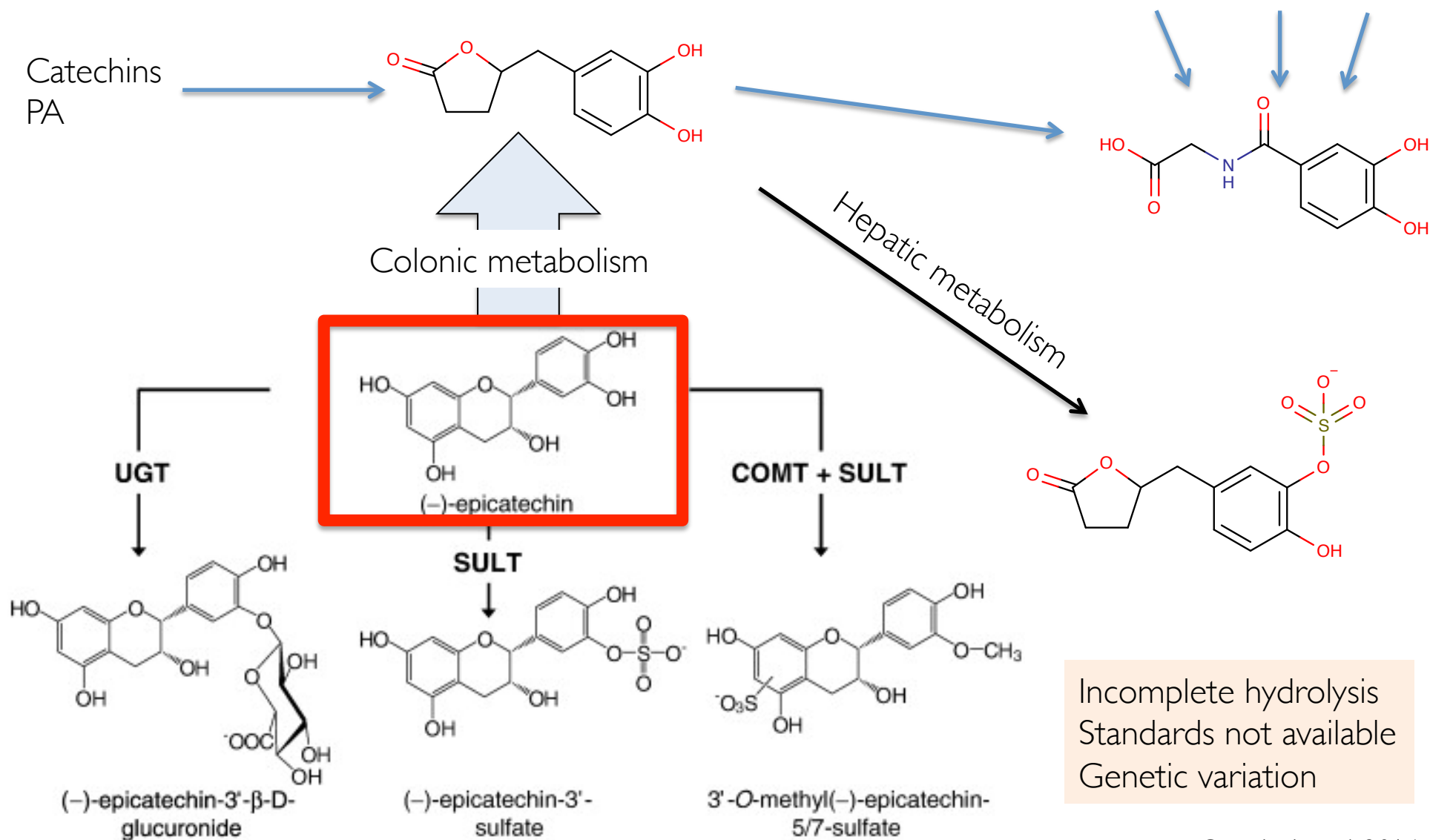
What do we measure?



Ottaviani *et al.* 2014

Technical strengths and limitations

Metabolism and analytical challenges



Ottaviani *et al.* 2014

Analytical methods - metabolites

- Identification and analysis of all metabolites
 - Time intensive (identification)
 - Cost intensive (authentic standards)
 - Not possible for all metabolites
 - Better data
 - Metabolite pattern
- Hydrolysis/summary method
 - Fewer data
 - Introduces variability (differences in metabolism affect hydrolysis)
 - Cheaper

Analytical methods – sample stability

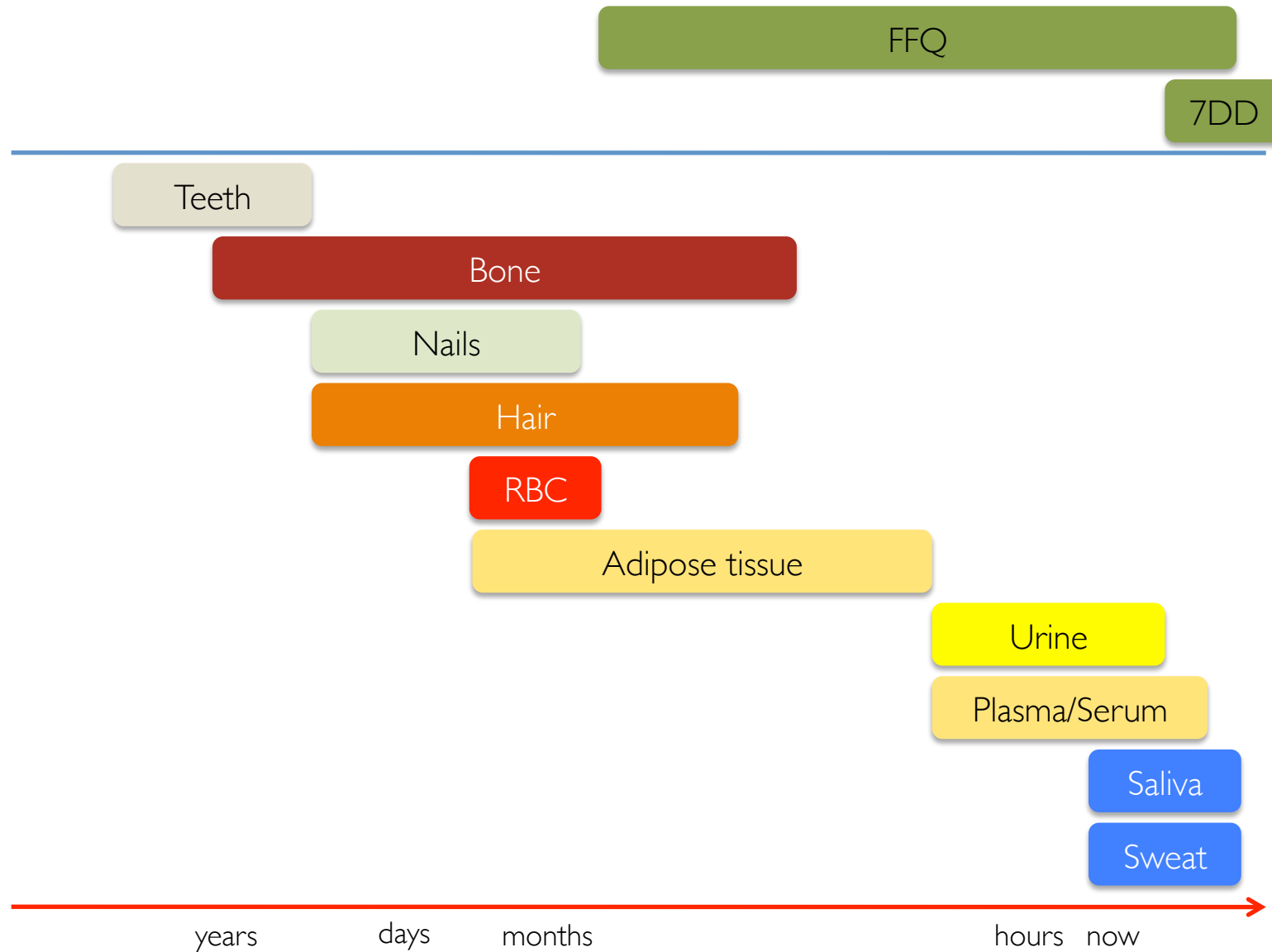
- Sample collection predates analysis by several years
 - Non-uniform sample processing
 - Incompatible preservatives
 - Finite amount of sample
 - Cost of retrieval
- Sample stability
 - Stability of metabolite unknown
 - Inter-individual differences in stability (e.g. urine pH)

Analytical methods – method development and QA

- Method development and validation
 - Time consuming and labour some
 - Often neglected
 - Validation in different laboratories
- Quality assurance
 - Standard method validation
 - Blinded QCs

Key strength of
biomarkers
Robust & reproducible
analytical method

Timescale of dietary assessment



Future aspects

Future aspects

- Timeframe
- Development
- Metabolism
- High-throughput
- Validation/data sharing

Future aspects – limitations to be addressed

- Development of new biomarkers
- Better validation of biomarker
 - Establishing relationship between intake and biomarker
 - Effect of genotype and metabolism
- Time-frame of assessment
- Methodology
 - Analytical method validation
 - Sample stability and storage
 - High-throughput/automated method
- Statistical methods
- Data/Method sharing

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