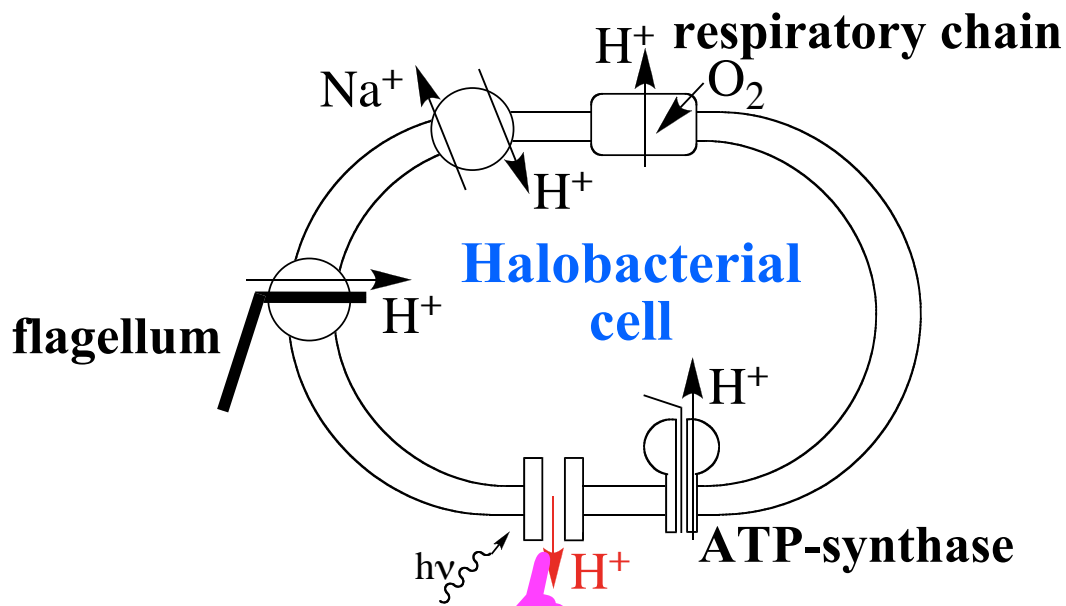


**Physics of
Solar Energy Conversion
in Halobacteria by
Photoinduced Proton Pumping**

**Christoph Kuhn and Hans Kuhn
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Light-driven proton pumping from inside to outside of cell

Photoinduced translocation of H⁺ from cytoplasmic channel with pH > 10 to extracellular channel with pH < 3.5

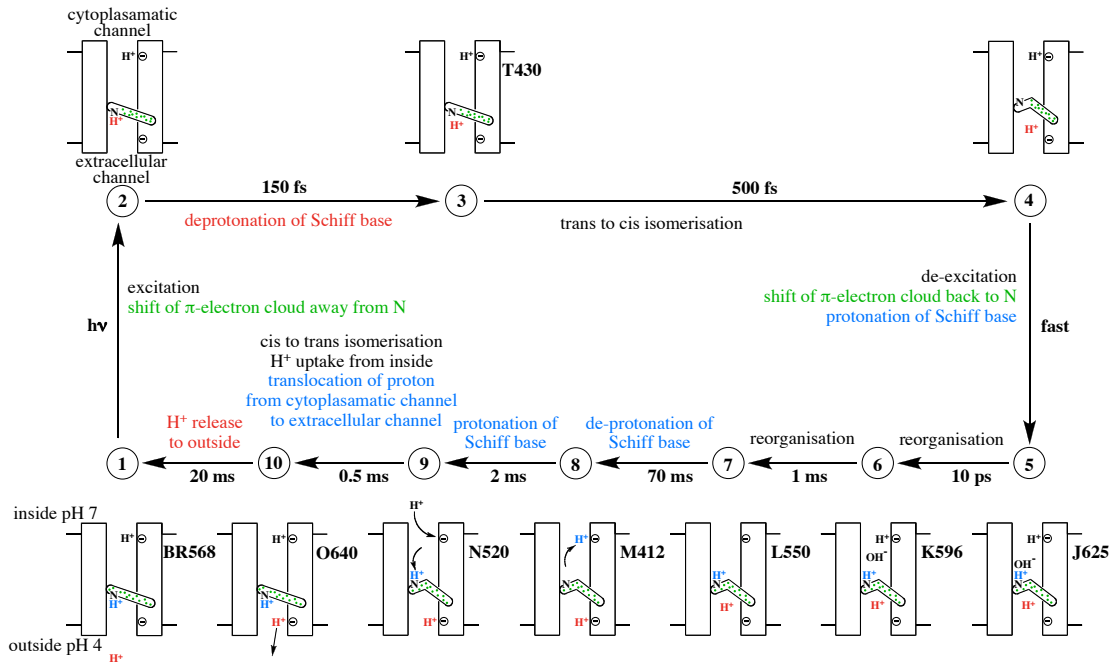
Traditional model: *How can this happen?*

- translocation of H⁺ from cytoplasmic channel to extracellular channel by conformational change of protein corresponding to step from 7 (stage L550) to 8 (stage M412)

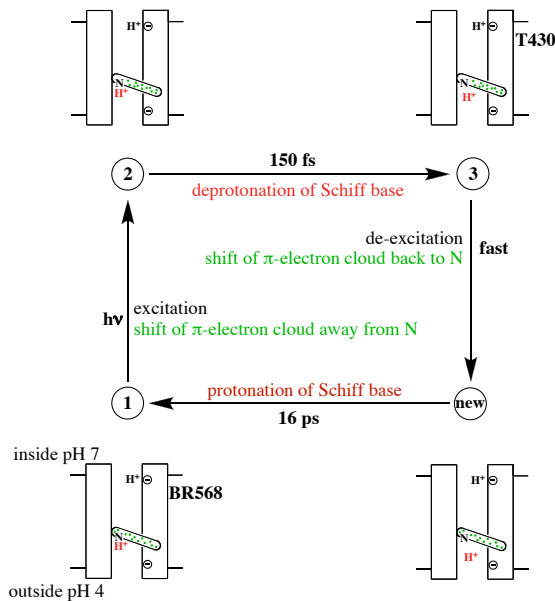
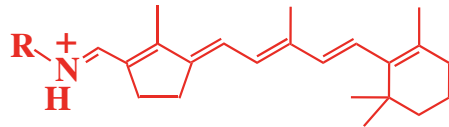
Present model:

- initial steps from 1 to 3: **photoinduced π -electron shift away from N and thus deprotonation of Schiff base** leaving H⁺ in extracellular channel
- **translocation of H⁺ from cytoplasmic channel to extracellular channel** by thermal cis-trans isomerisation (step from 9 to 10)

Presented model: Synopsis



Present model supported
by mutant
in which trans-form of chromophore is blocked:



- photoinduced release of H⁺ into extracellular channel as in wild-type
- recombination slow (16ps)

Traditional model:

- U. Haupts, J. Tittor, D. Oesterhelt
Biochemistry 36, 2 (1997)

Present model:

- H. Kuhn, C. Kuhn
Chem. Phys. Lett. 253, 61 (1996)
- H.Kuhn, H.-D. Försterling, D.
Waldeck Principles of Physical Chemistry
2nd Ed., Wiley 2008

Femto-second spectroscopy:

- J. Dober, W. Zinth, W. Kaiser, D. Oesterhelt
Chem. Phys. Lett. 144, 215 (1988)
- J. Herbst, K. Heyne, R. Diller
Science 217, 822 (2002)

Mutant with chromophore blocked in trans-form:

- A. Aharoni, I. Weiner, M. Ottolenghi, M. Sheves
J. Biol. Chem. 275, 21010 (2000)