

Metabolite Imaging: The Next Frontier in Spatial Biology

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Panome Bio

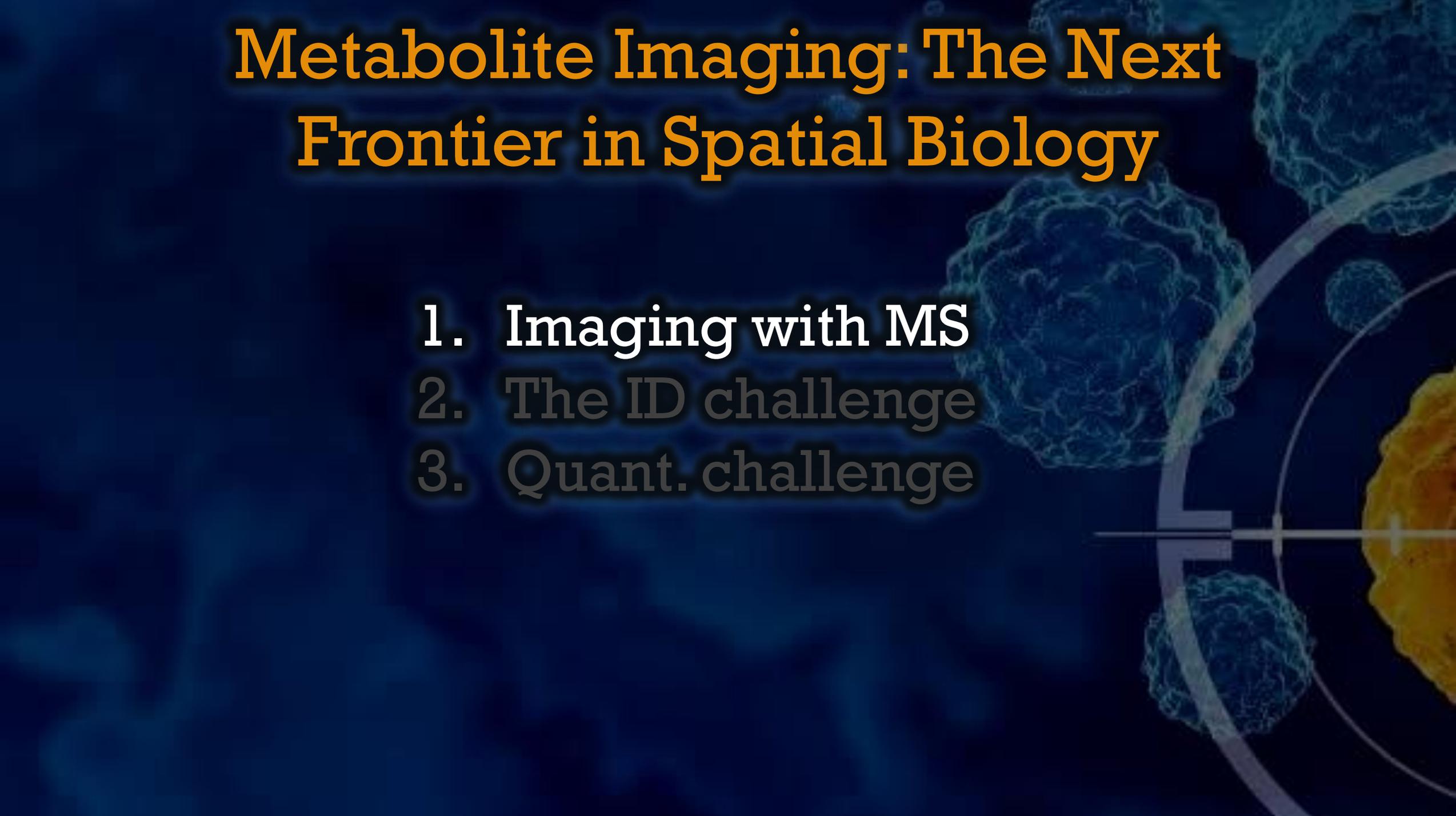
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Metabolite Imaging: The Next Frontier in Spatial Biology

1. Imaging with MS
2. The ID challenge
3. Quant. challenge



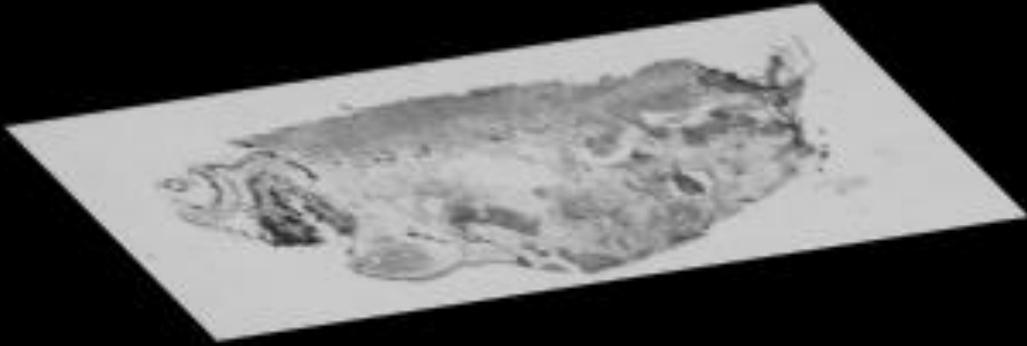
Metabolite Imaging: The Next Frontier in Spatial Biology



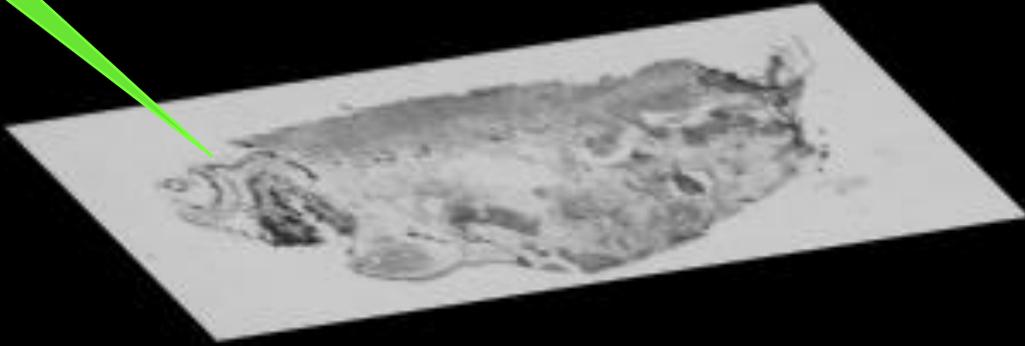
1. Imaging with MS
2. The ID challenge
3. Quant. challenge

1. Imaging with Mass Spectrometry

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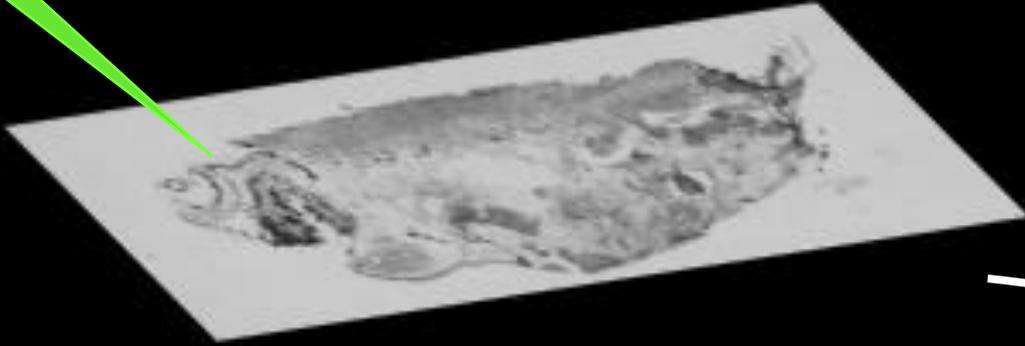


1. Imaging with Mass Spectrometry

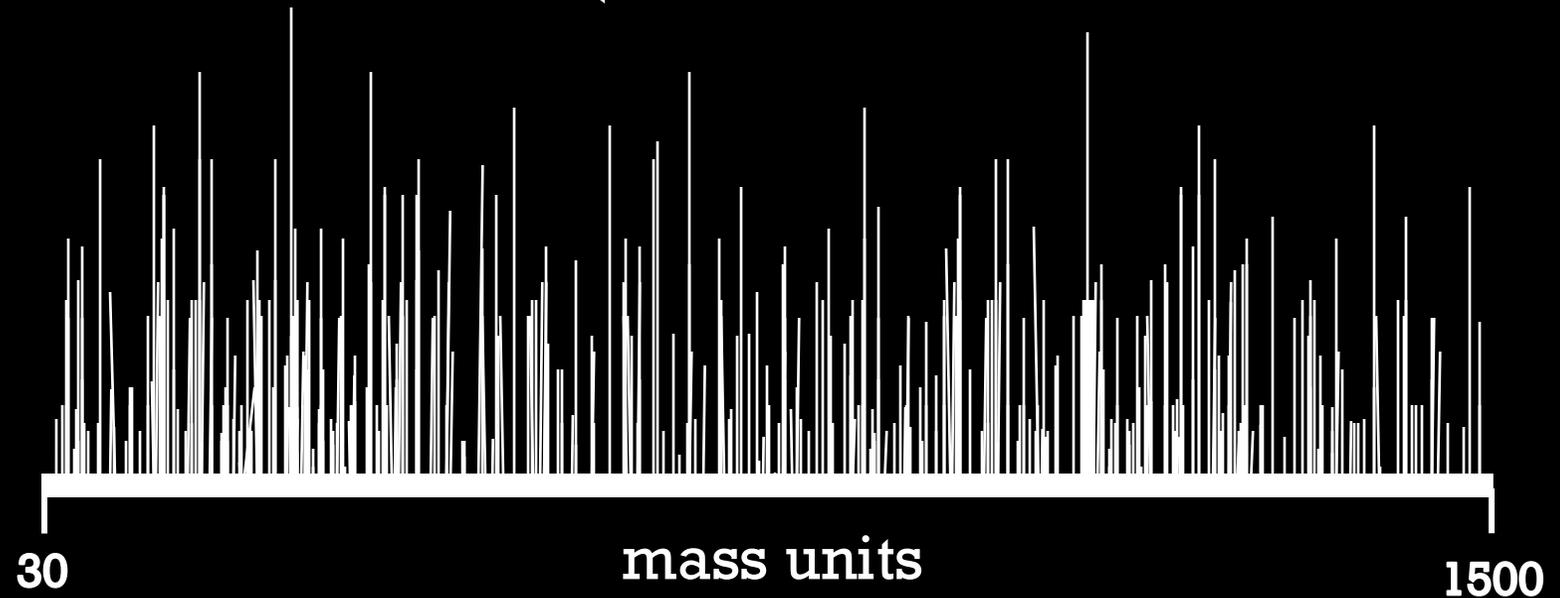


Laser beam, MALDI
Solvent beam, DESI
[1° ion beam, SIMS]

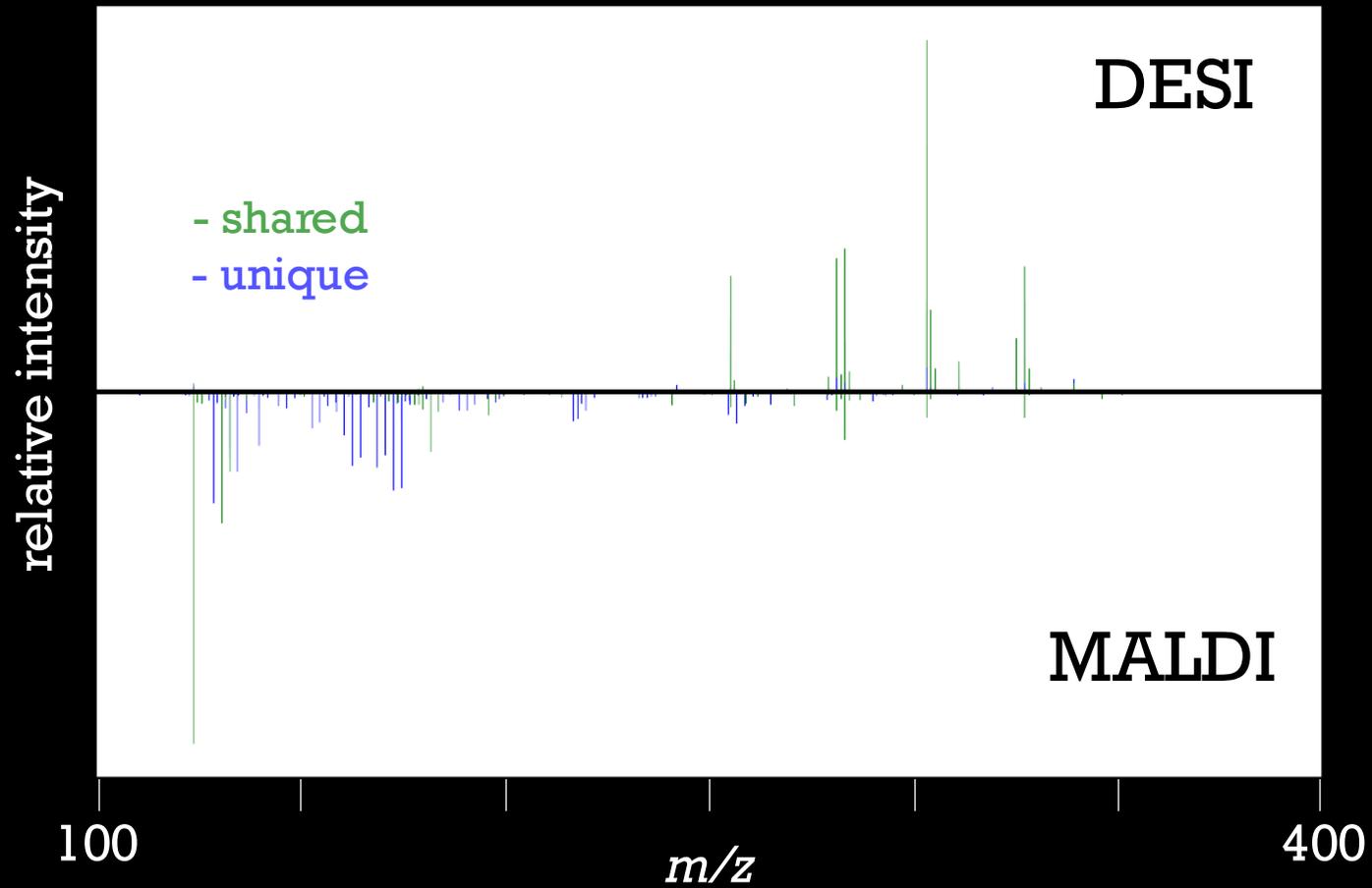
1. Imaging with Mass Spectrometry



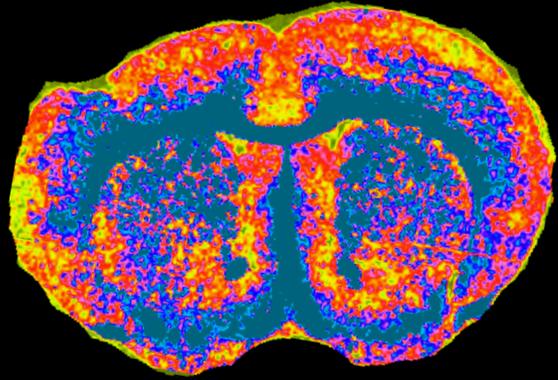
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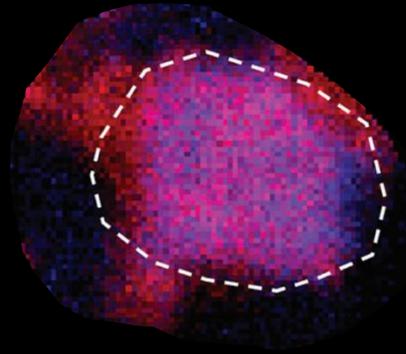
1. Imaging with Mass Spectrometry



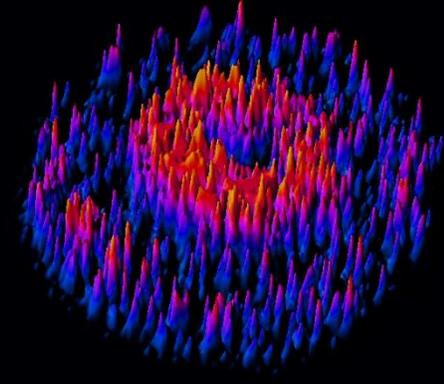
1. Imaging with Mass Spectrometry



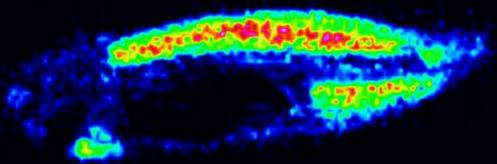
mouse brain



human kidney



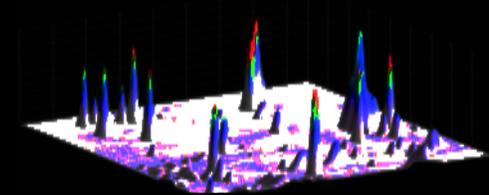
plants



zebrafish



C. elegans



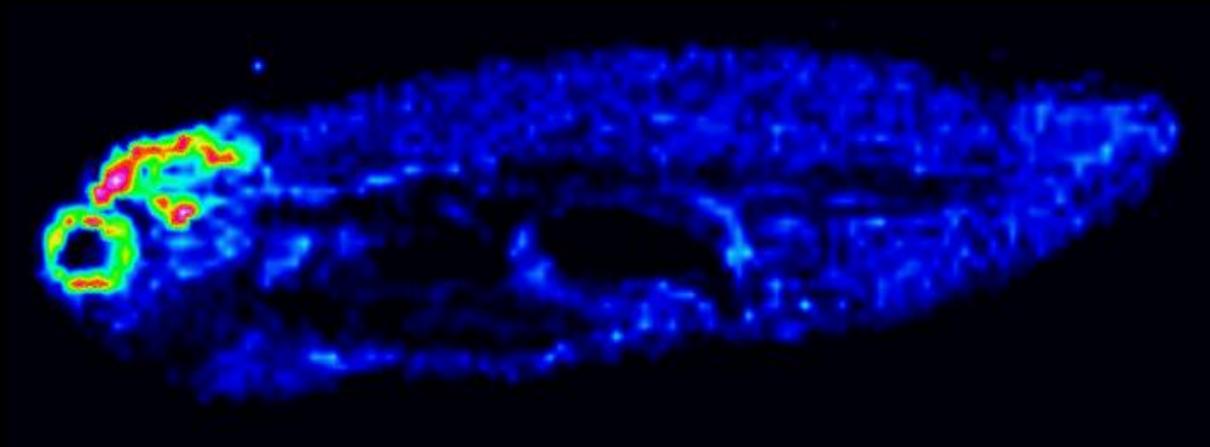
single cells

1. Imaging with Mass Spectrometry

(a) anatomical localization

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(a) anatomical localization



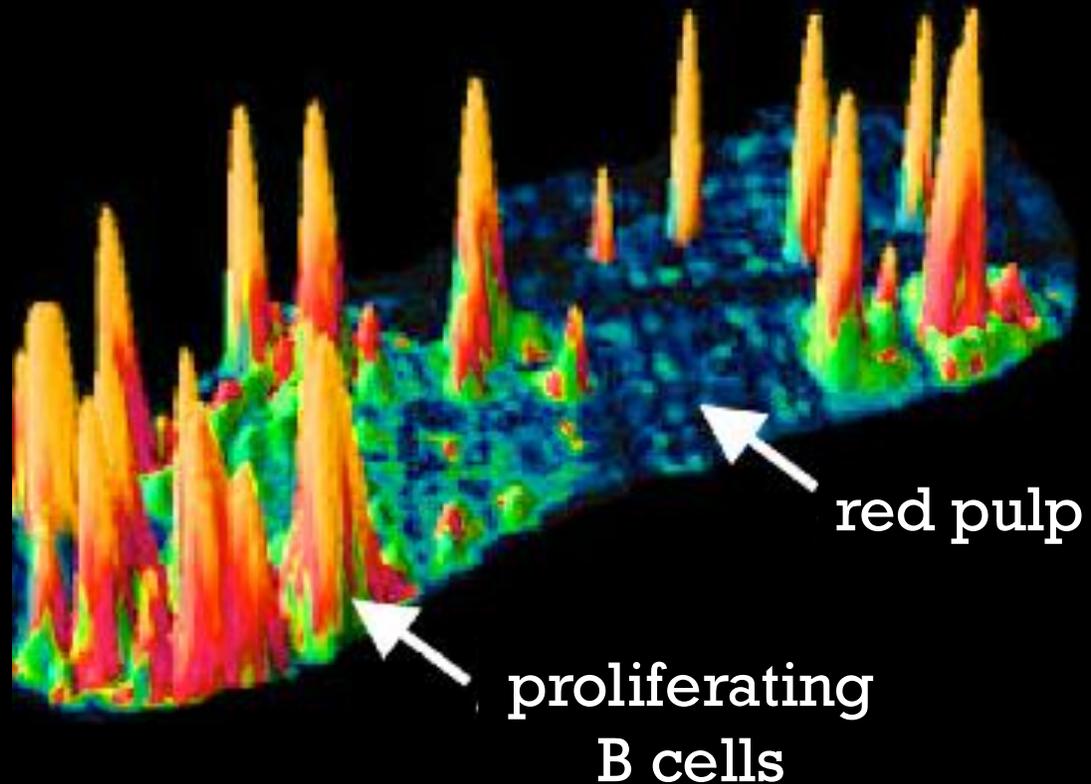
phosphatidylserine

1. Imaging with Mass Spectrometry

(b) functional tissue units

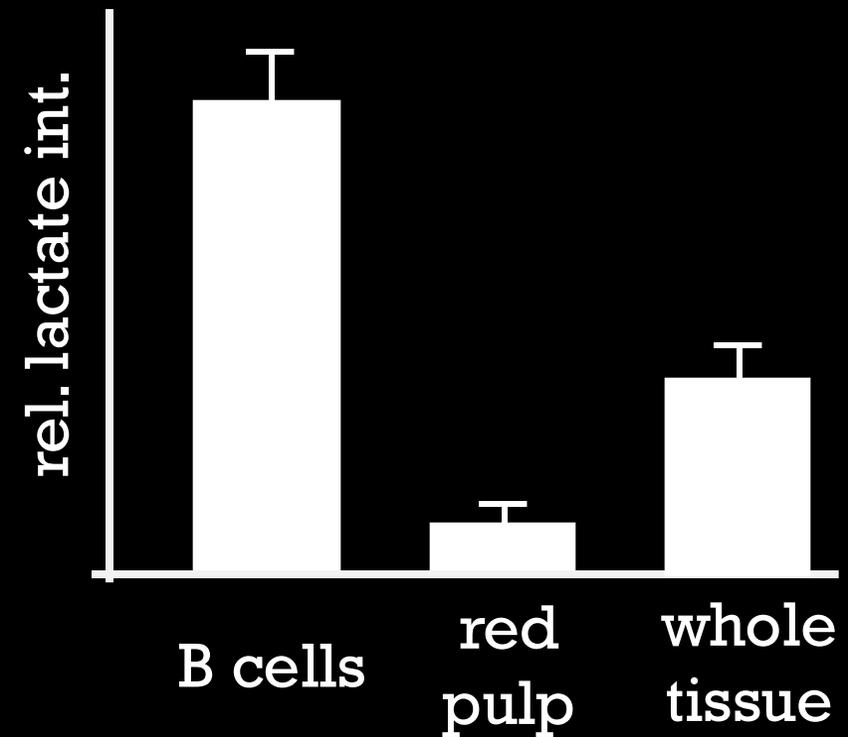
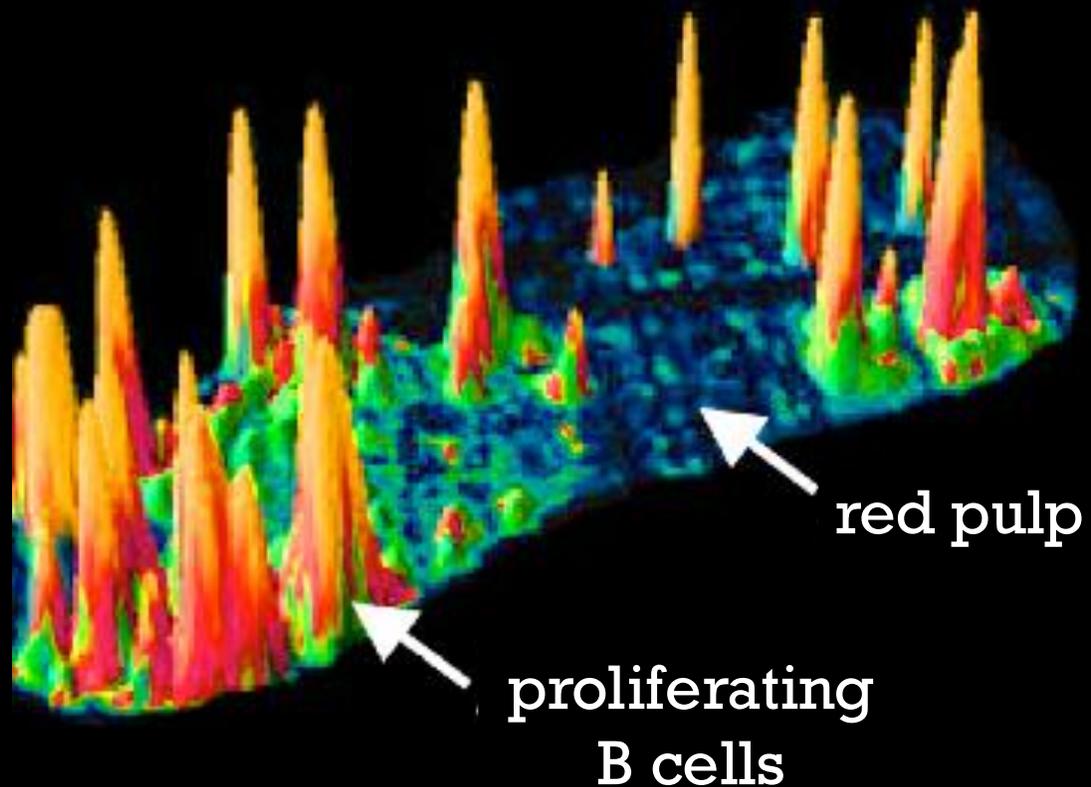
1. Imaging with Mass Spectrometry

(b) functional tissue units



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(b) functional tissue units

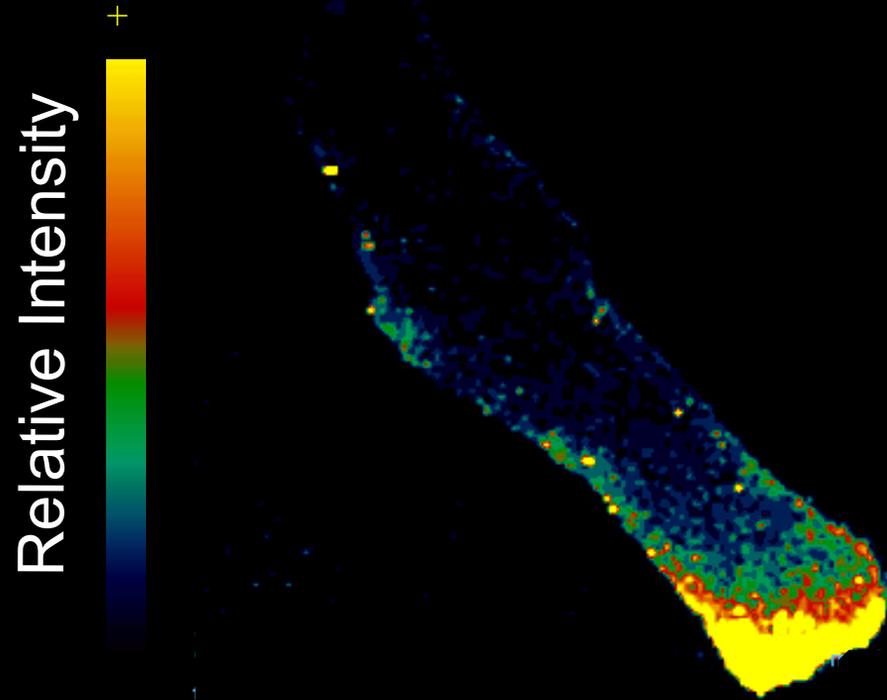


1. Imaging with Mass Spectrometry

(c) neighborhoods of cells

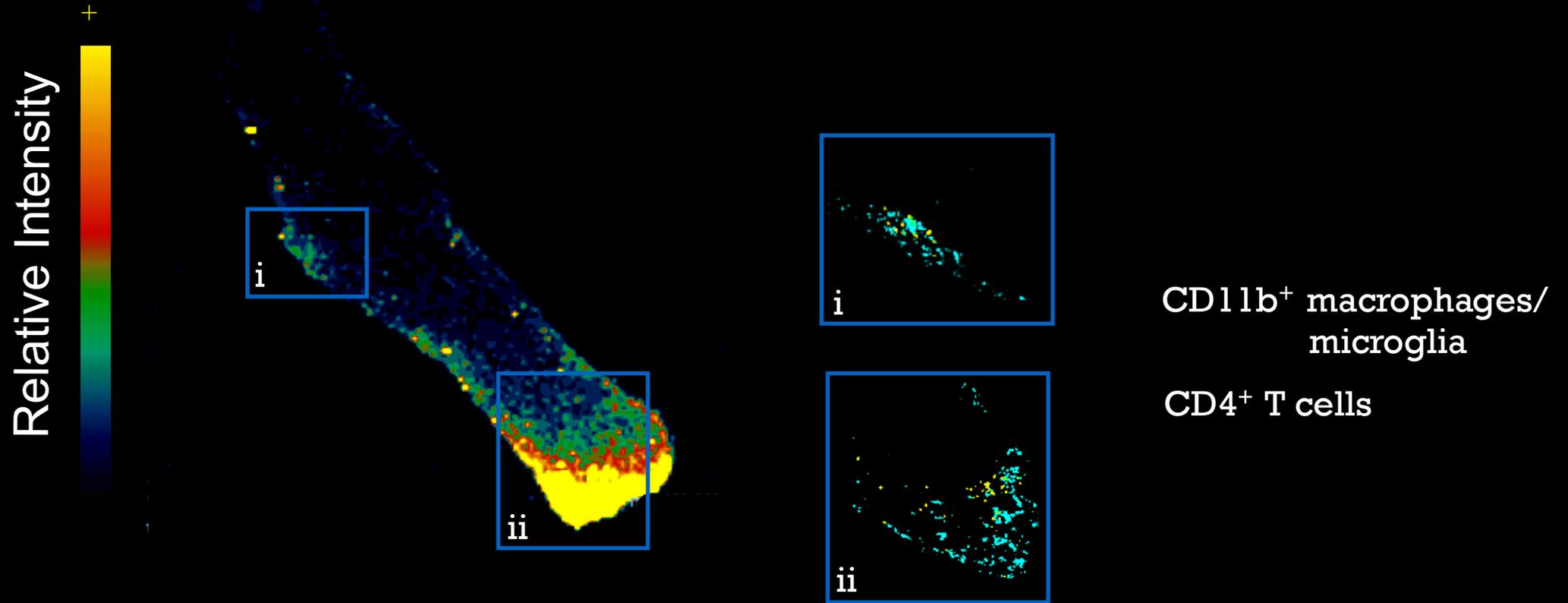
1. Imaging with Mass Spectrometry

(c) neighborhoods of cells



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(c) neighborhoods of cells

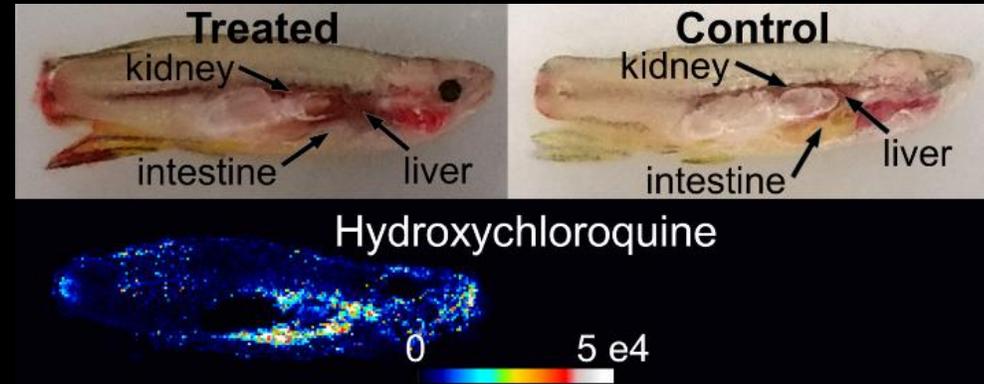


1. Imaging with Mass Spectrometry

(d) drug pharmacokinetics

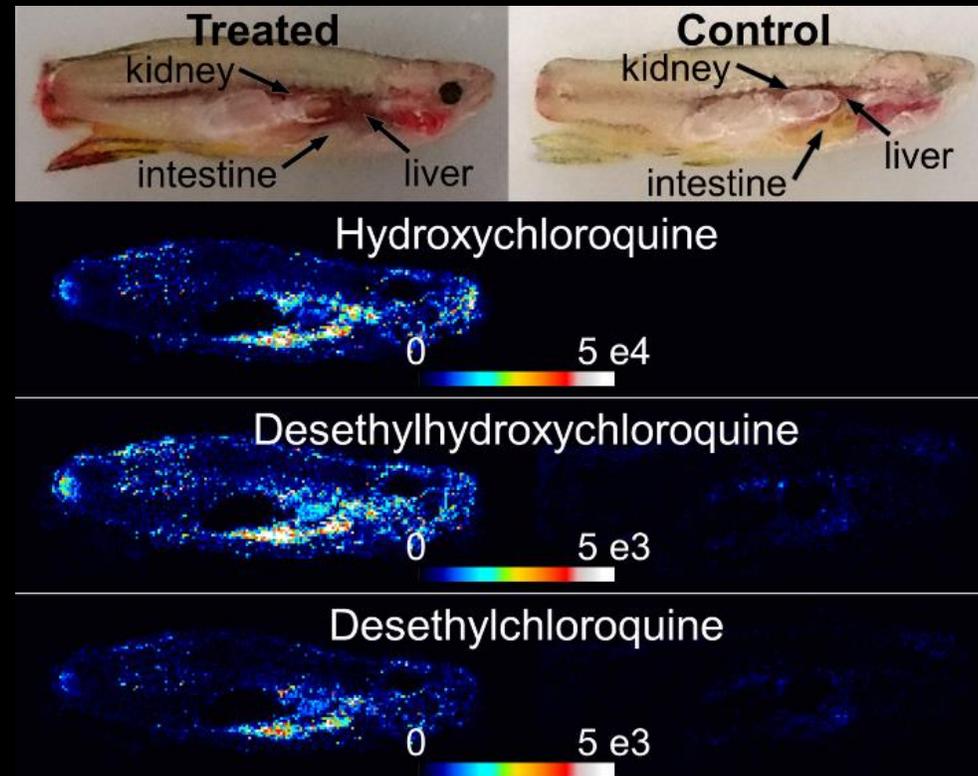
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(d) drug pharmacokinetics

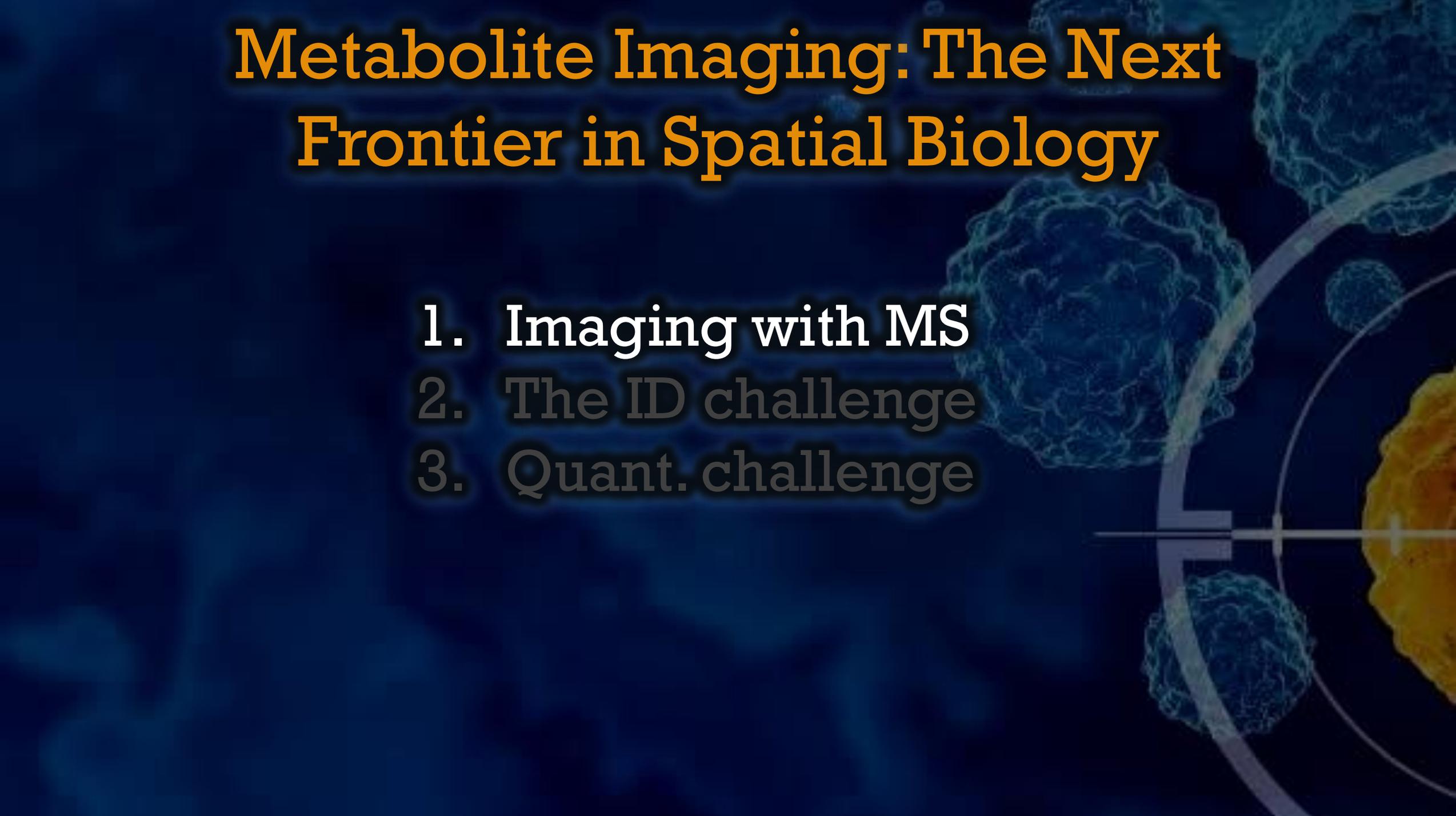


1. Imaging with Mass Spectrometry

(d) drug pharmacokinetics



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2. The ID challenge
3. Quant. challenge

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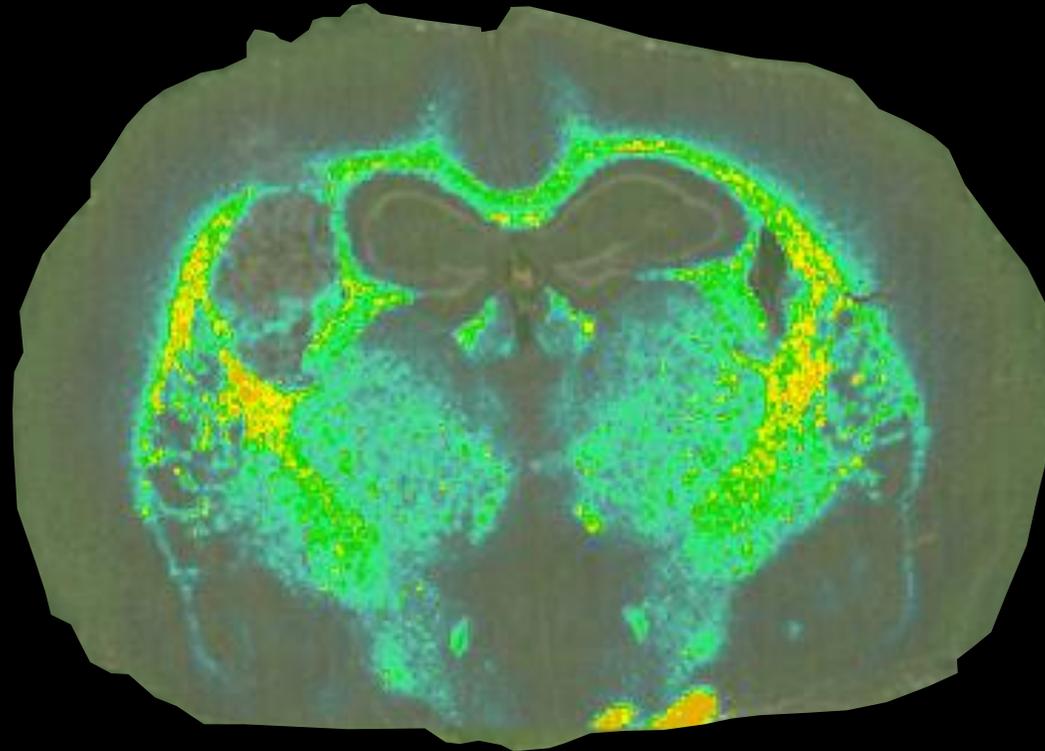
2. The identification challenge

2. The identification challenge

Level 1	Confident structure	MS/MS and RT or CCS (in house)
Level 2	Probable structure	MS/MS and RT or CCS (from DB)
Level 3	Possible structure	Characteristic fragment and/or RT
Level 4	Unknown structure	Accurate mass measurement only

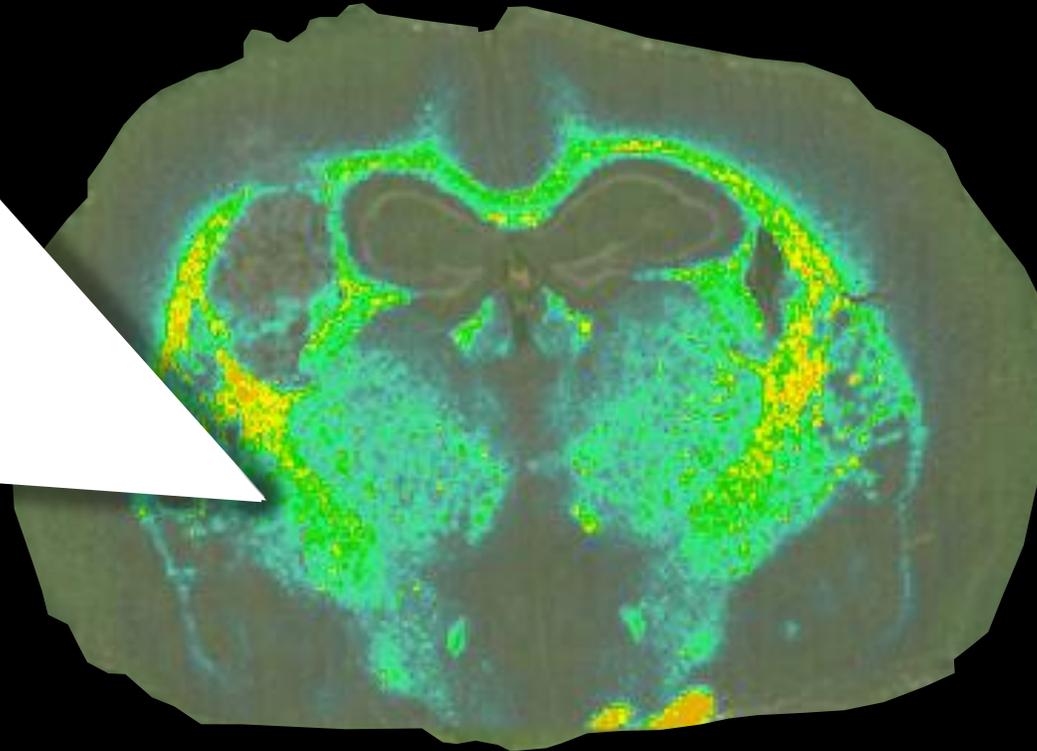
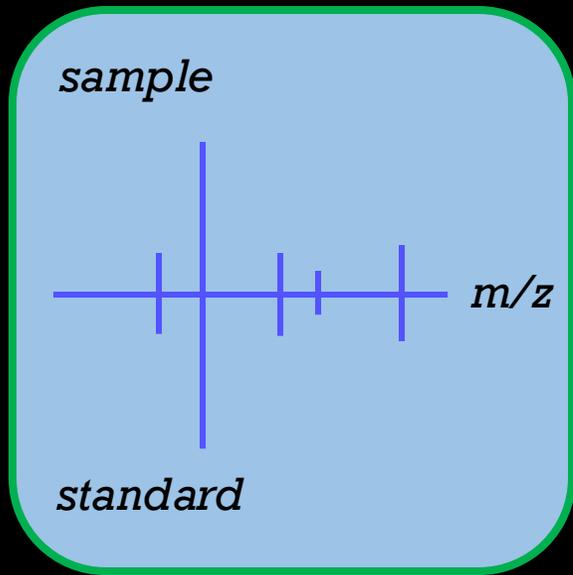
2. The identification challenge

$m/z = 259.022$



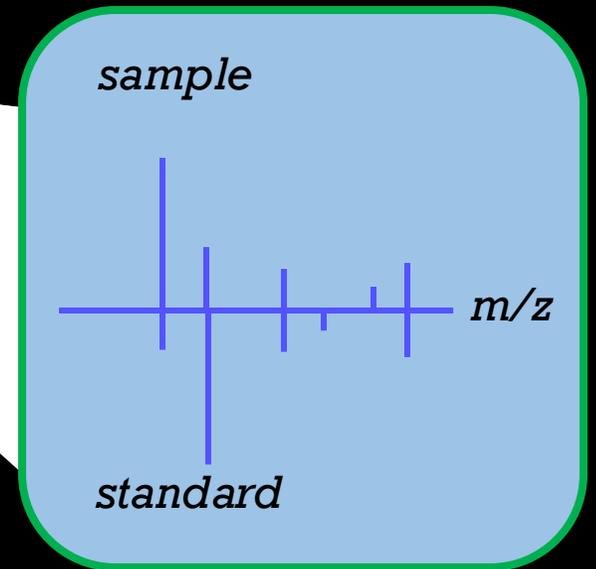
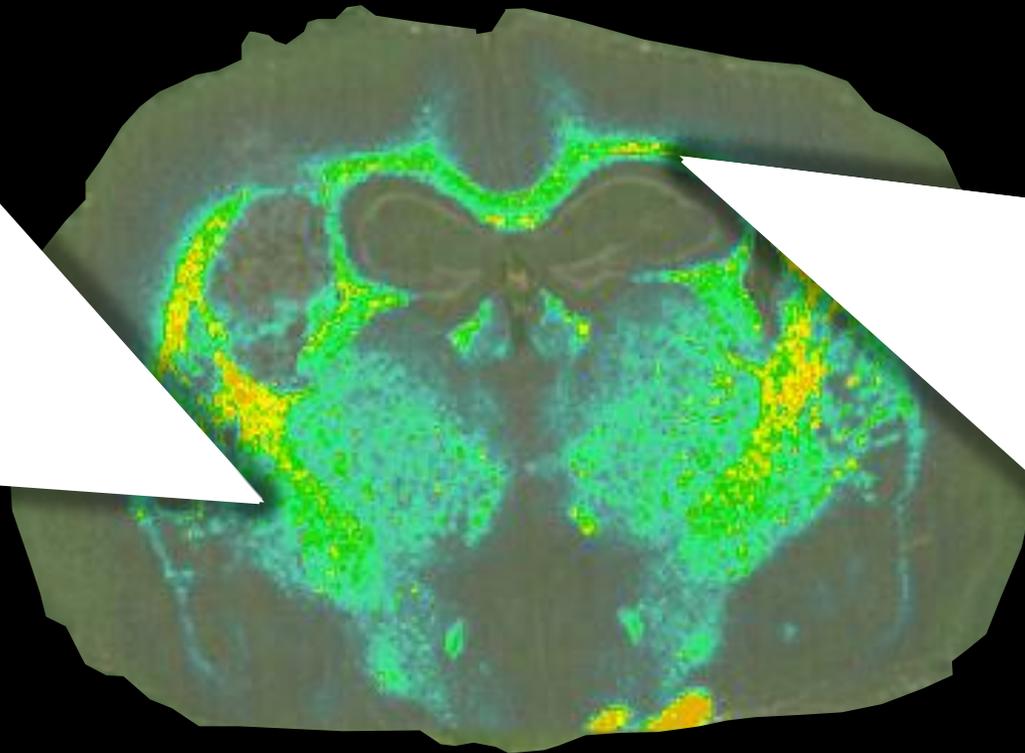
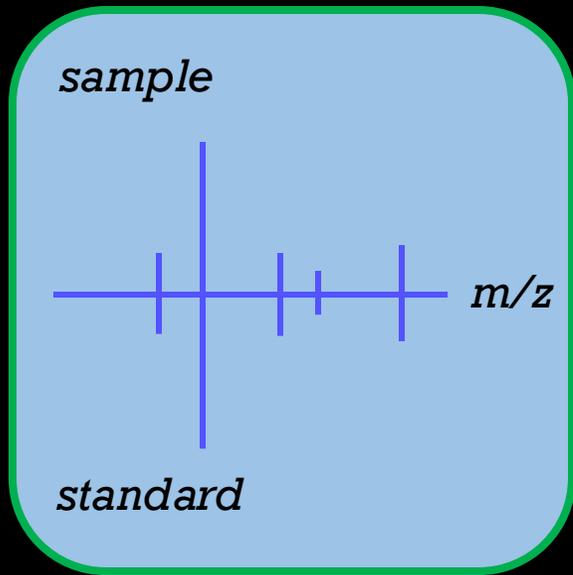
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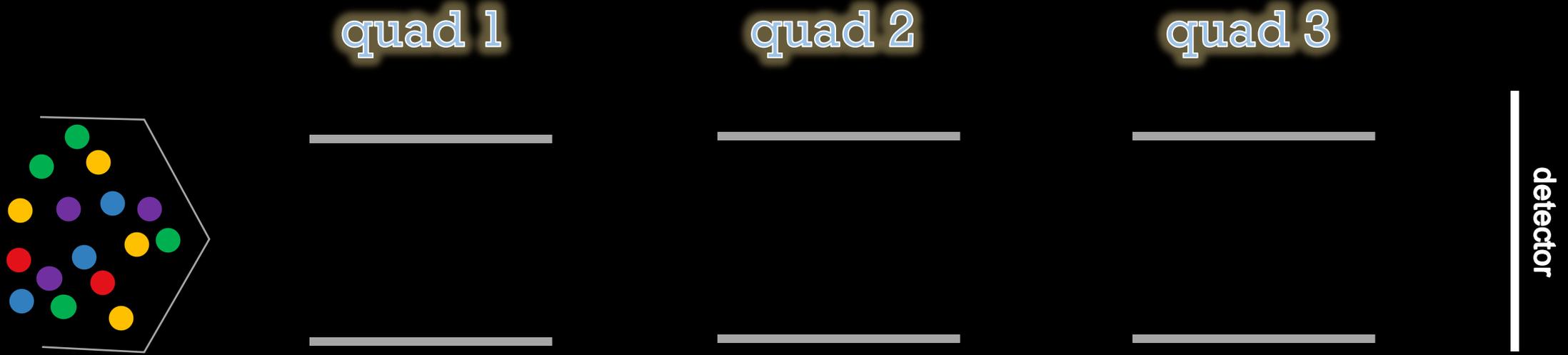


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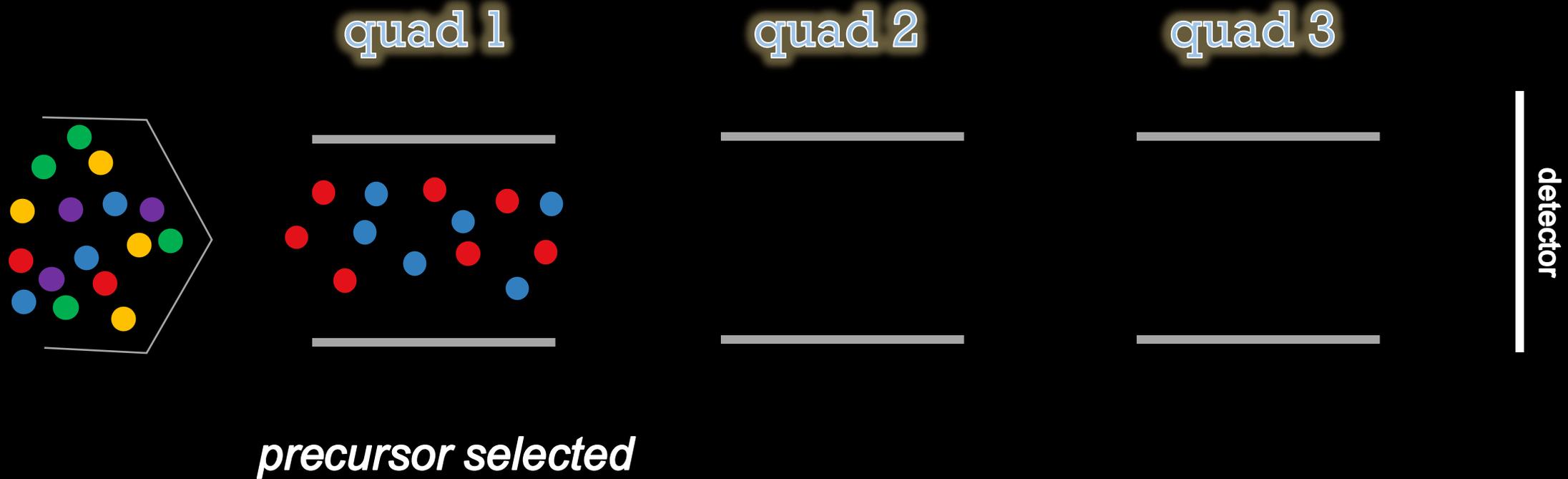
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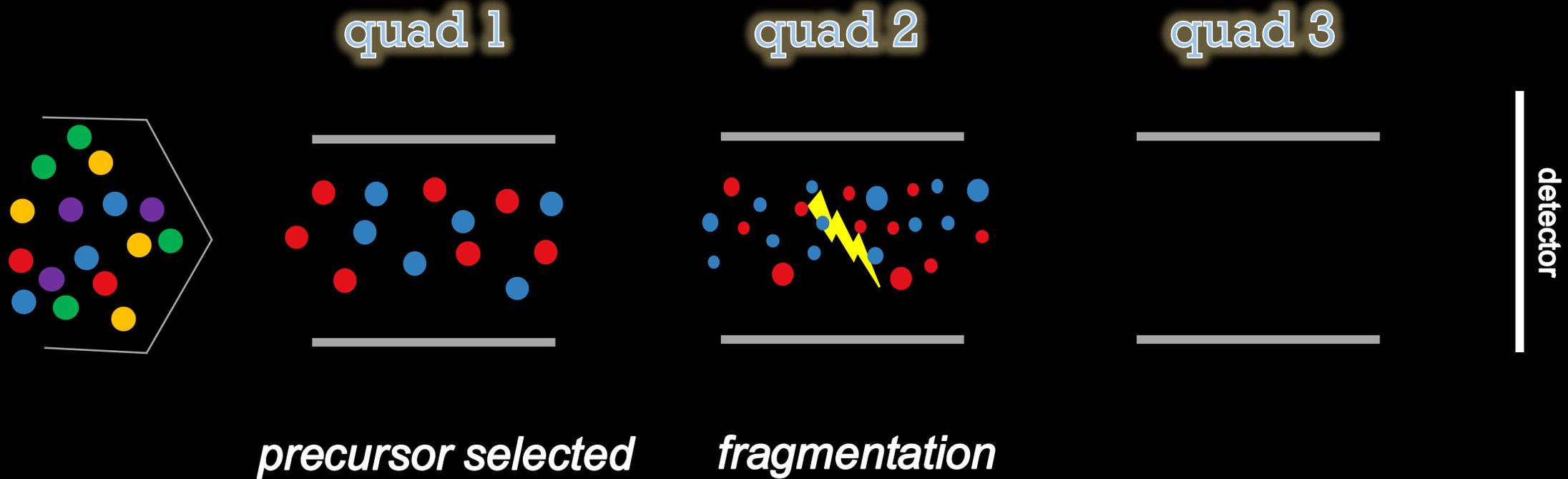
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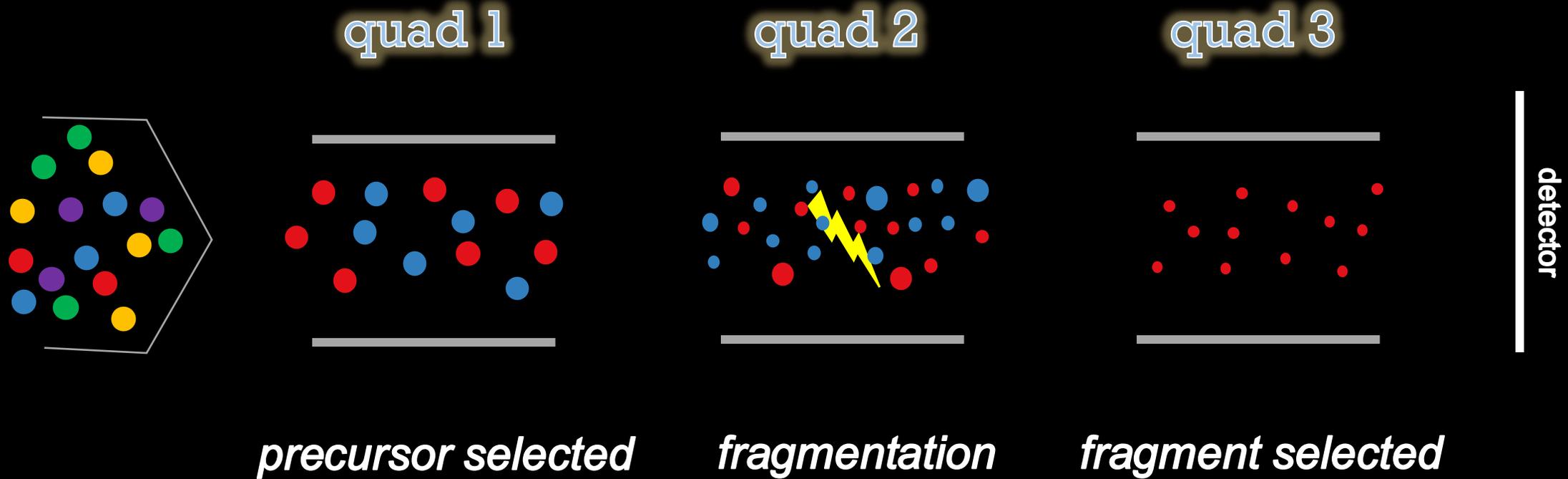
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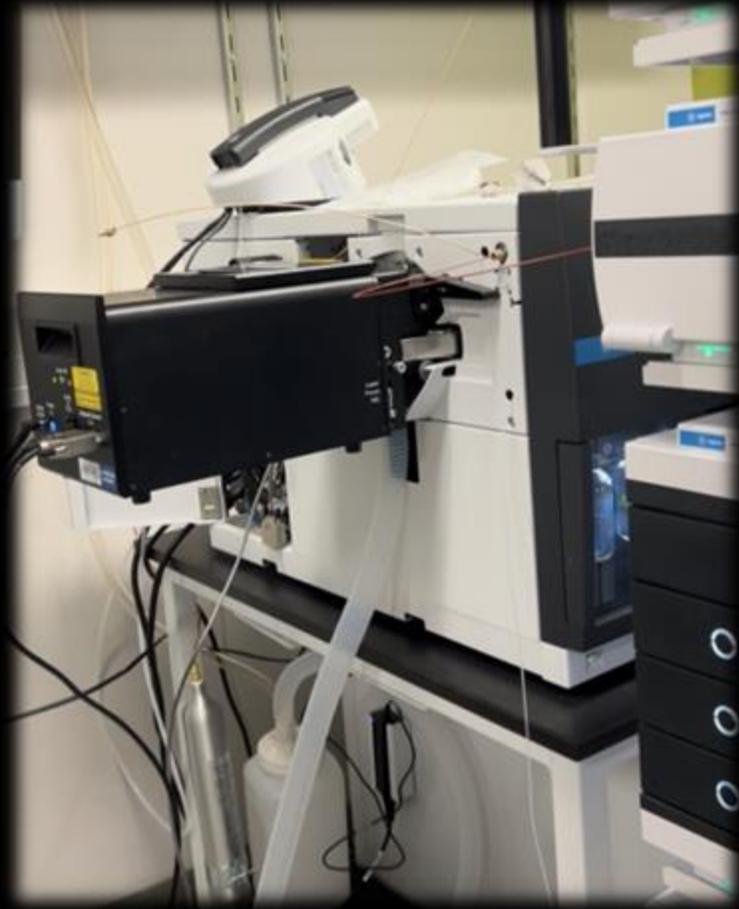
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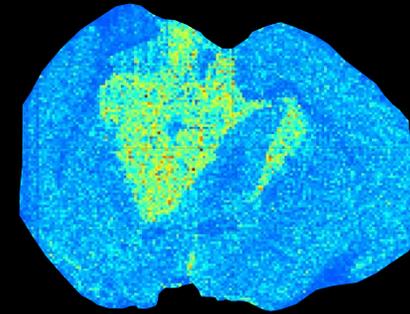
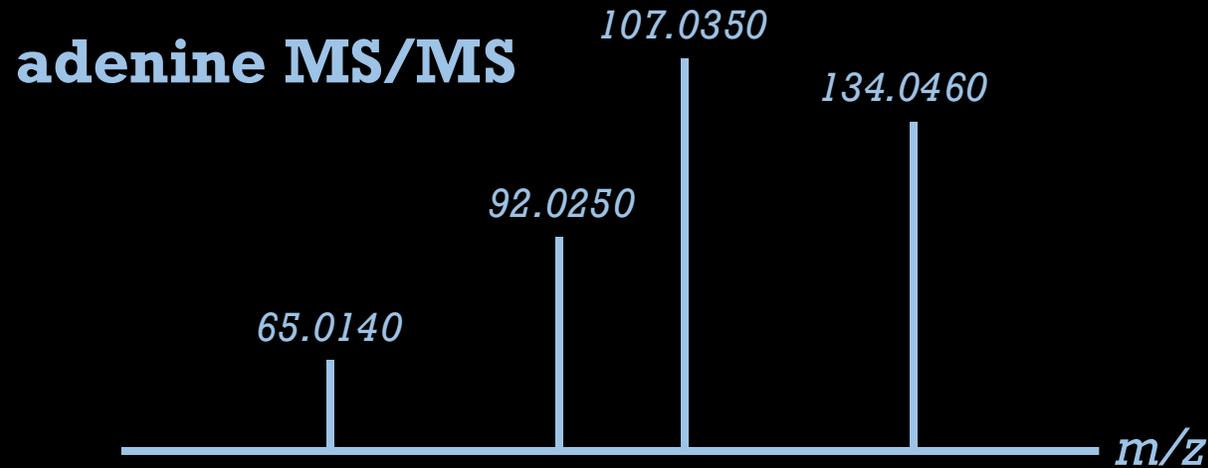
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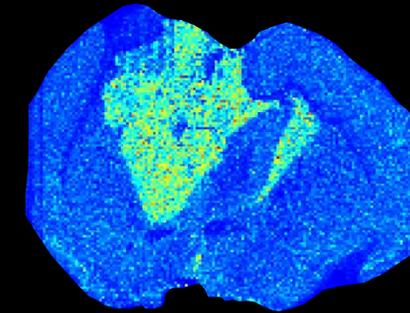
MASSTECH 

- AP-MALDI for QqQs (or QTOFs)
- Up and running in about 30 min
- Spatial resolution of 25 microns
- Software options (SCiLS, Mozaic)

2. The identification challenge



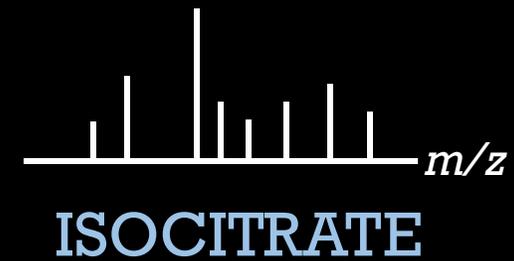
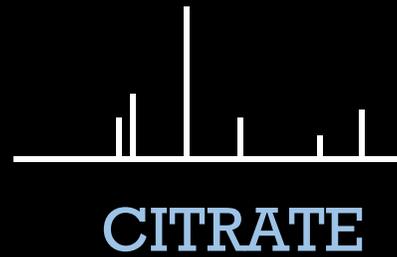
134.0 → 92.03



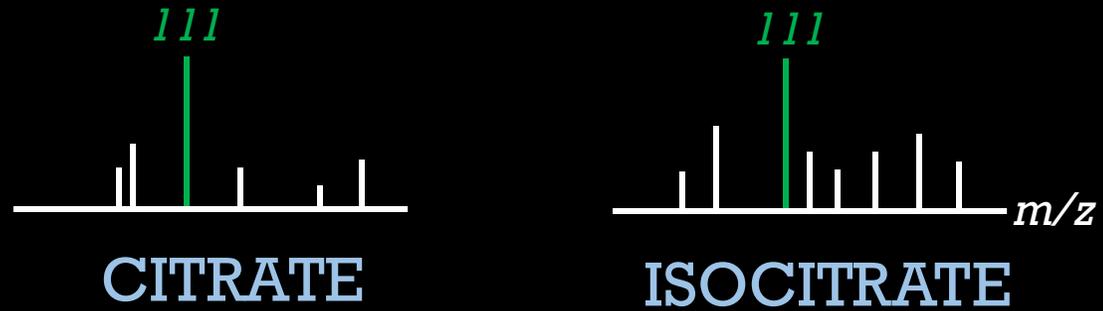
134.0 → 107.04

- better ID confidence
- avoids interferences
- enhanced sensitivity

2. The identification challenge



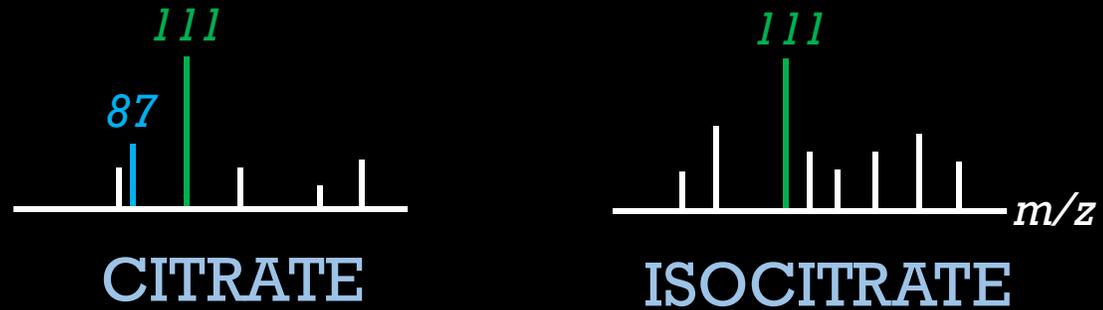
2. The identification challenge



191 → 111

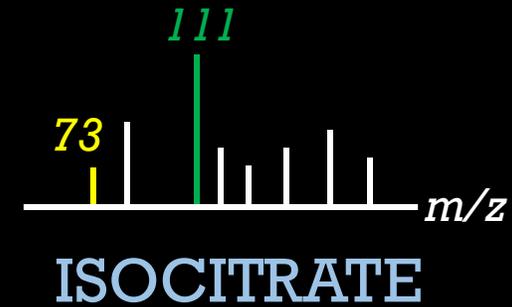
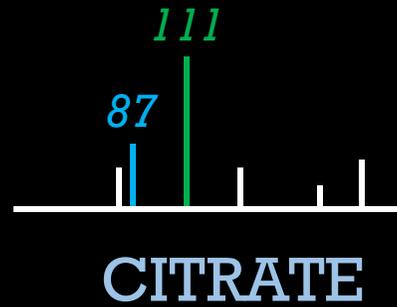


2. The identification challenge



$191 \rightarrow 111$		
$191 \rightarrow 87.1$		N.D.

2. The identification challenge



$191 \rightarrow 111$



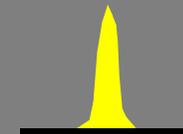
$191 \rightarrow 87.1$



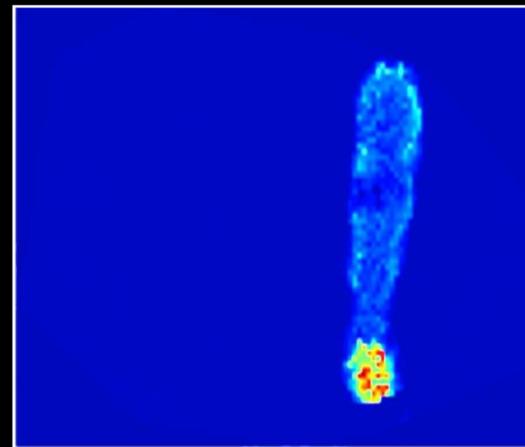
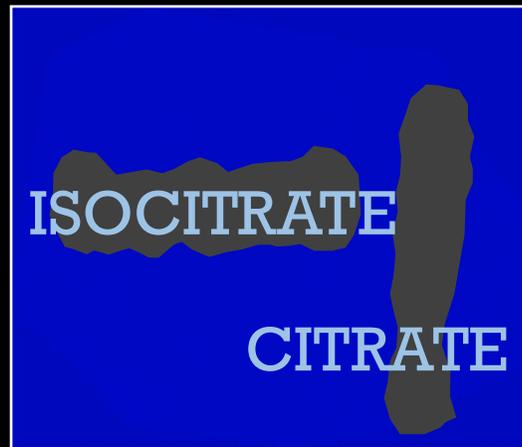
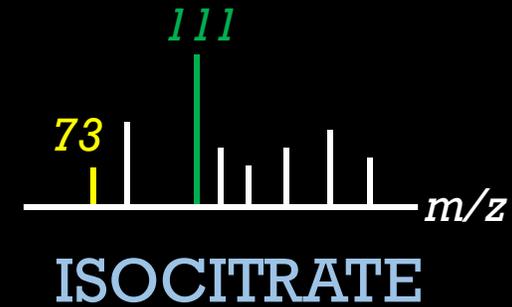
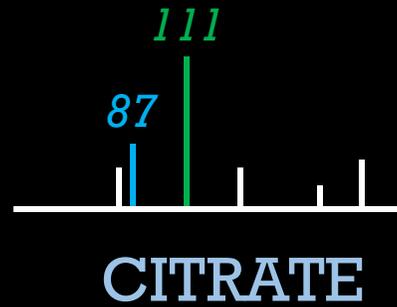
N.D.

$191 \rightarrow 73.0$

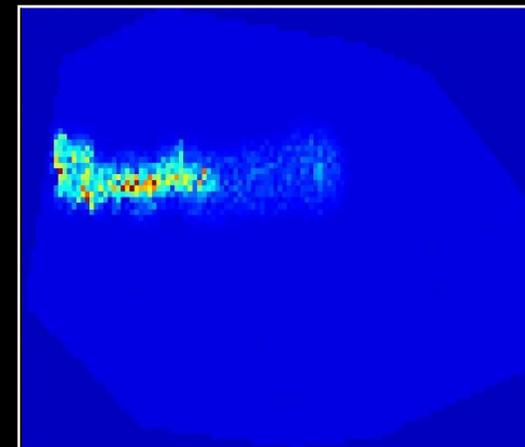
N.D.



2. The identification challenge

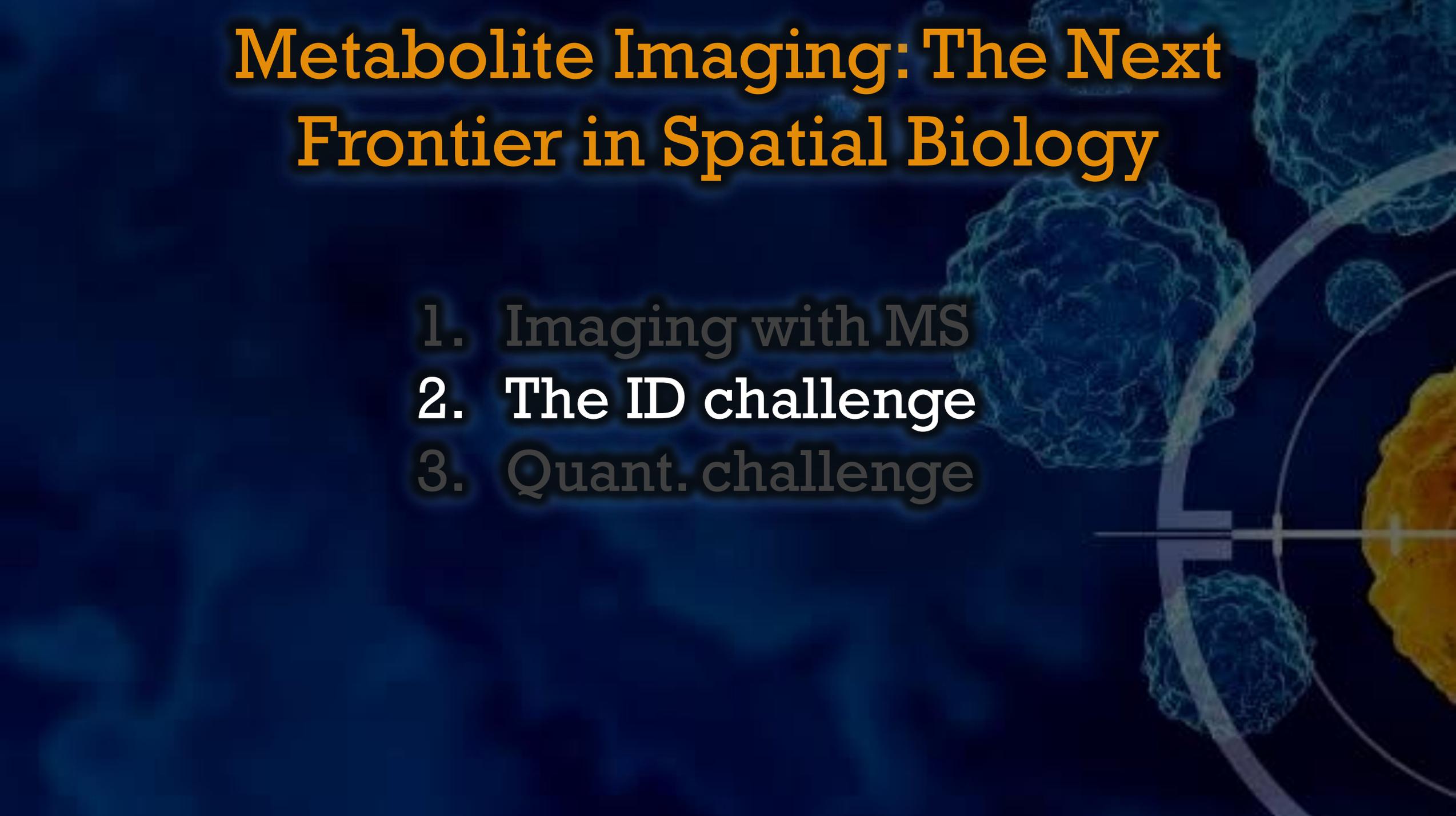


191 → 87.1



191 → 73.0

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- 2. The ID challenge**
3. Quant. challenge

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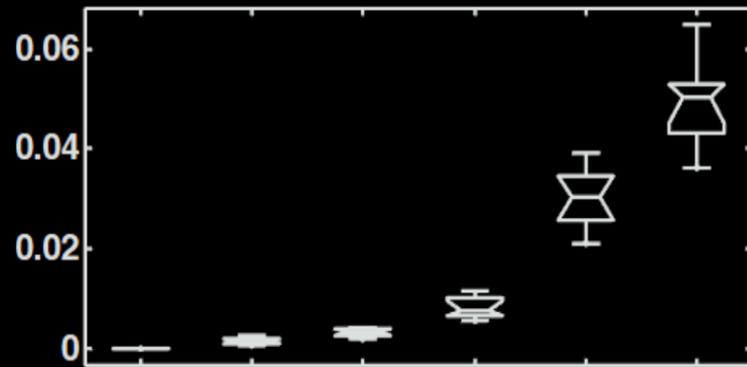
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2. The ID challenge
3. **Quant. challenge**



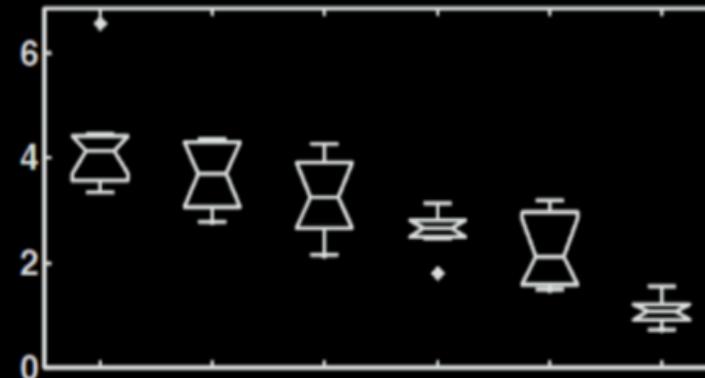
3. The quantitation challenge

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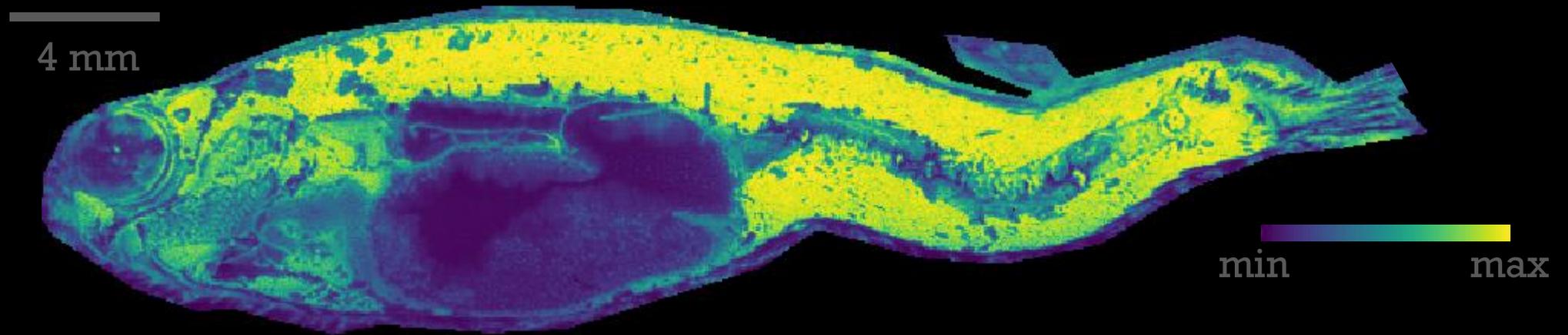
His



Mal

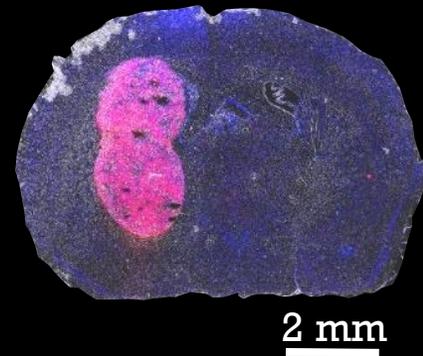


3. The quantitation challenge

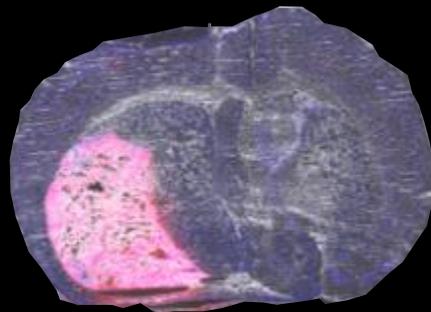
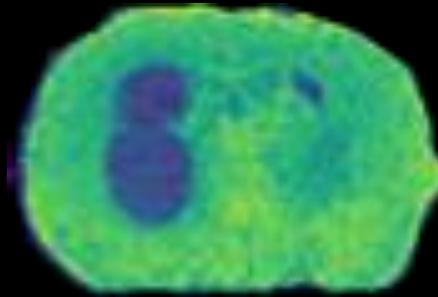


diff. organs have diff. matrix

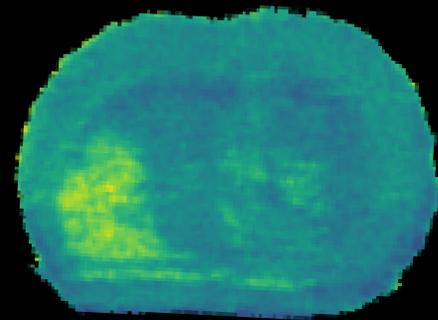
3. The quantitation challenge



MALDI



DESI



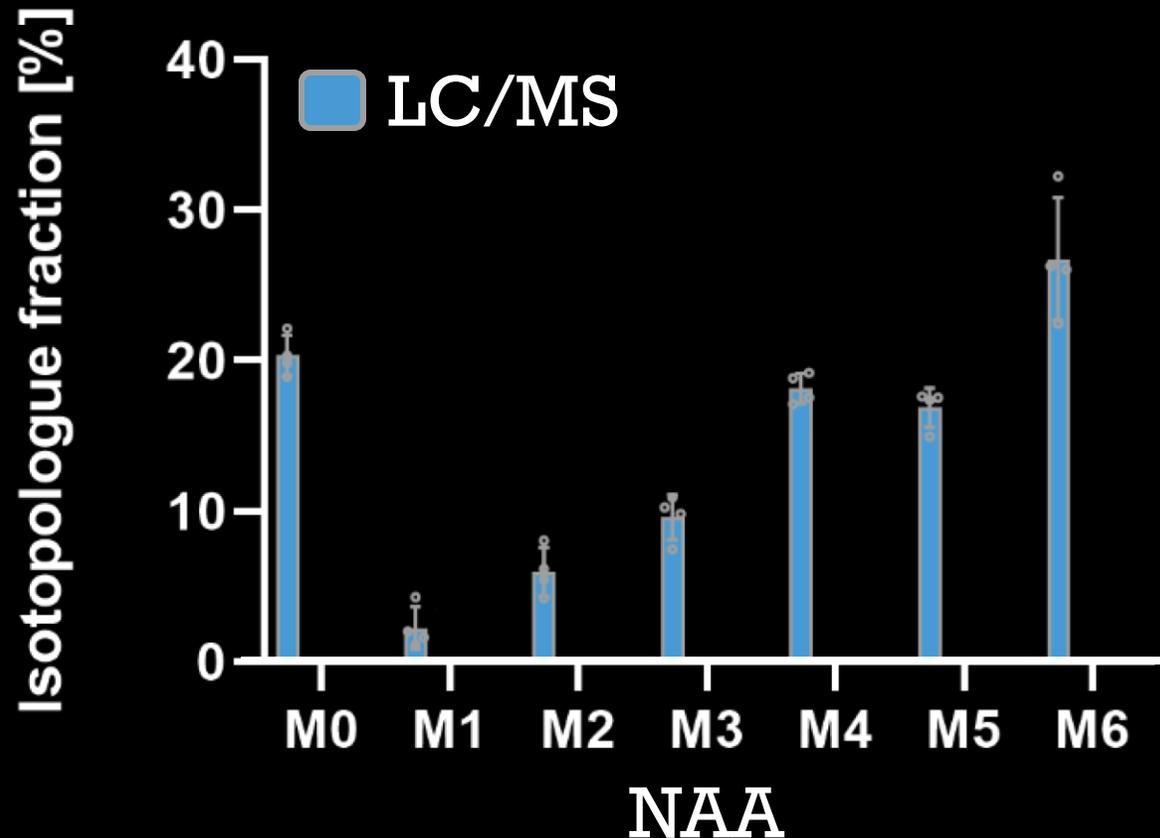
min  max
16:0 intensity

3. The quantitation challenge

the isotope-tracing alternative

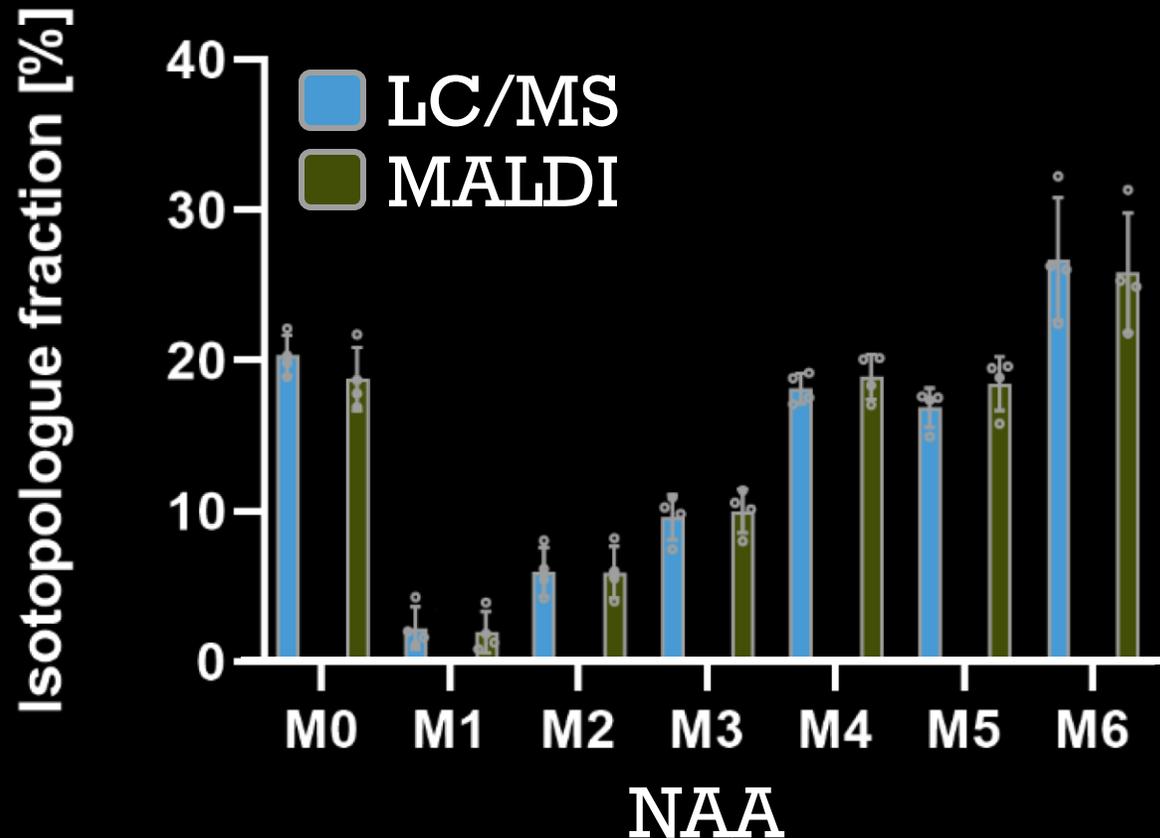
3. The quantitation challenge

the isotope-tracing alternative



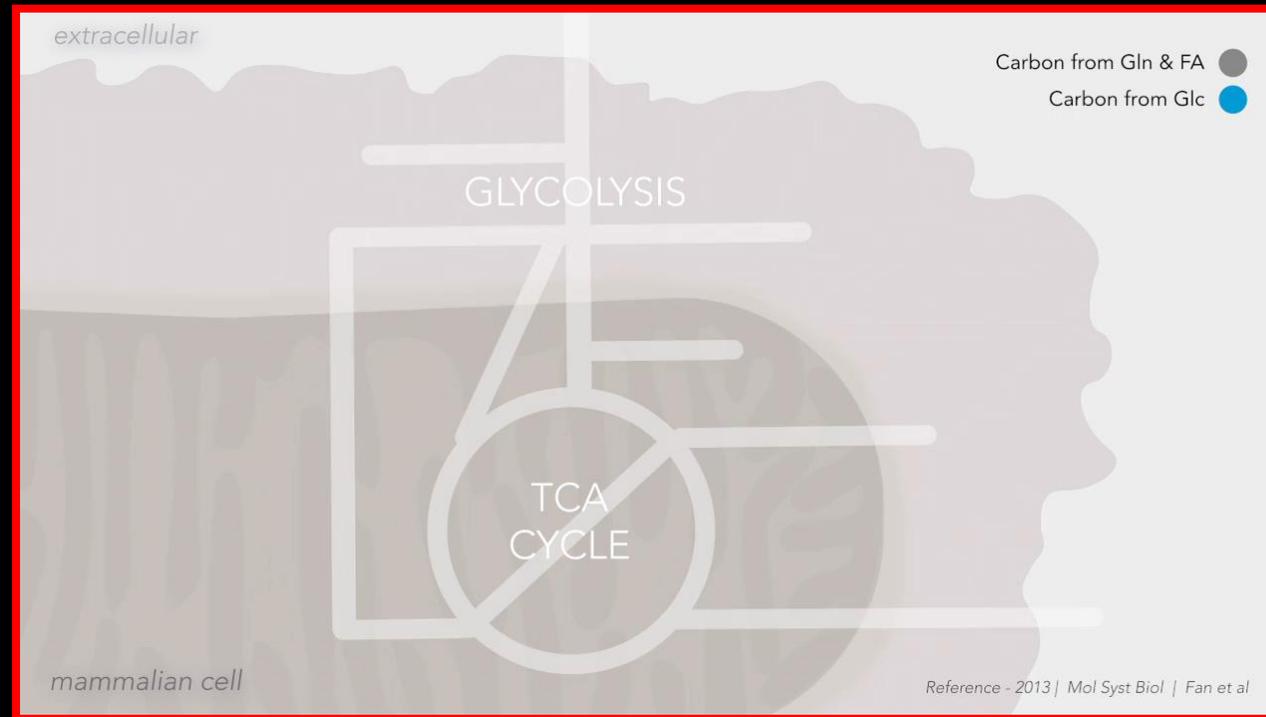
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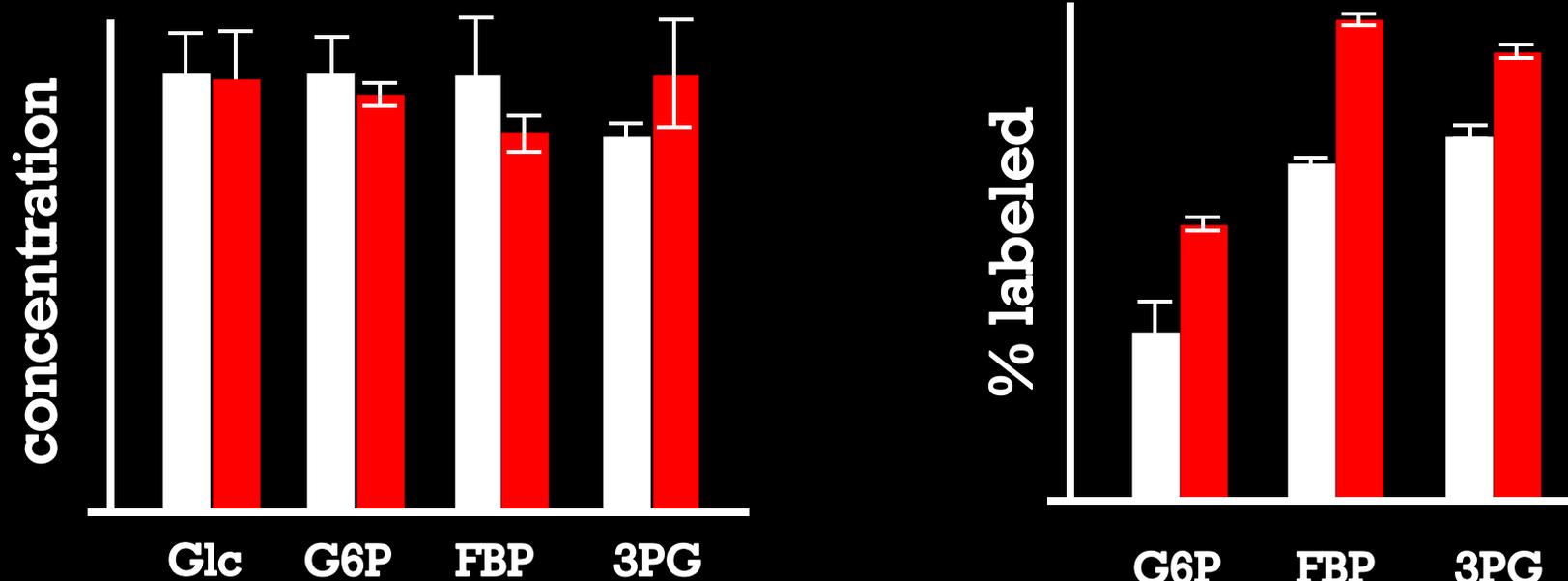
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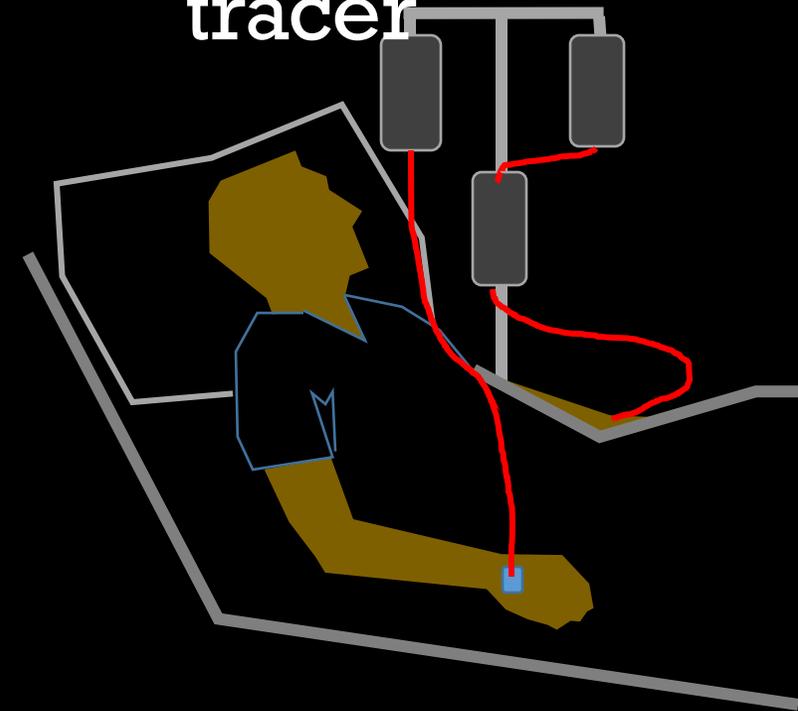
tracer



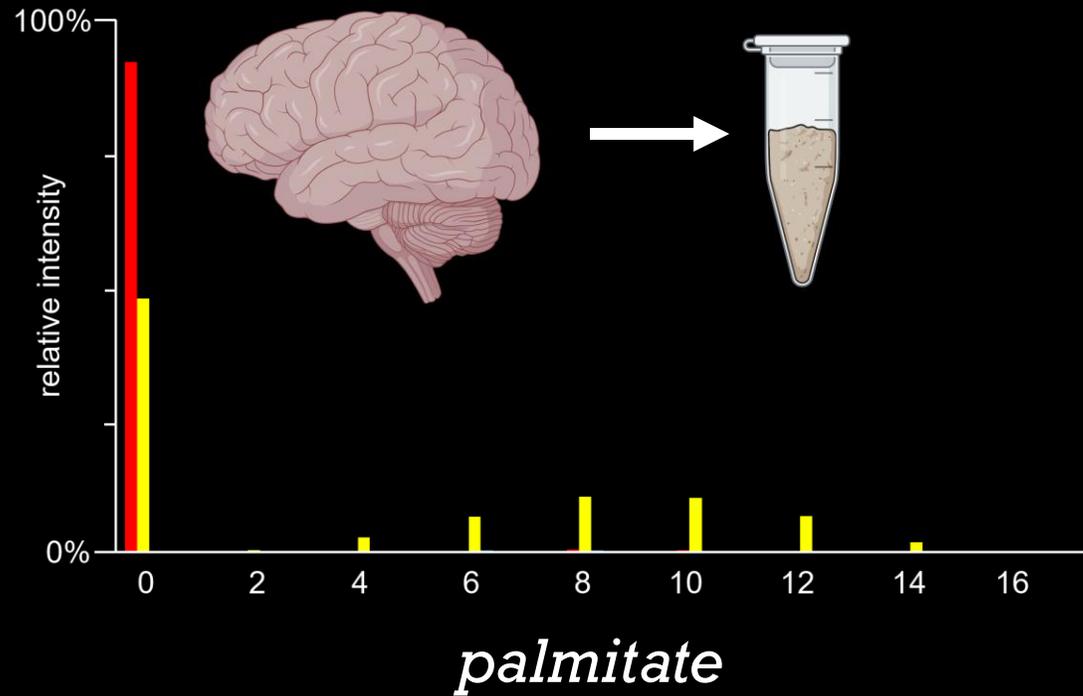
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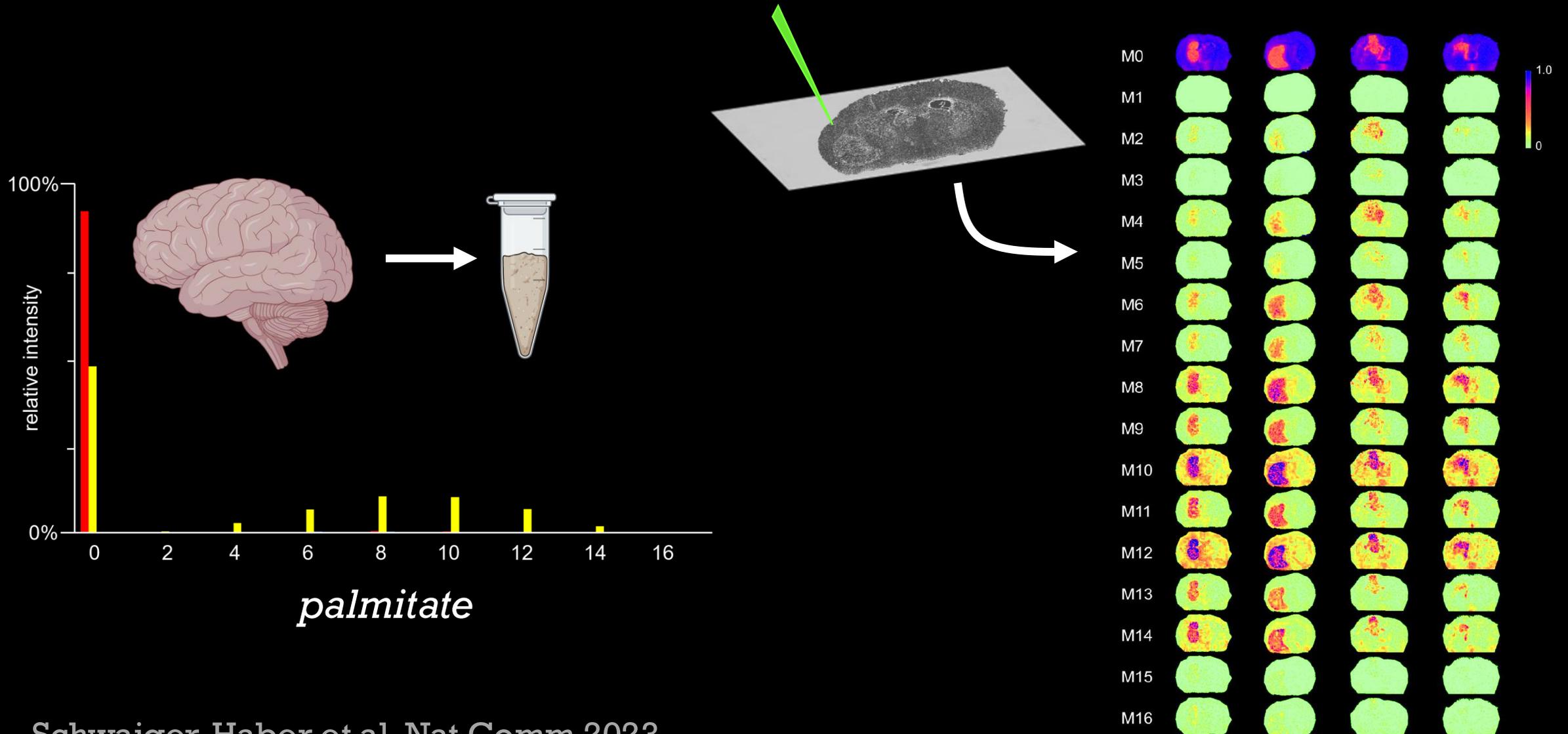
tracer



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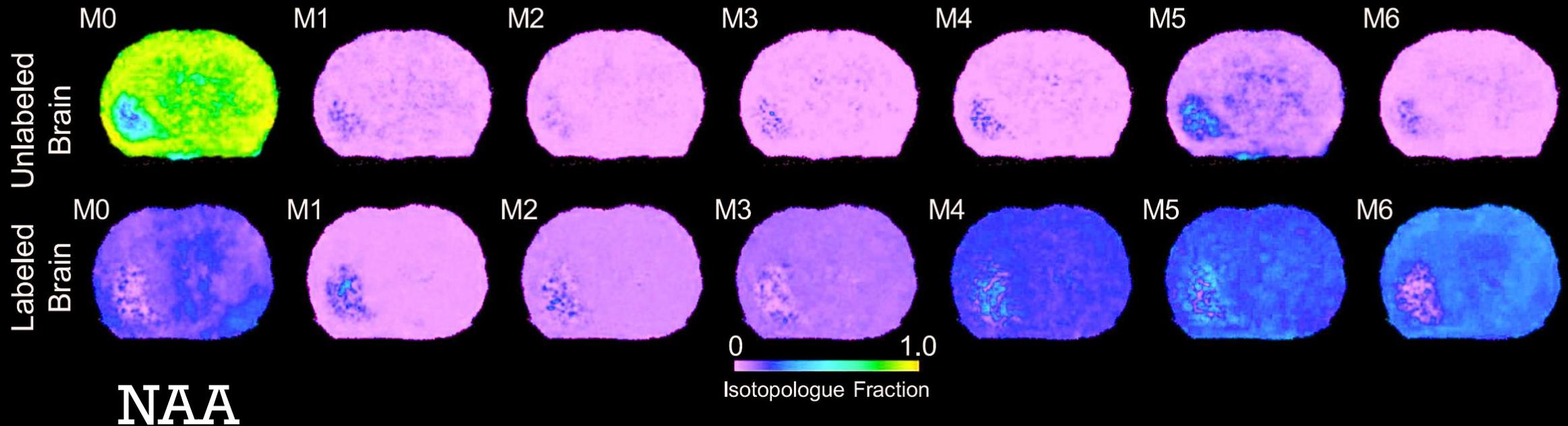


3. The quantitation challenge



3. The quantitation challenge

main limitation: interferences



3. The quantitation challenge

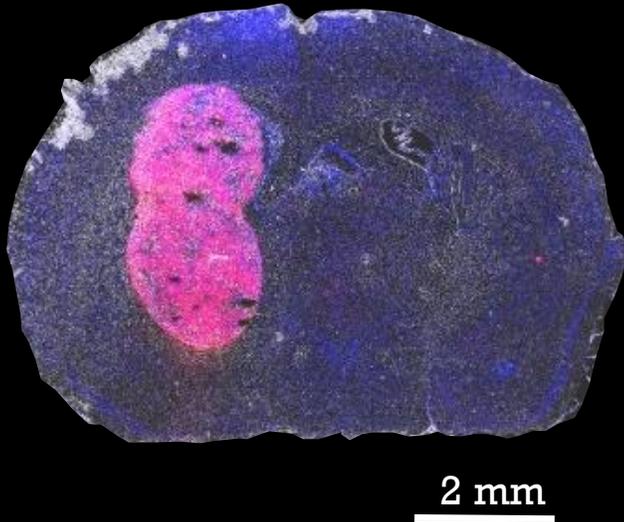
main limitation: interferences



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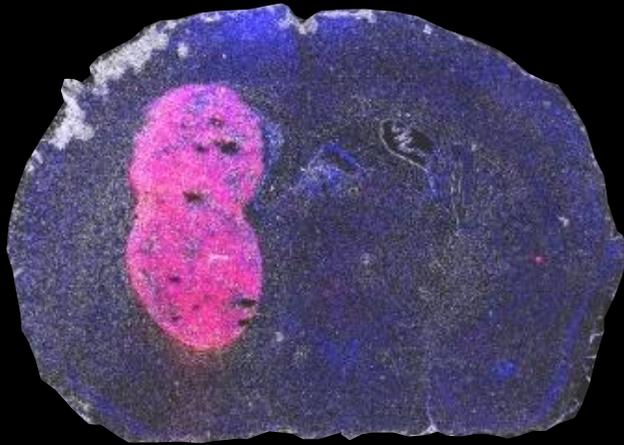
3. The quantitation challenge

immunofluorescence



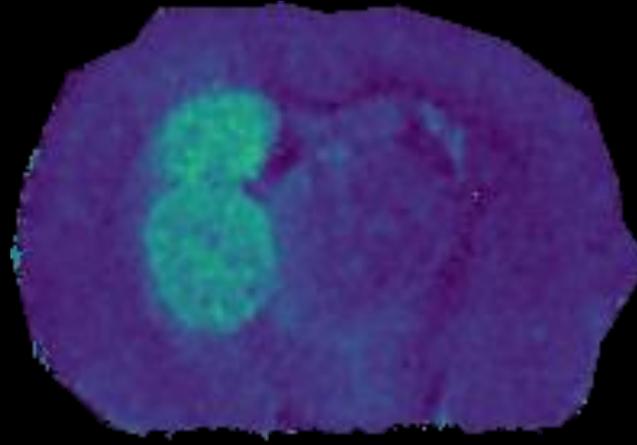
3. The quantitation challenge

immunofluorescence



2 mm

MS imaging

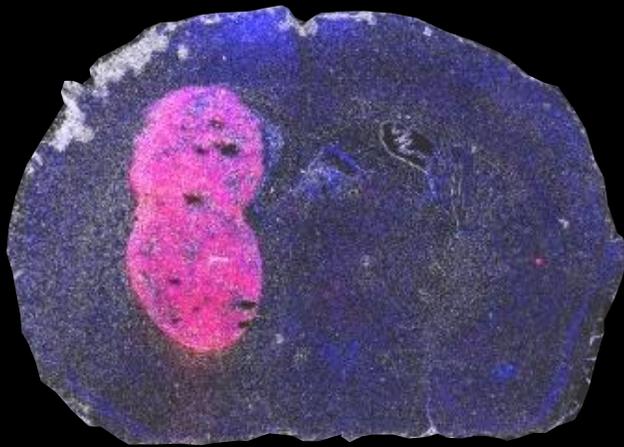


min max

FAS flux

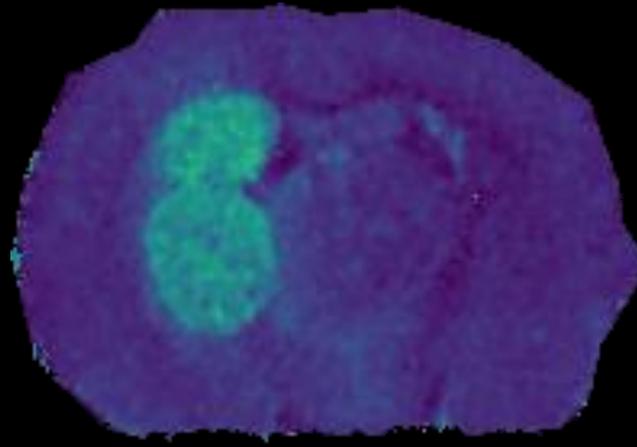
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immunofluorescence



2 mm

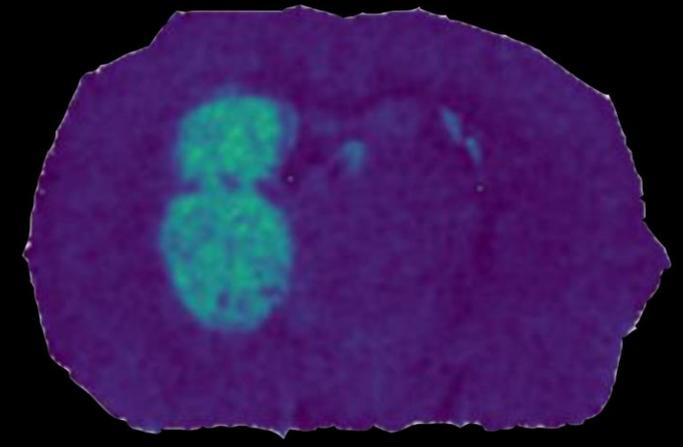
MS imaging



min max

FAS flux

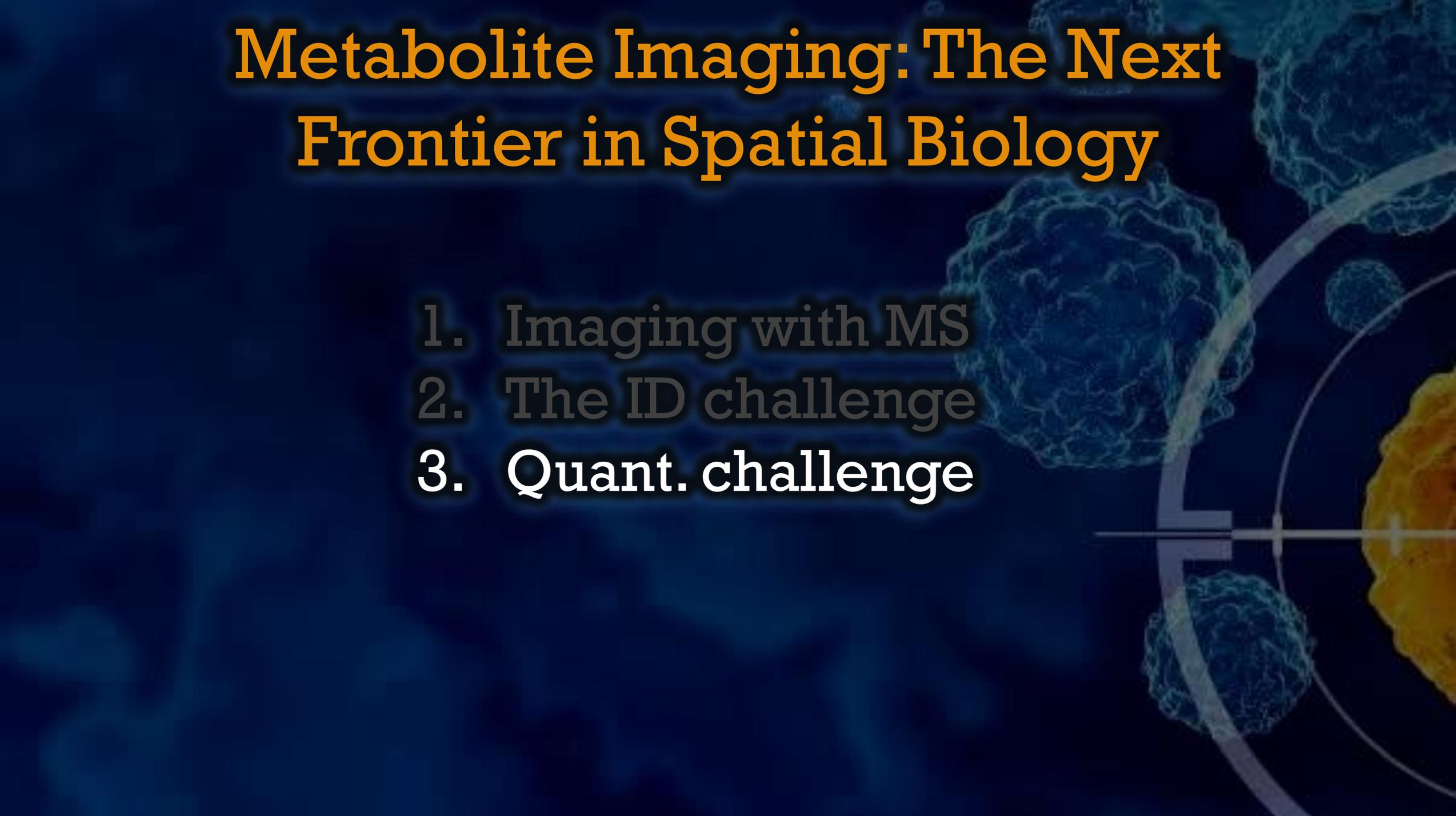
MS imaging



min max

elongase flux

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Acknowledgements

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Maddie Jackstadt

Junjie Yang

Ronnie Fowle-Grider

Kayla Adkins-Travis

Jihyun Kang

Ling Wu

Triston Groff

James Schmitz

Qiuyuan Guo

Wenzhu Liu

Nick Terzich

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Vaha Akbary

Hao Zhang

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