Interreg
Öresund-Kattegat-Skagerrak
European Regional Development Fund

EUROPEAN UNION

MOVING LIFE SCIENCE RESEARCH AND INNOVATION FORWARD WITH MACRO-REGIONAL UNIQUE RESOURCES
JANUARY 31, 2022 | COPENHAGEN

Hanseatic League of Science
Interconnecting infrastructures
for life science research and innovation
HALOS

Wired life

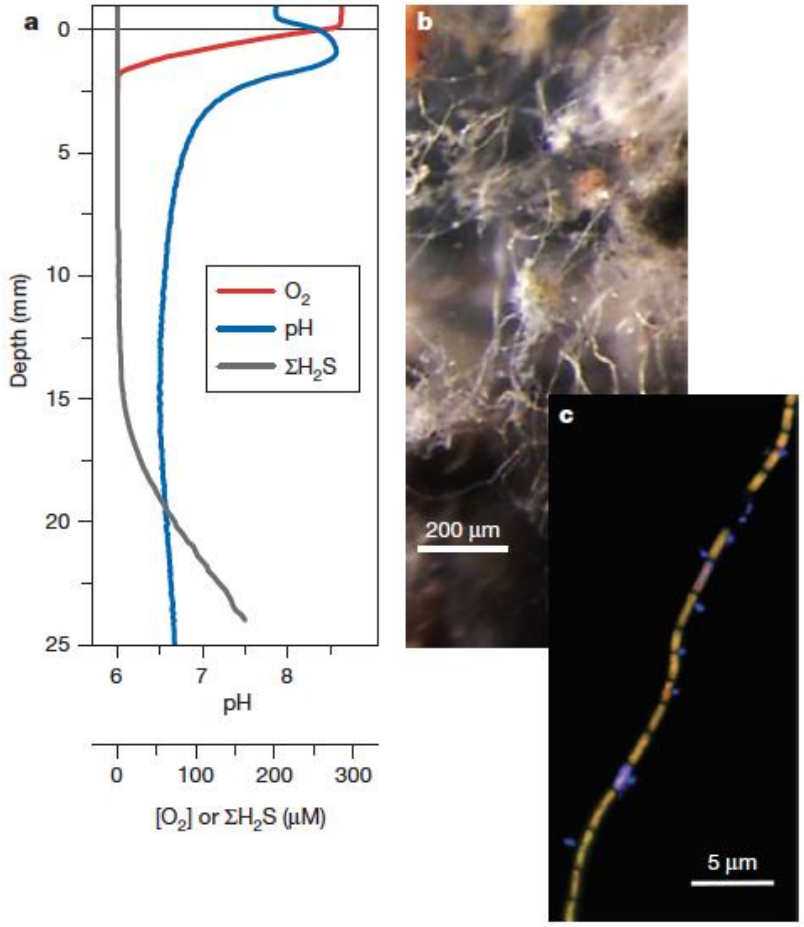
insights into unique enzymes from cable bacteria

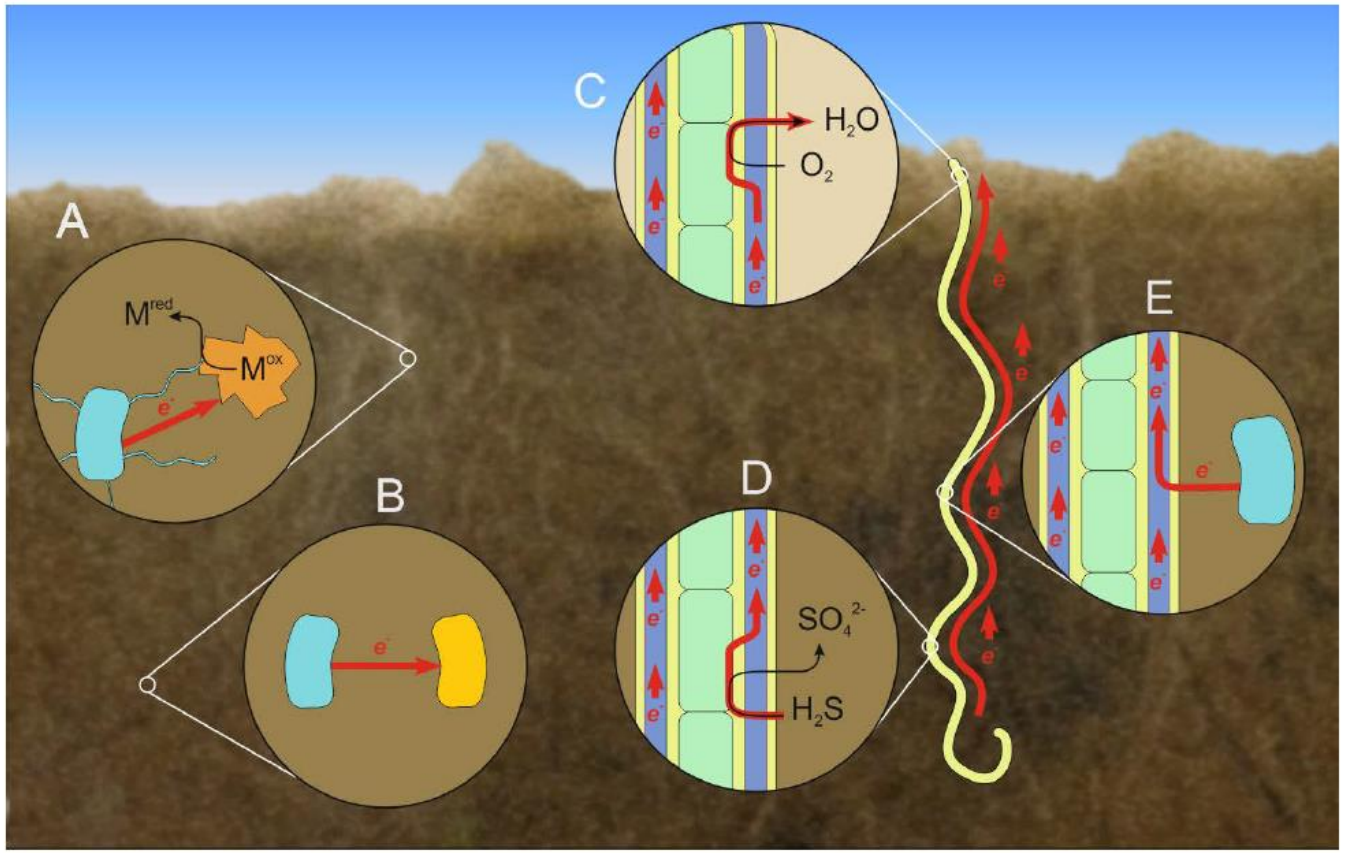
Thomas Boesen and Kajsa Sigfridsson Clauss

CEM CENTER FOR ELECTROMICROBIOLOGY

MAX IV LABORATORY

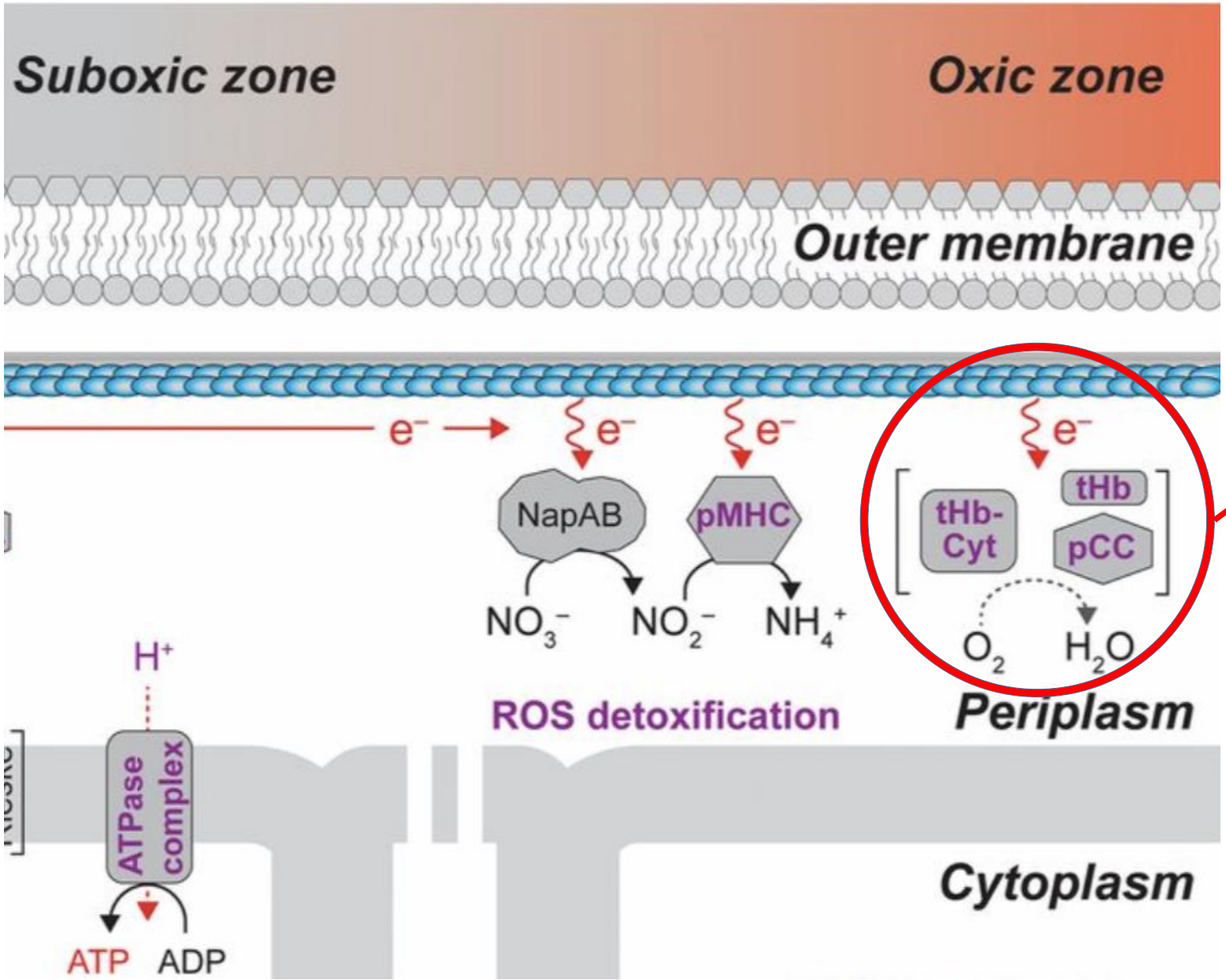
Cable bacteria





Nielsen *et al*, Nature 2010, Pheffer *et al*, Nature 2012

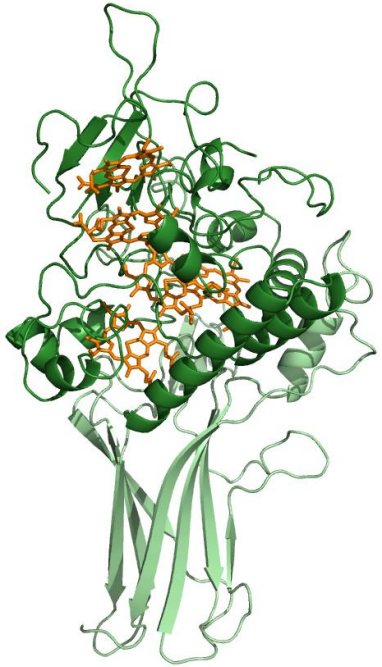
A metabolic model for electron flow

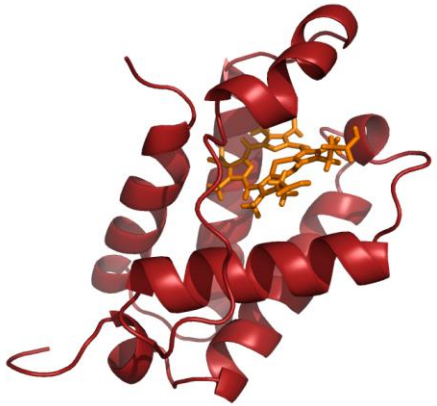


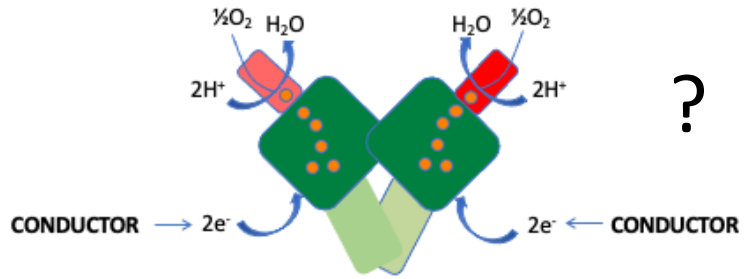
PHC_{tX} (tHb-Cyt)
and
PHC (pCC)

Kjeldsen et al., PNAS 2019

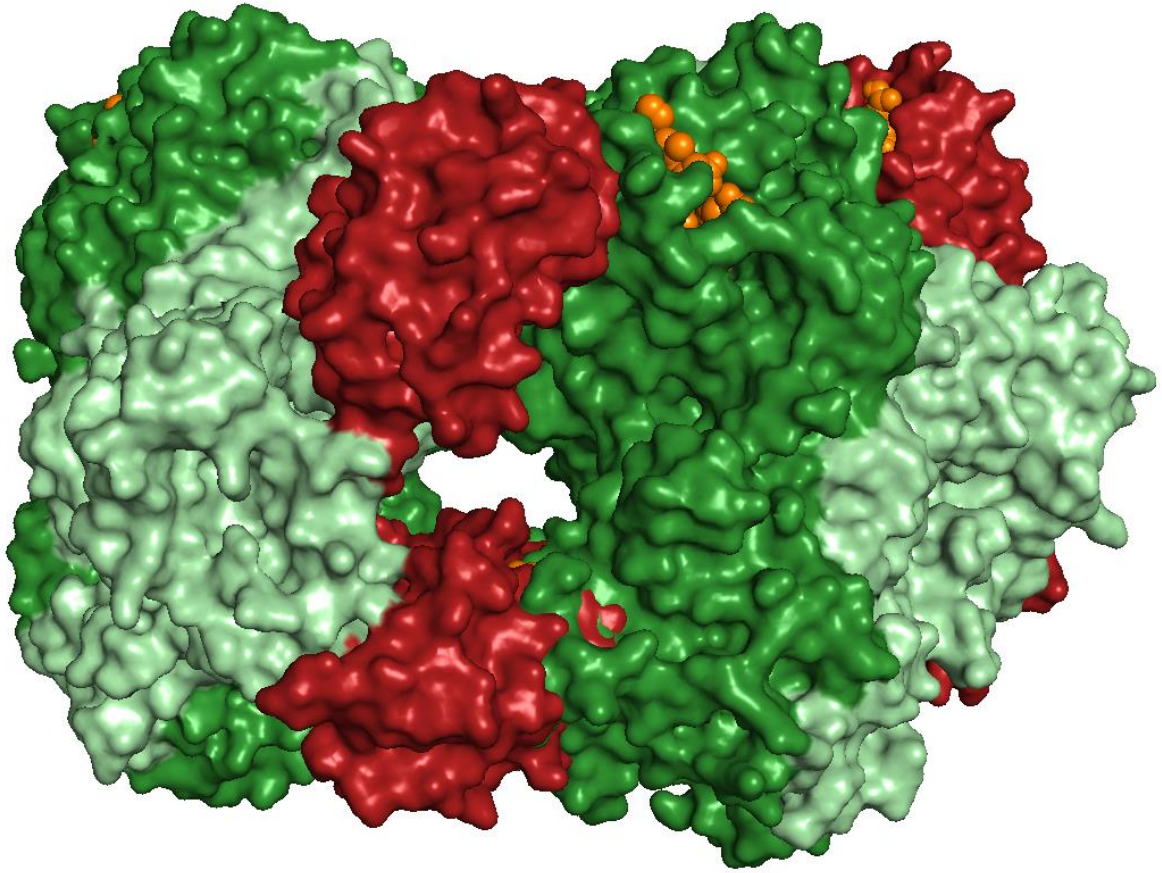
PHC_{tX}







?



PHC_{tNC}

MAX IV /Balder /X-ray Absorption Spectroscopy

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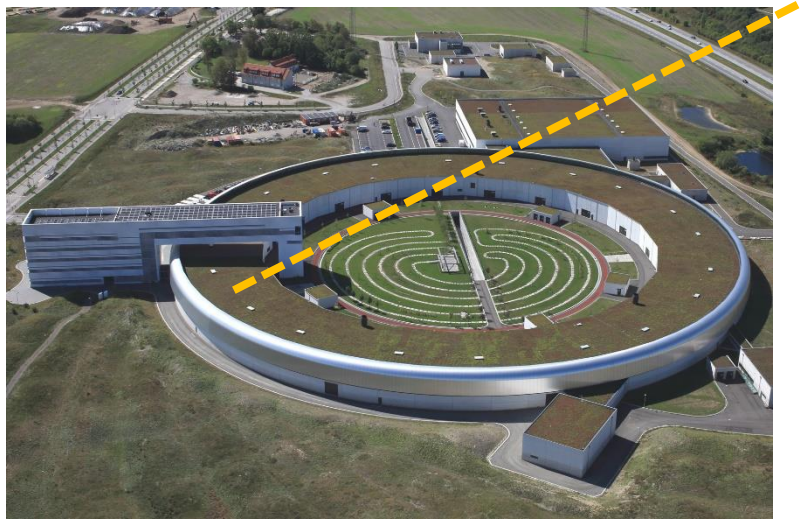
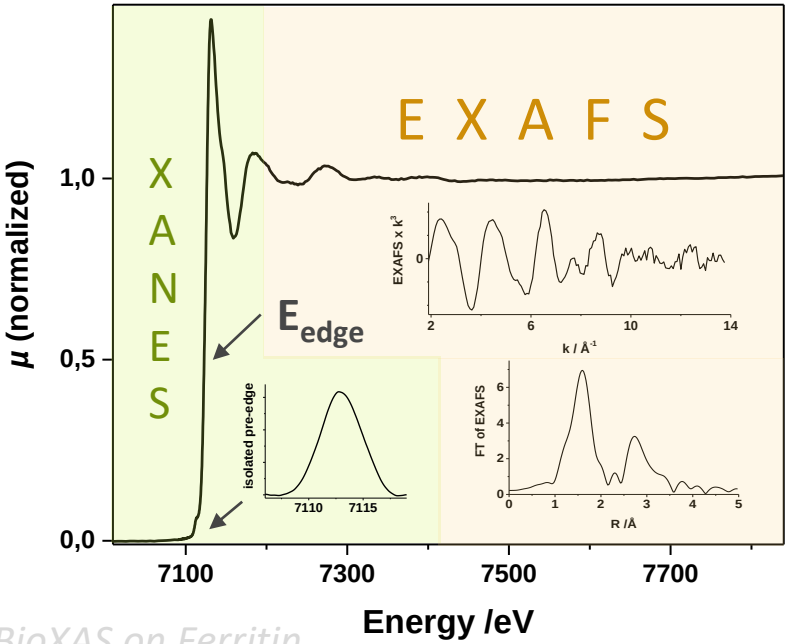


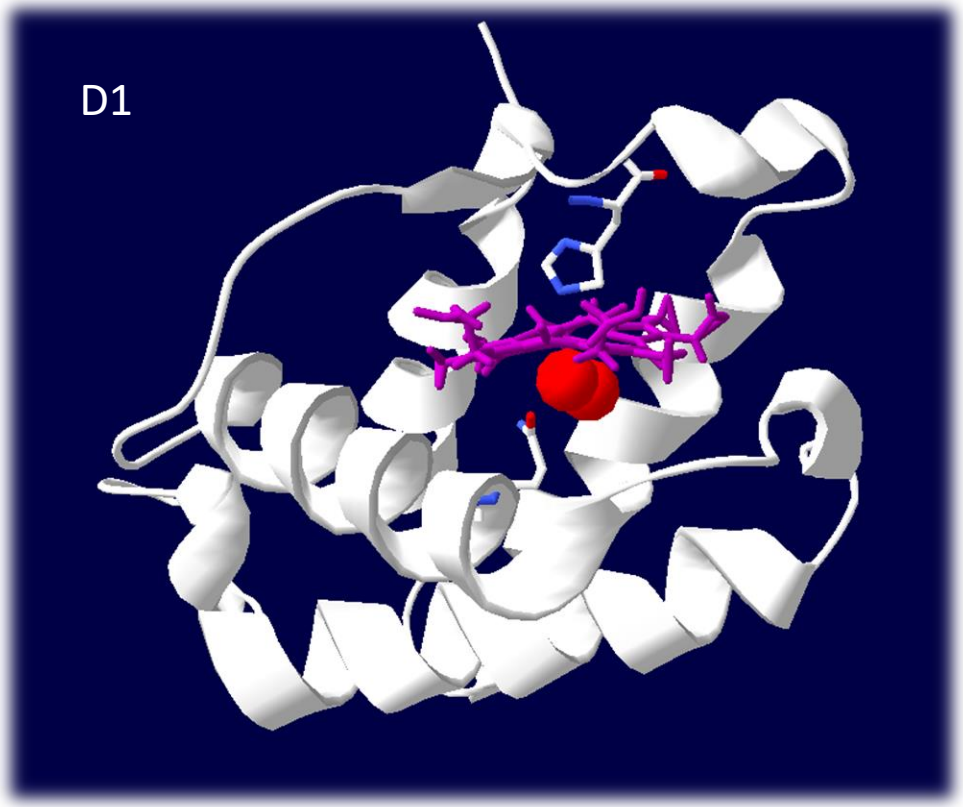
Balder

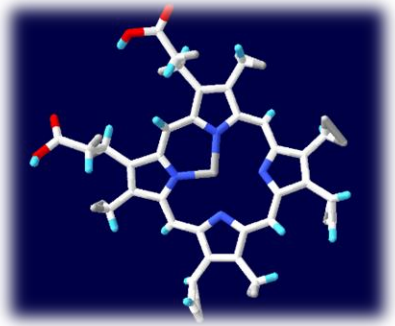
XAS = 

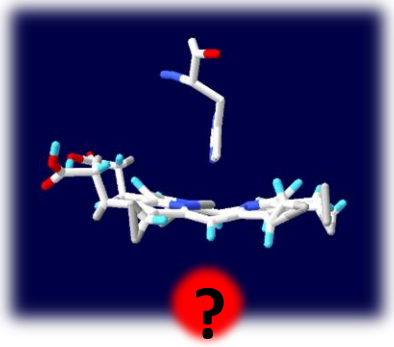


BioXAS on Ferritin

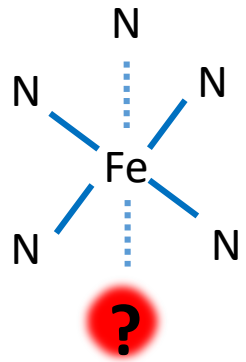
Metal site structure of hemoglobin domain







O_2, H_2S, H_2O, ?



Fe oxidation state
Geometric structure
=XANES

Local atomic structure around Fe
Identity of neighbor atoms
Distance to neighbor atoms
Number of neighbor atoms
= EXAFS

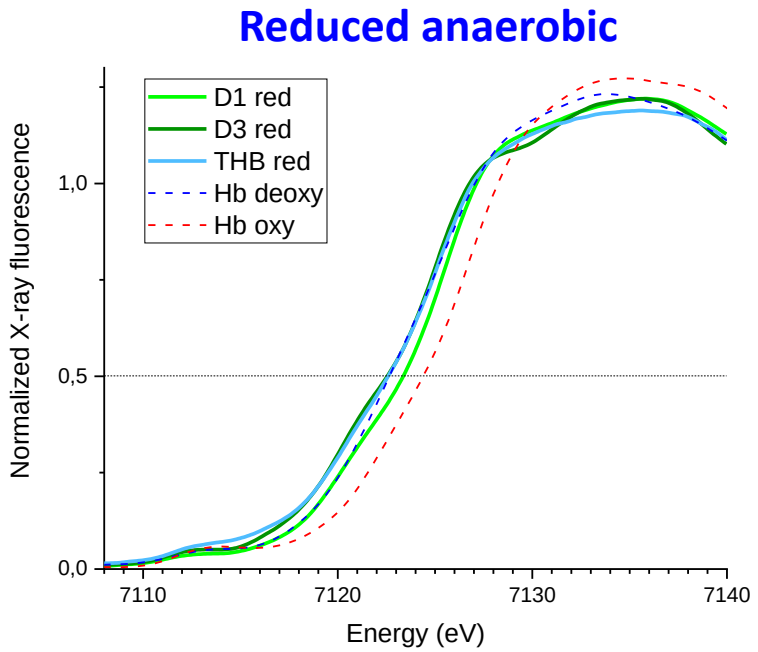
XANES and EXAFS on D1, D3 and THB

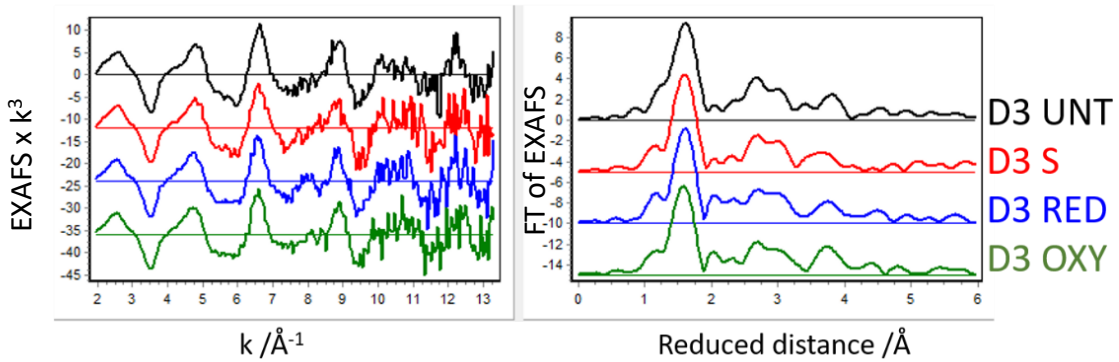
Sample environments

- **Cryostat 15 K**
- Microfluidic flowcell
- Electrochemistry flowcell

Different conditions

- Reduced (anaerobic)
- O_2 flushed
- H_2S treated
- Untreated





Next steps

- Next beamtime: pH dependence of the O_2 and H_2S affinity to the hemoglobin domain “the Bohr effect”

- Investigate other heme proteins in the CB electron transfer chain.

Long term goal:

To understand the reaction mechanism from heme to molecule to organism using XAS.