1. **Header:**

**Title**: Ion channels versus ion pumps the principal difference - in principle

**Why did I read this paper:** I want to find out the answer for the question: should I incluse channel proteins in my datasets for predicting transporters and their substrate specificities

**Source:** <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2742554/pdf/nihms126060.pdf>

**Year of published:** 2009

1. **Summary of abstract**

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| **Ion channels** | **Ion pumps** |
| * When open, ion channels let selected ions diffuse down the concentration (gradient or electrical gradients) | * Labour tirelessly to maintain the gradients, by comsumming energy to slowly move ions against them |

The both:

* + Have diametrically opposed tasks
  + Have divergent speeds

🡪 channels and pumps have traditionally been viewed as completely different entities as alike as chalk and cheese

**BUT** new structual and mechasistic information about both classes of these molecular machines challenge the comfortable separation, forcing its re-evaluatiob

1. **Outstanding points**
   * new structual and mechasistic information about both classes 🡪 can not think they are the different and we need to re-evaluate the separation
2. **Lesson learned from the papers**
3. **Facts**

* The movements of ions into and out of cells and organelles are essential for all life and these movements should be precisely controlled
* Some processes that are mediated by cell ions:
  + Signalling
  + pH balance
  + volume regulation
  + cell cycle
* Furthermore, some processes that are mediated by cell ions in higher organisms:
  + fertilization
  + immune responses
  + secretion
  + muscle contraction
  + electrical signals in nerves, muscles and synapses
* ion flows through channels generates transmembrane electric currents
  + Na or K ion currents cause changes in membrane potential that act as physical signals
  + Ca ion currents themselves usually represent the signal
  + Cl ion currents tend to stabilize membrane potentials
* Because ion flow through channels dissipates the very gradients that drive it, channel contain gates regulated to turn the ion flow on only when needed. Does this relate to some proteins named **voltage-gated channels or ligand-gated ion channels?**
* Thermodynamically uphill transport = active transport
* “Pumps” encompasses all transporters capable of thermodynamically uphill transport
* Ion pumps that hydrolyze ATP, ATPase, are sometimes called primary pumps to distingush them from secondary pumps
* According to the relative directions of the couple downhill and uphill ion flows, secondary pumps are also called:
  + Co-transporters (symports???)
  + Counter-transporters (antiport??)
  + exchangers
* The difference between ion channels and ion pumps

|  |  |
| --- | --- |
| **Ion channels** | **Ion pumps** |
| * When open, ion channels let selected ions diffuse down the concentration (gradient or electrical gradients) * Passive * thermodynamically downhill * high speed ion movement through channels * a channel needs no more than a single gate | * Labour tirelessly to maintain the gradients, by comsumming energy to slowly move ions against the gradients * Active * Thermodynamically uphill transport, frequent incorporation of enzyme-like reaction mechanisms * Low speed of ion movement through pumps * A pump needs at least two gates that should never be open at once |

1. **Other notes**

* Some examples from both types were examined. For more: refer to the paper.