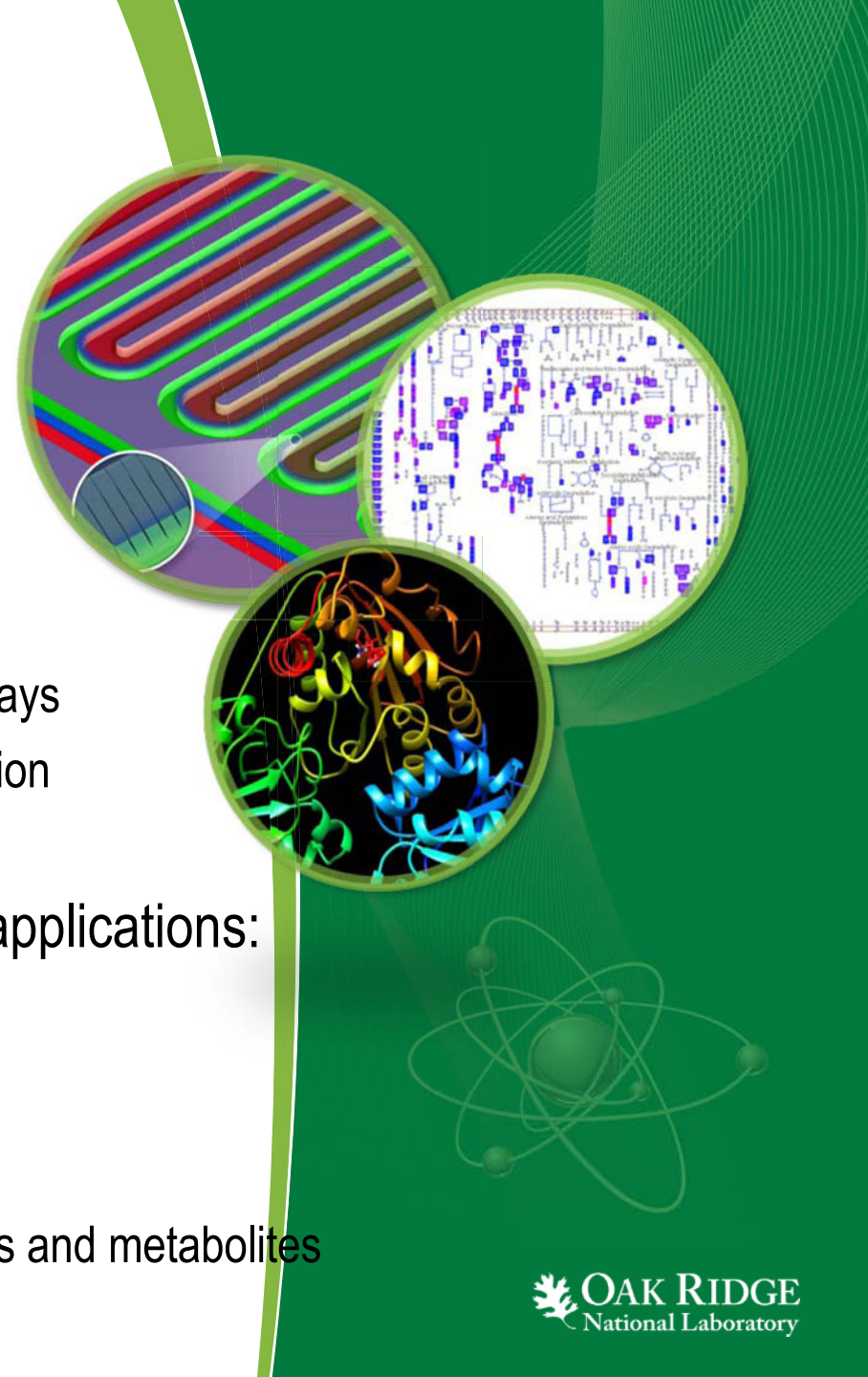


Advancing cell free technologies for diverse applications

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- Cell free approaches for:
 - Prototyping metabolic conversion pathways
 - Producing proteins and annotating function
 - Producing secondary metabolites
- Analytical tools for enabling cell free applications:
 - Proteomics, metabolomics, and imaging
- Micro-/nanoengineered systems for:
 - Mimicking cells
 - Portable, remote manufacture of proteins and metabolites



Analytical technologies are used for interpreting cell free processes

- Proteomics

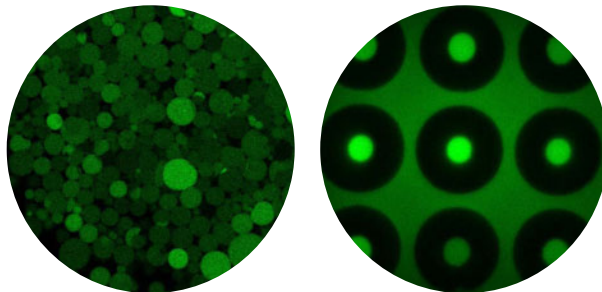
- Information on the extract and the product

- Metabolomics

- Tracking small molecule use and production (GC-MS, HPLC)

- Imaging

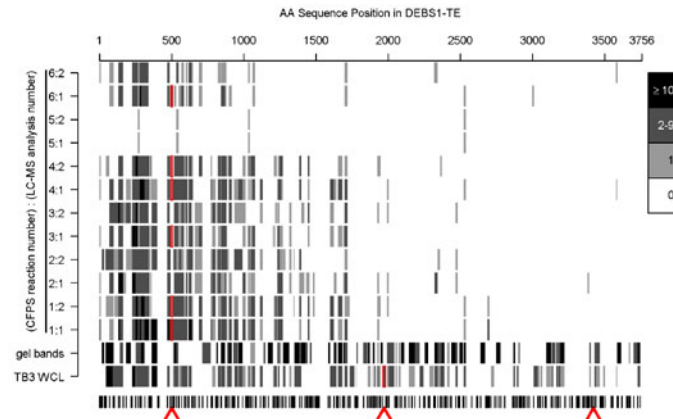
- Visual monitoring of RNA and protein in containers/vesicles



Liposomes and small volume reaction chambers for expressing labeled RNA and protein by CFPS

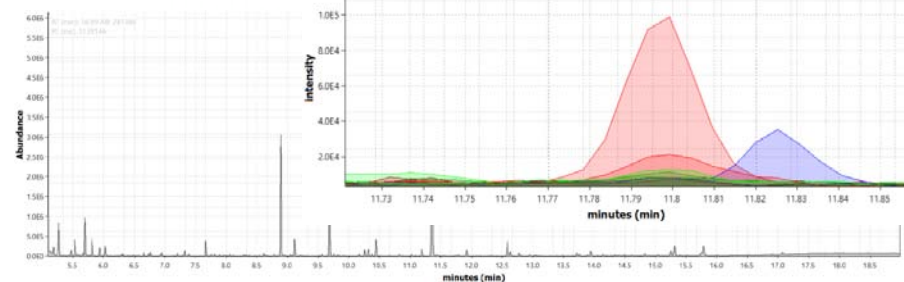
Proteome coverage of translation factors in cell extract →

SeqID	Accession	Length	Score	E-value
Seq1
Seq2
Seq3
Seq4
Seq5
Seq6
Seq7
Seq8
Seq9
Seq10
Seq11
Seq12
Seq13
Seq14
Seq15



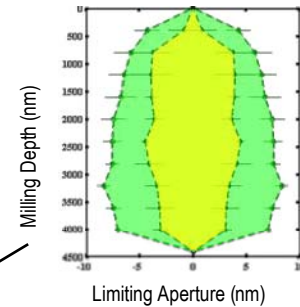
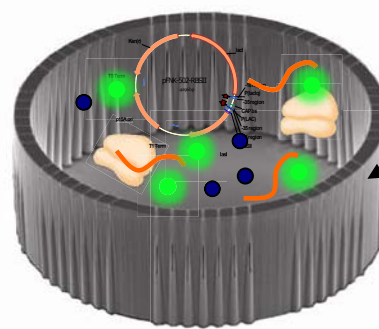
Peptide coverage and PTM assignment for a CFPS produced polyketide synthase

Monitoring of cell free metabolic engineering processes



Microfabricated platforms can carry out cell free processes at a range of scales

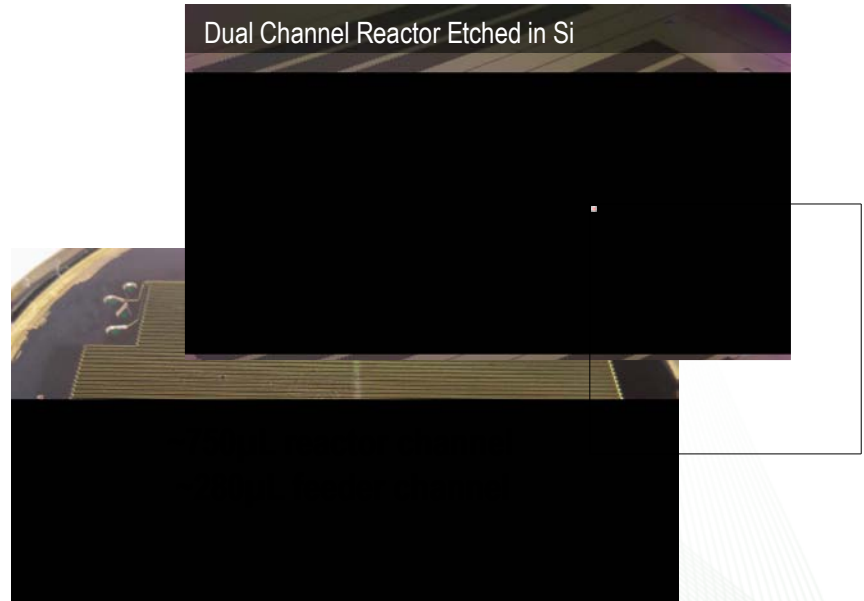
- Nanoengineered membranes are used to define small scale exchange reactors
- Picoliter scale “cell mimics”
- Milliliter scale “biologic production”
- Can be integrated with other functionalities



Fletcher, et al. (2004) *NanoLetters*, 4(10), 1809-1814
 Retterer et al., (2010) *Lab on a Chip*, 10(9) 1174-1181
 Siuti et al., (2011) *Lab on a Chip*, 11(20) 3523-3529



Millet et al., (2015) *Lab on a Chip*, 15(8) 1799



Timm et al., (2016) *Small*, 12(6) 810 - 817