Table S1. The key P*i* transporters of terrestrial plants.

|  |  |  |  |
| --- | --- | --- | --- |
| **Transporter** | **Organism** | **Remarks** | **Refs.** |
| \*PTx family of high-affinity P*i* transporters (e.g. AtPT1 from *A. thaliana*) | *A. thaliana*, *Licopersicon esculentum*, *Medicago sativa*, *Nicotiana tabacum* etc. | Membrane proteins from MFC family. | [1-3] |
| Phtx family of low-affinity P*i* transporters | *A. thaliana*, *Oryza sativa* etc. | Pi:H+ symporters; apparent Km for P*i* — 0.4 mM |
| PHR1, homolog of Psr1 | *A. thaliana*, *Brassica* spp. etc. | P*i* starvation-inducible, homologous to β-glucosidase, may induce deglycosylation and regulation of acid phosphatases  during Pi starvation |

Table S2. Key genes involved in P acquisition and polyP metabolism in eukaryotic microalgae with C*. reinhardtii* as reference. Most of the genes involved are under control of the transcription factor psr1 (see further detail in [4-6] )

| **Gene or enzyme** | | **Annotation 1** | | **Annotation 2** | **Remarks** | | | **Refs.** | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Psr1* (phosphorus starvation regulator 1) | | (Cre12.g495100) | | Q9S807 | Putative transcriptional activator, crucial for acclimation of the alga to P*i* starvation | | | [5,7] | |
| *Lpb1* (low-P bleaching) | | (Cre12.g554250) | | Q4VGM5 |  | | | [8] | |
| *Pta1-4* | | (Cre02.g075050; Cre16.g686800; Cre16.g686750; Cre16.g686850) | | Q8LP71  Q8LP70  Q8LP69  A8ISD7 | P*i* transporter (H+/P*i* family) | | |  | |
| *Ptb1–5,6a,7–9,12* | | Cre12.g491600, Cre07.g325741, Cre07.g325740, Cre02.g144750, Cre02.g144700, Cre16.g655200, Cre12.g489400, Cre16.g676757, Cre02.g144600, Cre02.g144650) | | Q8LP68  Q8LP67  A8JH07  A0A2K3E3U8  A8J0U2  A8J994  A0A2K3D267  -  A0A2K3E3X0  A8J0U1 | P*i* transporter (Na+/P*i* family) | | |  | |
| *Ptc1* | | (Cre06.g251650) | | A0A2K3DLZ3 | P*i* transporter (low affinity) | | |  | |
| *Phox* | | (Cre04.g216700) | | A0A2K3DTA4 | Calcium-dependent alkaline phosphatase | | |  | |
| *Pho1* | (Cre08.g359300) | | A8JGF3 | | | Alkaline phosphatase |  | |
| *Phod* | (Cre05.g239850) | | A0A2K3DT40 | | | Alkaline phosphatase |  | |
| *Mpa1,2,8,9,11,13* | Cre03.g146207, Cre12.g500250, Cre11.g468500, Cre11.g476700, Cre13.g578350, Cre16.g672250) | | A8J2X5  -  A0A2K3D861  -  -  A0A2K3CVM3 | | | Calcineurin-like phosphatase |  | |
| *Vtc1* | (Cre12.g510250) | | A8IKM0 | | | Vacuolar transporter chaperone family (putative polyP synthesis) |  | |
| *Vtc4* | Cre09.g402775 | | A0A2K3DF66 | | |  |  | |
| *Vtcx* | (Cre01.g005500, Cre10.g461500, Cre10.g461500, Cre09.g402812) | | A0A2K3E503  A0A2K3DBW4  A0A2K3DF49 | | |  |  | |

Table S3. Key genes involved in P acquisition and polyP metabolism in cyanobacteria with *Synechococcus sp* as reference. In prokaryotes, the genes constituting the pho regulon are controlled by the transcription factor PhoB. Based on the Pho regulon components of *Synechococcus* sp. WH8102 described here [9], we provided available data for *Synechococcus* sp. WH8102 as well as *Synechococcus* sp. strain WH7803 using Uniprot database.

| **Gene/ enzyme** | **Annotation 1** | **Annotation 2** | **Remarks** | **Ref** |
| --- | --- | --- | --- | --- |
| *phoR* | SynWH7803\_1546 | Q56181 | Activated during P depletion, a regulatory component that phosphorylates phoB. Also annotated as sphS in other Synechococcus species (P39664, for S elongatus) | [10] |
| *phoB* | SynWH7803\_1545 | Q56180 | Controls transcription of the Pho regulon. Also annotated as sphR in other Synechococcus species (P39663, for S elongatus) |
| *ptrA* | SynWH7803\_1046 | A5GKK7 | Protein with a potential regulatory role under P depletion/stress |
| *phoU* | Syn7502\_00586 | K9SQ49 | A regulatory protein regulating Pi import through the Pst system by interacting with PstB and PhoB | [11] |
| *pstC* | SynWH7803\_1245 | A5GL56 | Subunits constituting the Pi import complex | [12] |
| *pstSI* | SynWH7803\_2513 | A5GPS4 |
| *pstSII* | SynWH7803\_1045 | A5GKK6 |
| *pstA* | SynWH7803\_1244 | A5GL55 |
| *pstB* | SynWH7803\_1243 | A5GL54 |
| *phnC* | SynWH7803\_1469 | A5GLT0 | Subunits consituting the phosphonate-ABC transporter |
| *phnD* | SynWH7803\_1471 | A5GLT2 |
| *phnE* | SynWH7803\_1470 | A5GLT1 |
| *phoA* | syc0750\_c | A0A0H3K146 | Alkaline phosphatases |
| *phoD* | SynWH7803\_1802 | A5GMR3 |
| *phoV* |  | Q55320 |
| *ppk1* | SYNW2495 | Q7U3D7 | Polyphosphate kinase 1 | [13] |
| *ppx* | SynWH7803\_1855 | A5GMW6 | Exopolyphosphatase |

**Supplementary references**

1. Grossman, A.; Takahashi, H. Macronutrient utilization by photosynthetic eukaryotes and the fabric of interactions. *Annual Review of Plant Biology* **2001**, *52*, 163-210.

2. Raghothama, K. Phosphate acquisition. *Annual review of plant biology* **1999**, *50*, 665-693.

3. Raghothama, K. Phosphate transport and signaling. *Current opinion in plant biology* **2000**, *3*, 182-187.

4. Bajhaiya, A.K.; Dean, A.P.; Zeef, L.A.; Webster, R.E.; Pittman, J.K. PSR1 is a Global Transcriptional Regulator of Phosphorus Deficiency Responses and Carbon Storage Metabolism in Chlamydomonas reinhardtii. *Plant physiology* **2015**, pp. 01907.02015.

5. Wykoff, D.D.; Grossman, A.R.; Weeks, D.P.; Usuda, H.; Shimogawara, K. Psr1, a nuclear localized protein that regulates phosphorus metabolism in Chlamydomonas. *Proceedings of the National Academy of Sciences* **1999**, *96*, 15336-15341.

6. Sanz-Luque, E.; Grossman, A.R. Chapter 4 - Phosphorus and sulfur uptake, assimilation, and deprivation responses. In *The Chlamydomonas Sourcebook (Third Edition)*, Grossman, A.R., Wollman, F.-A., Eds. Academic Press: London, 2023; <https://doi.org/10.1016/B978-0-12-821430-5.00006-7pp>. 129-165.

7. Moseley, J.L.; Chang, C.-W.; Grossman, A.R.J.E.c. Genome-based approaches to understanding phosphorus deprivation responses and PSR1 control in *Chlamydomonas reinhardtii*. **2006**, *5*, 26-44.

8. Chang, C.W.; Moseley, J.L.; Wykoff, D.; Grossman, A.R. The LPB1 gene is important for acclimation of Chlamydomonas reinhardtii to phosphorus and sulfur deprivation. *Plant Physiol* **2005**, *138*, 319-329, doi:10.1104/pp.105.059550.

9. Tetu, S.G.; Brahamsha, B.; Johnson, D.A.; Tai, V.; Phillippy, K.; Palenik, B.; Paulsen, I.T. Microarray analysis of phosphate regulation in the marine cyanobacterium Synechococcus sp. WH8102. *The ISME Journal* **2009**, *3*, 835-849.

10. Dyhrman, S.T. Nutrients and Their Acquisition: Phosphorus Physiology in Microalgae. In *The Physiology of Microalgae*, Borowitzka, M.A., Beardall, J., Raven, J.A., Eds. Springer International Publishing: Cham, 2016; 10.1007/978-3-319-24945-2\_8pp. 155-183.

11. Hudek, L.; Premachandra, D.; Webster, W.A.; Bräu, L. Role of Phosphate Transport System Component PstB1 in Phosphate Internalization by Nostoc punctiforme. *Appl Environ Microbiol* **2016**, *82*, 6344-6356, doi:10.1128/aem.01336-16.

12. Tiwari, B. Chapter 7 - Phosphate metabolism in cyanobacteria: fundamental prospective and applications. In *Cyanobacteria*, Mishra, A.K., Singh, S.S., Eds. Academic Press: 2024; <https://doi.org/10.1016/B978-0-443-13231-5.00002-7pp>. 159-175.

13. Gomez-Garcia, M.R.; Fazeli, F.; Grote, A.; Grossman, A.R.; Bhaya, D.J.J.o.b. Role of polyphosphate in thermophilic Synechococcus sp. from microbial mats. **2013**, *195*, 3309-3319.