

OBT Speciation by the BIOCHEM Model

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The BIOCHEM model assumes that

$$\text{OBT} = \mathbf{X} + \mathbf{C} \text{ Bound Tritium} = \mathbf{XBT}_{\text{buried}} + \mathbf{CBT}$$

$$X = \text{N, O, S}$$

buried = non-accessible by the
rinsing solvent

This OBT definition contradicts the common opinion:

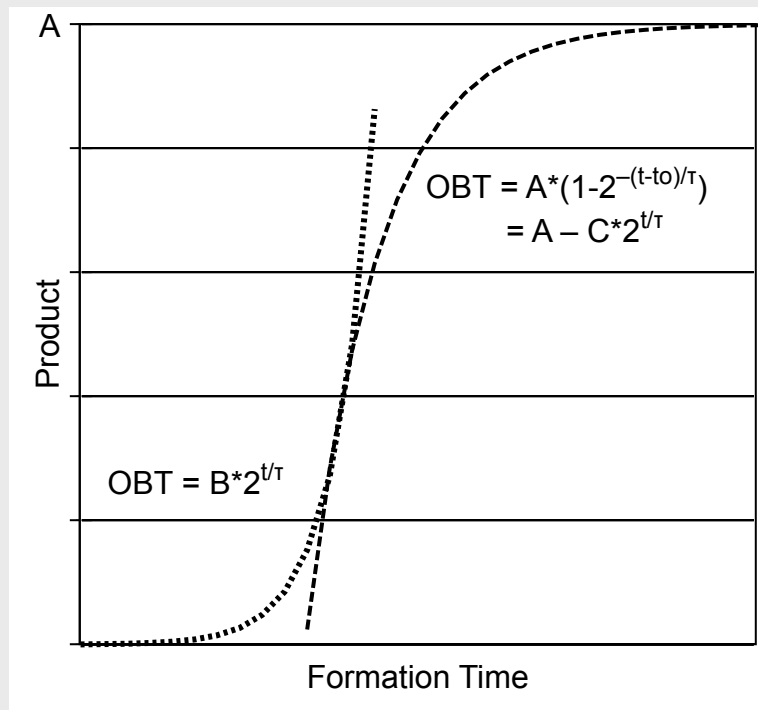
OBT = **C**arbon **B**ound **T**ritium = **CBT** (a biological product)
caused by photosynthesis or incorporation

Test of BIOCHEM aspects by analysis of OBT formation

In order to identify biological growth the fact is used:
biological growth is composed of a

I. Self-Accelerating Phase (Brody 1945, 1964)

and a II. Self-Inhibiting Phase (Brody 1945, 1964)



Thus,

Biological formation contains

Phase I and Phase II

But,

Mono-molecular reactions like isotope-exchange follow the same course

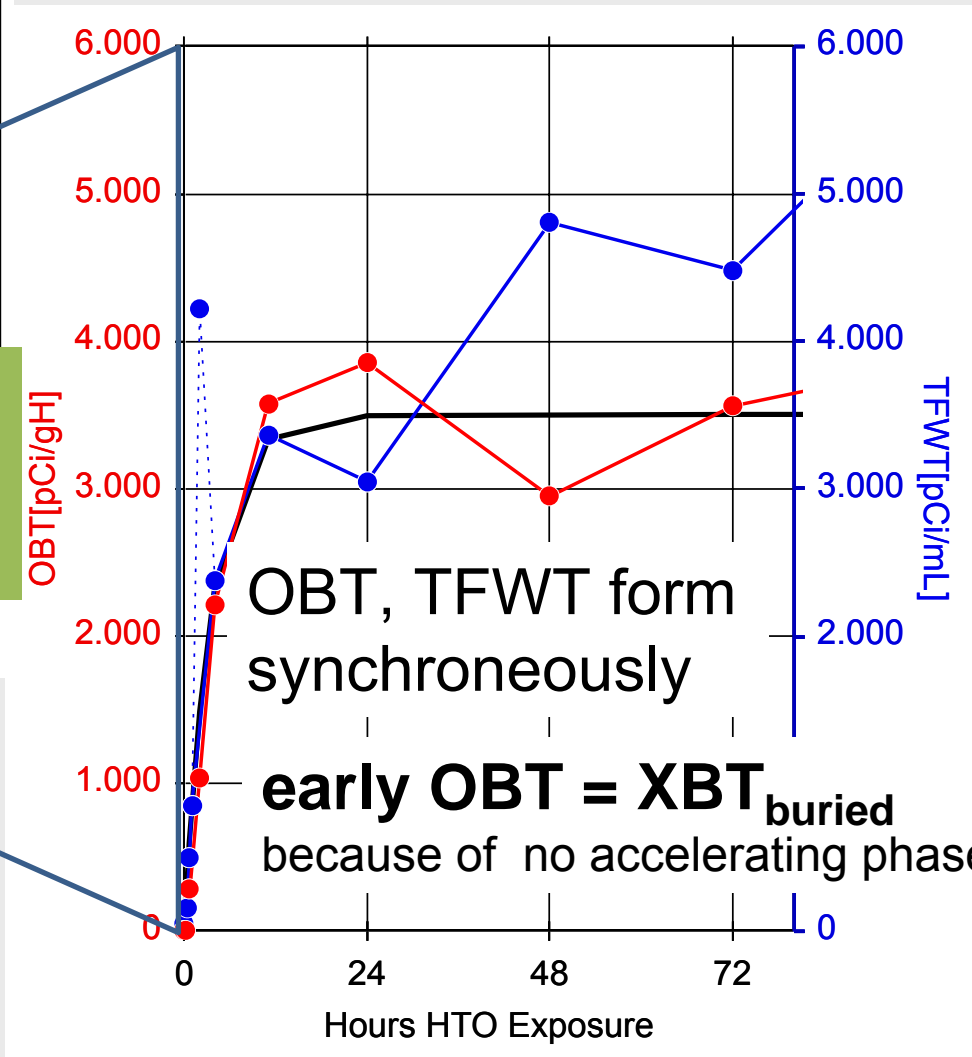
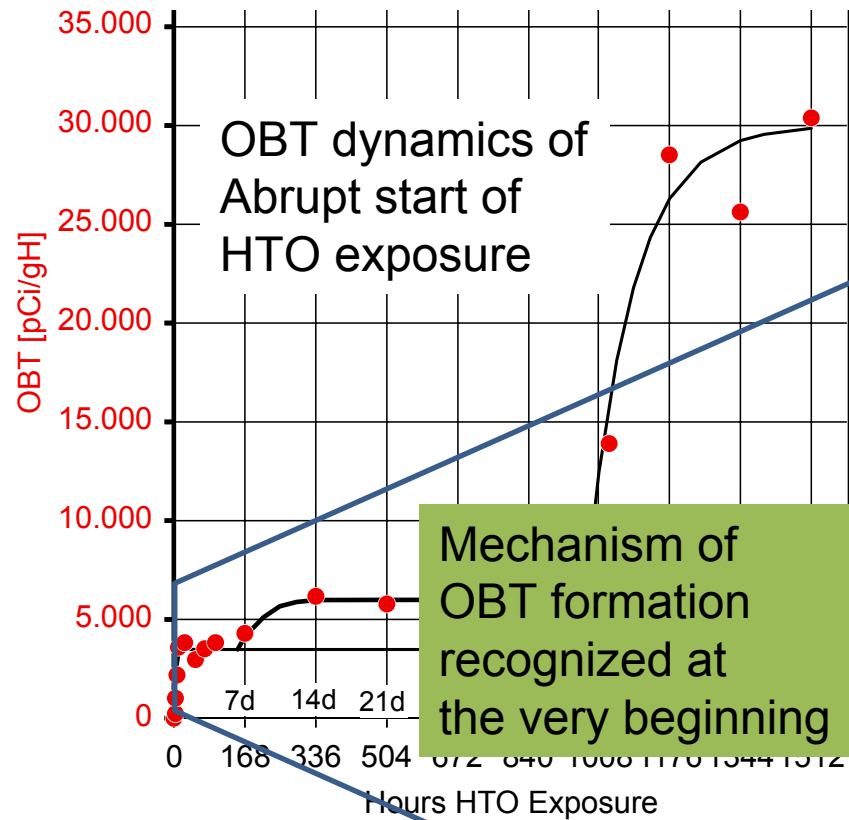
Therefore,

No difference in the course of XBT- and CBT- formation

TEST OF NON-BIOLOGICAL OBT FORMATION = OBT FORMATION WITHOUT PHASE I

Tomato plants, 9 weeks exposed to atmospheric HTO

(F.S.Spencer 1984: ONTARIO HYDRO 84-69-K)



Consequences of the rapid triton mobility: Early OBT window and a Late OBT window

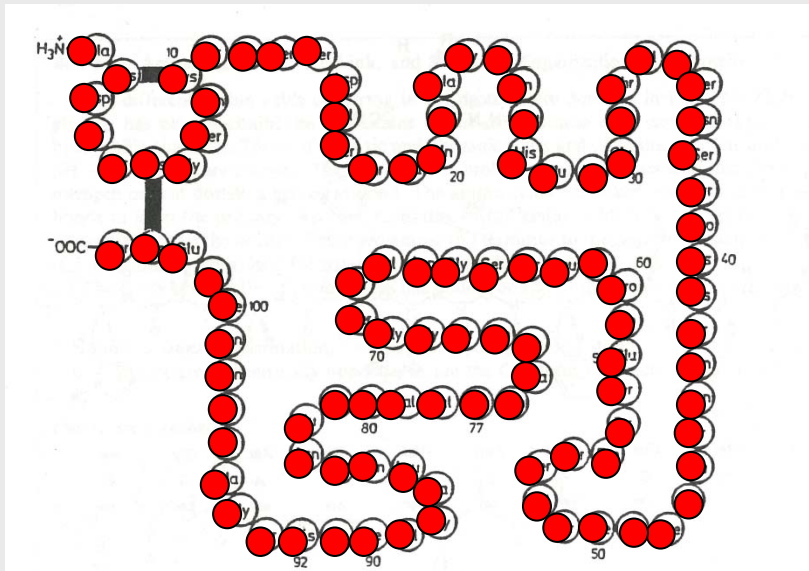
Molecular visualisation of the early window: formation of proteins

(we consider the case Ribonuclease)

Aminoacids \rightarrow Peptide chain $\xrightarrow{\text{ms}}$ Secondary $\xrightarrow{\text{ms}}$ $\xrightarrow{\text{ms}}$ Quartenary Structures

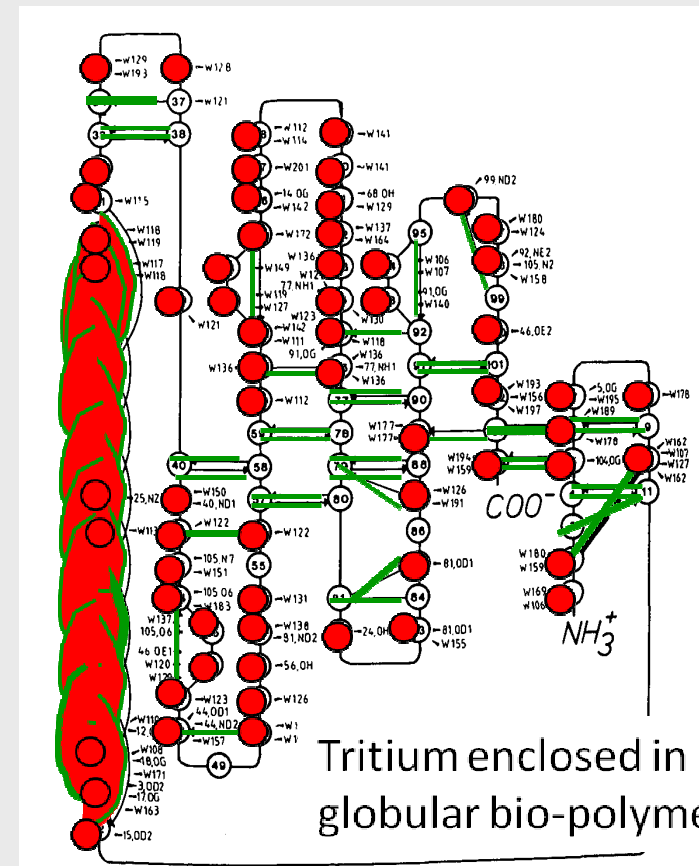
$\text{H}^+/\text{T}^+ \rightleftharpoons \mu\text{s}$

HTO



Ribonuclease T1, Takahashi K, 1985

$\xrightarrow{\text{multi ms}}$

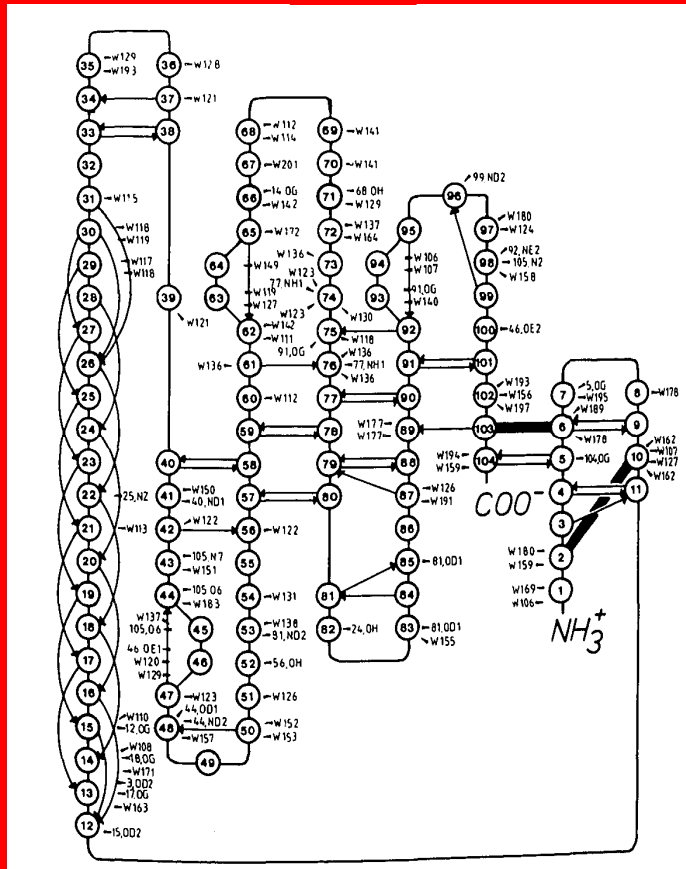


Tritium enclosed in globular bio-polymers

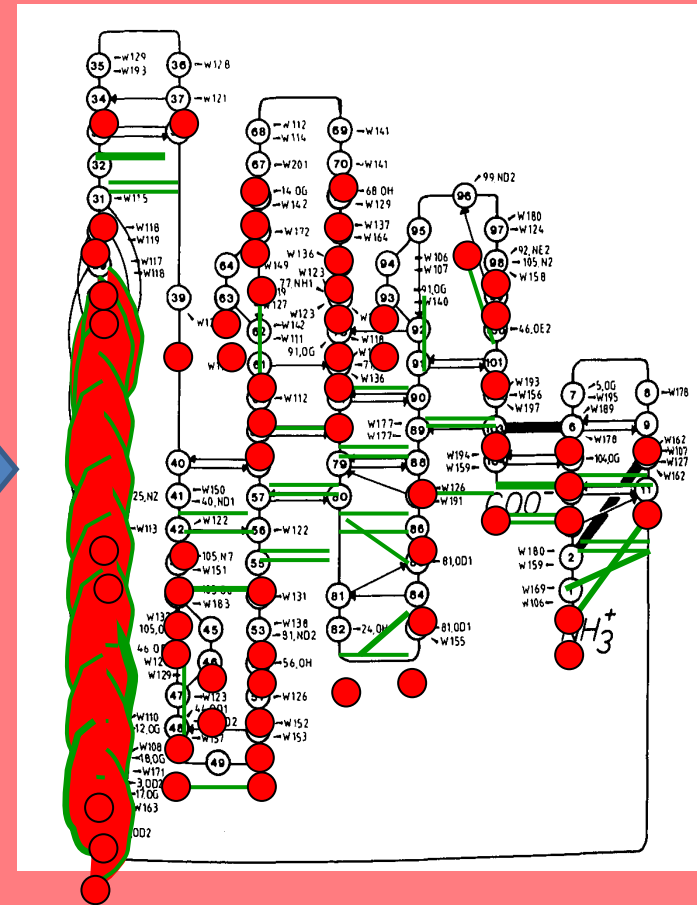
Molecular visualisation of the late window: H⁺ migration into proteins (case Ribonuclease)

Similar in polysaccharides, cellulose, starch

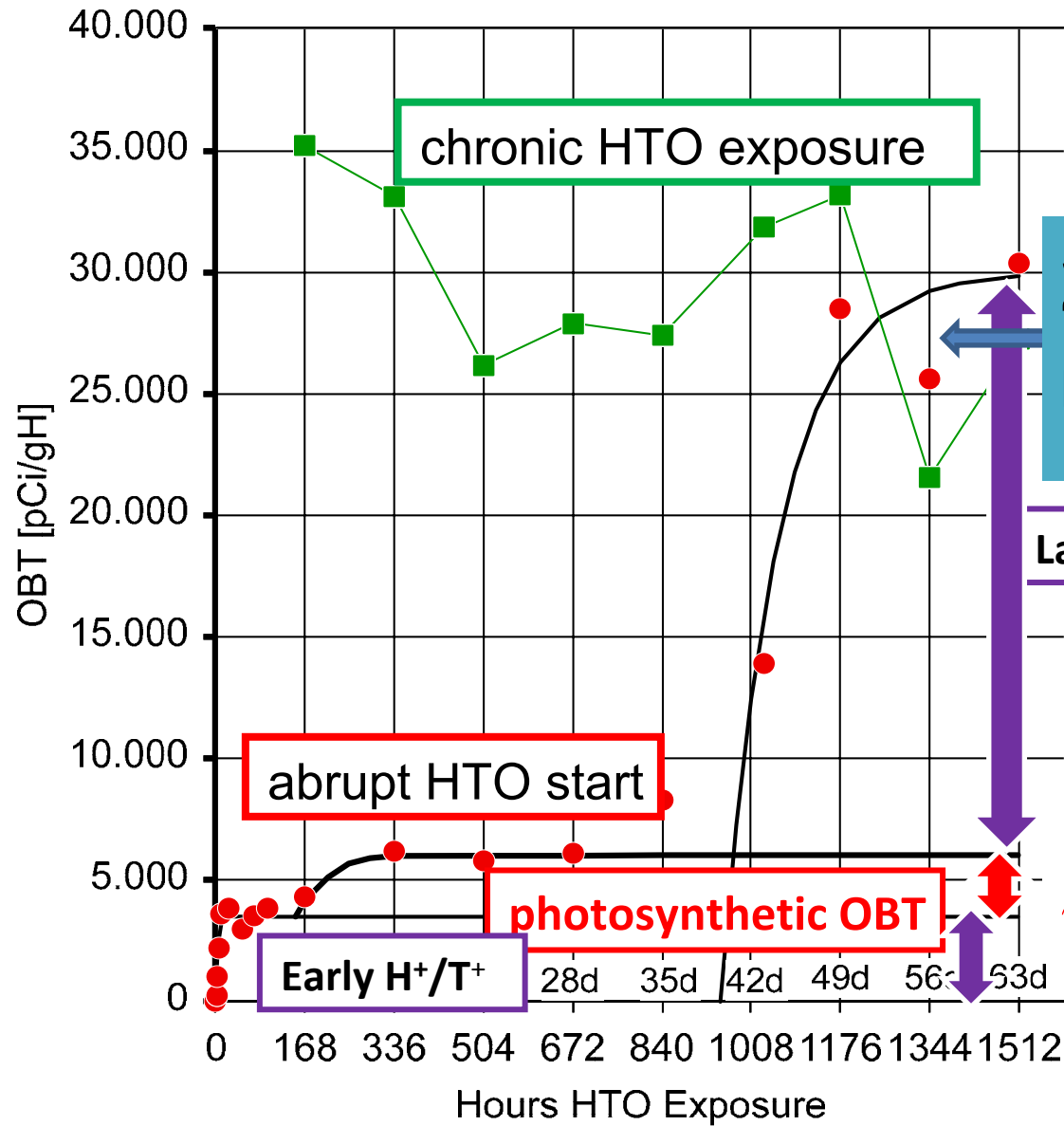
HTO



weeks
months
years



The XBT_{buried} fraction in tomato OBT

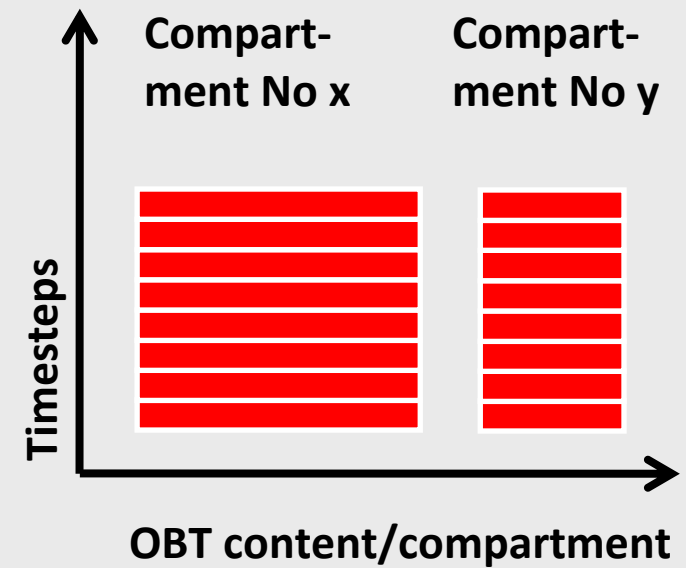
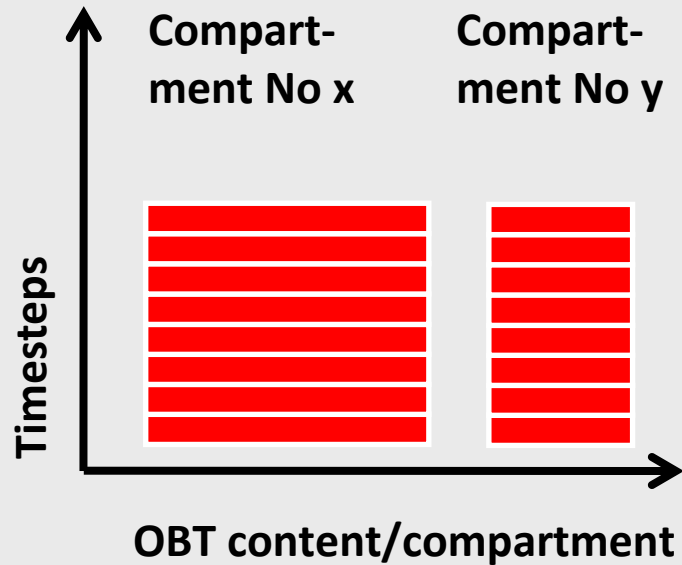


Spence 1984:
 “H⁺/T⁺ exchange paralleling
 photosynthesis”

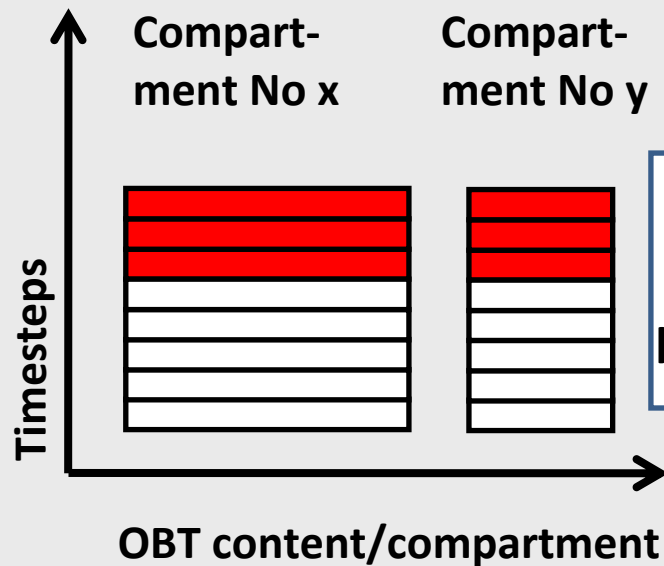
Late H⁺/T⁺

~10%

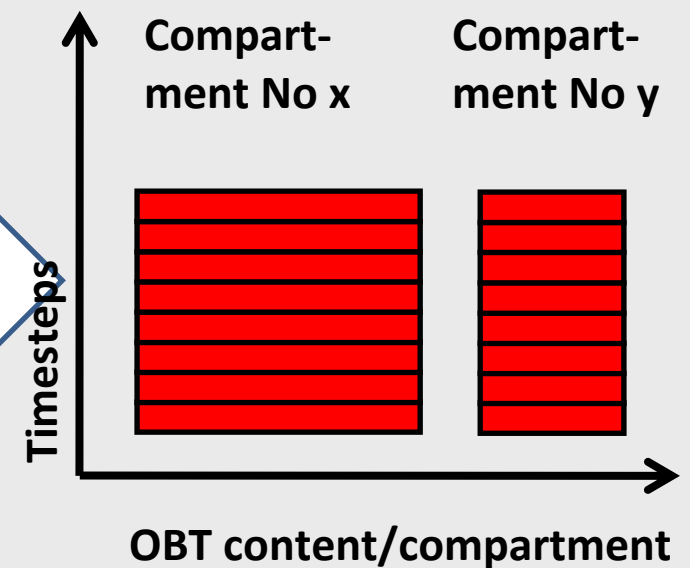
Chronic HTO exposure



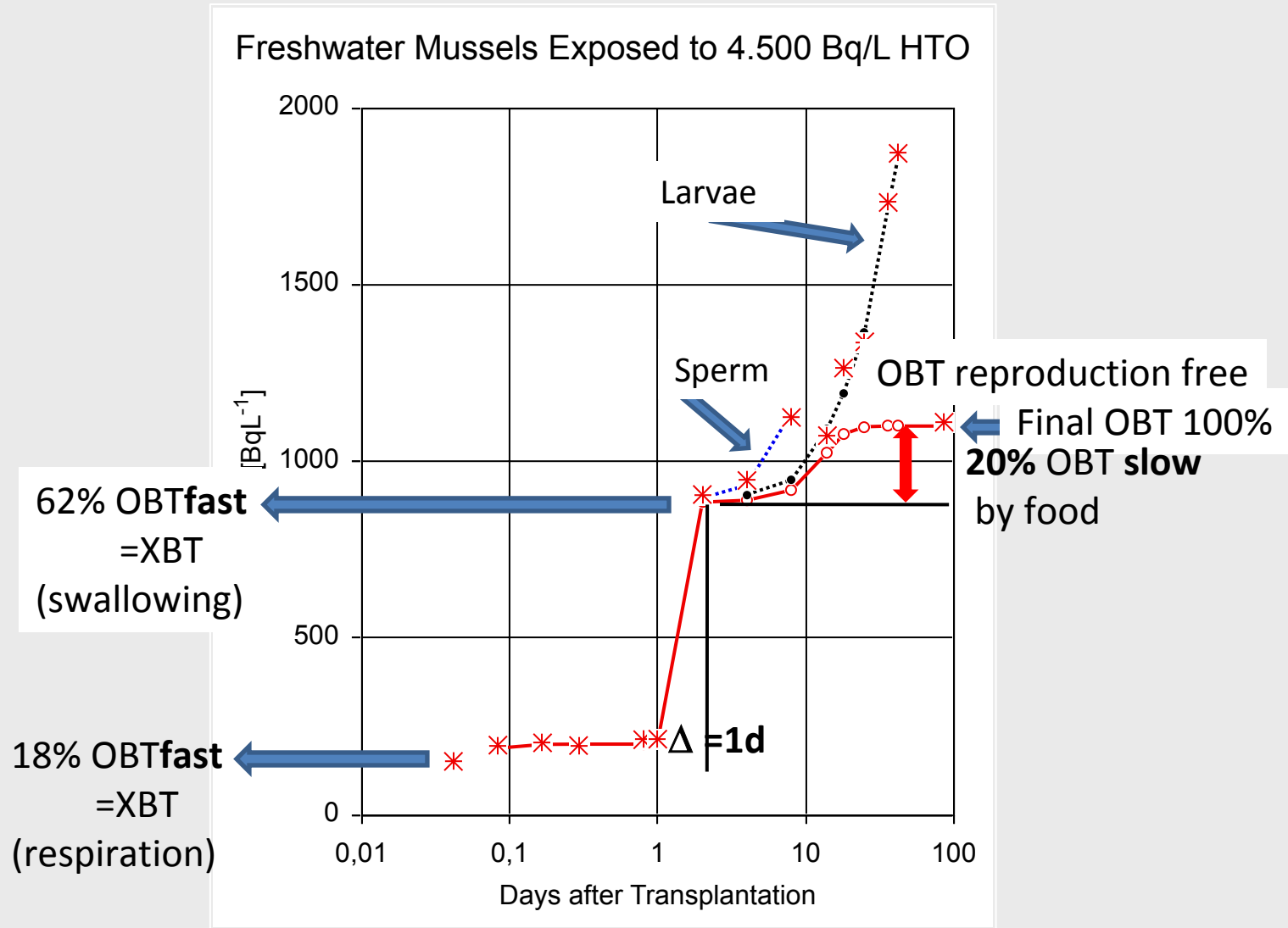
Abrupt start of HTO exposure



H⁺migration **weeks**
into **months**
bio-polymers **years**



The XBT_{buried} fraction in mussel OB



Conclusion

OBT formation

(abrupt and chronic, fast and slow)

can be modeled by respecting

$$\Rightarrow \text{OBT} = \text{XBT}_{\text{buried}} + \text{CBT}$$

\Rightarrow fast and late window of OBT formation

\Rightarrow $\text{XBT}_{\text{buried}}$ estimated from XBH

\Rightarrow XBH/compartment from food tables

Thank you for
your attention