

EXPLORING *Pseudomonas extremaustralis* 2E-UNGS GENOME FOR THE DEVELOPMENT OF INNOVATIVE ENVIRONMENTAL BIOTECHNOLOGIES.



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Introduction

Pseudomonas extremaustralis 2E-UNGS (former *P. veronii* 2E) is a native strain from the polluted Reconquista River basin (Buenos Aires Metropolitan Area, Argentina) with particular survival strategies that allowed its application in several processes such as waste biotreatments and biosensing. Regarding bacterial-metal interactions, *P. extremaustralis* 2E-UNGS is able to biosorb Cd(II), Zn(II) and Cu(II) and biotransform Cr(VI) to Cr(III), enabling their removal from aqueous systems and biosensor development. The complete circular 6372594 bp chromosome was annotated in NCBI GenBank with accession number NZ_CP091043.1.

The aim of this work was to explore within the genome sequence of this bacterium the presence of genes which represent potential new abilities to be exploited in innovative environmental biotechnologies.

Rapid Annotation using Subsystems Technology Server

<https://www.mg-rast.org/>

Pseudomonas Genome Database

Gene colour criteria:
 ■ Cytoplasmic
 ■ Cytoplasmic Membrane
 ■ Periplasmic
 ■ Outer Membrane
 ■ Extracellular
 ■ Unknown

<https://www.pseudomonas.com/>



Proksee-Genome Analysis

System for genome assembly, annotation and visualization. <https://proksee.ca/>

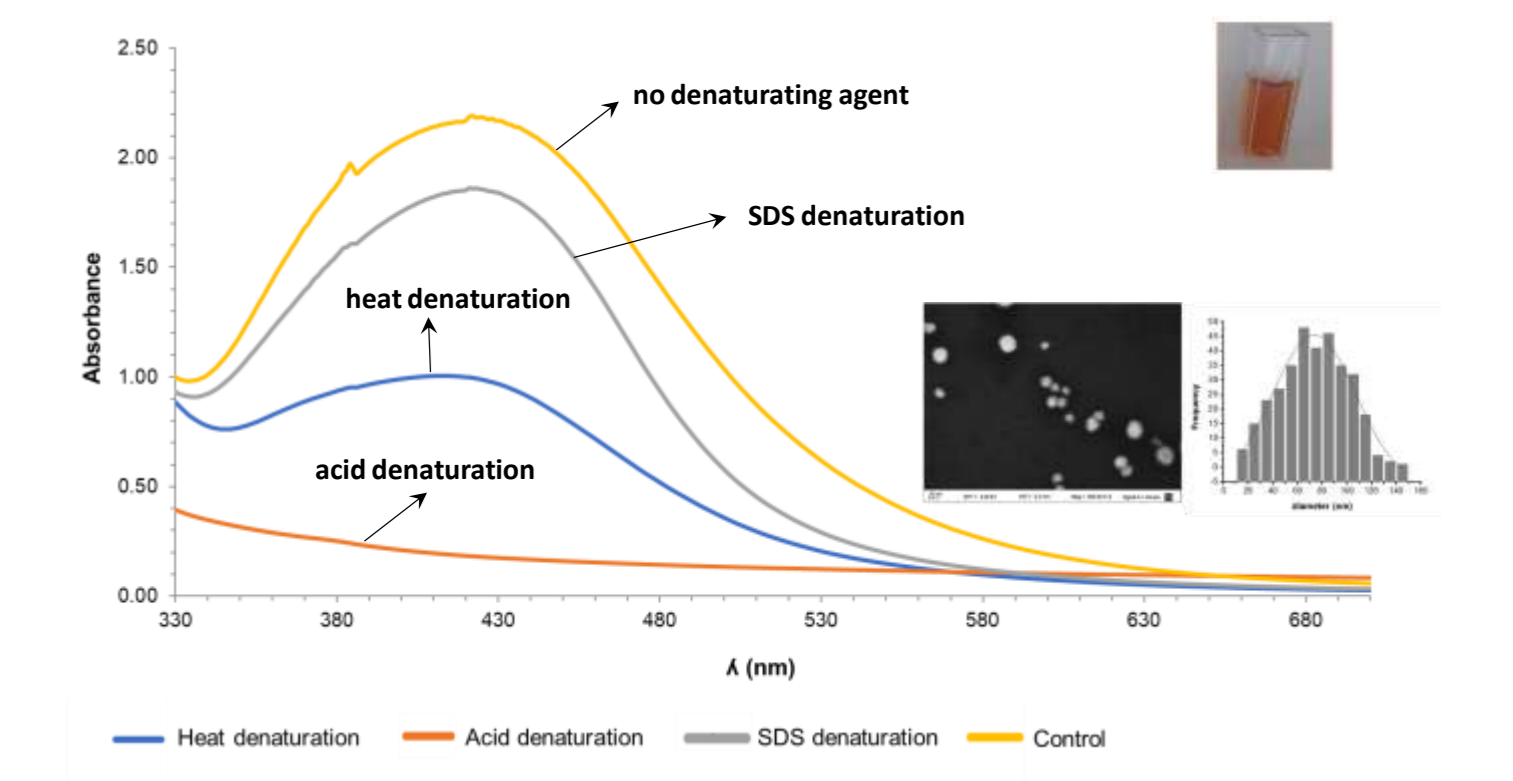
NIH/NCBI Basic Local Alignment Search Tool (BLAST) (highly similar -megablast- or somewhat similar -blastn-)

It is reported:
 Query cover = %QC
 Per. Ident = %PI

BLAST® » blastn suite

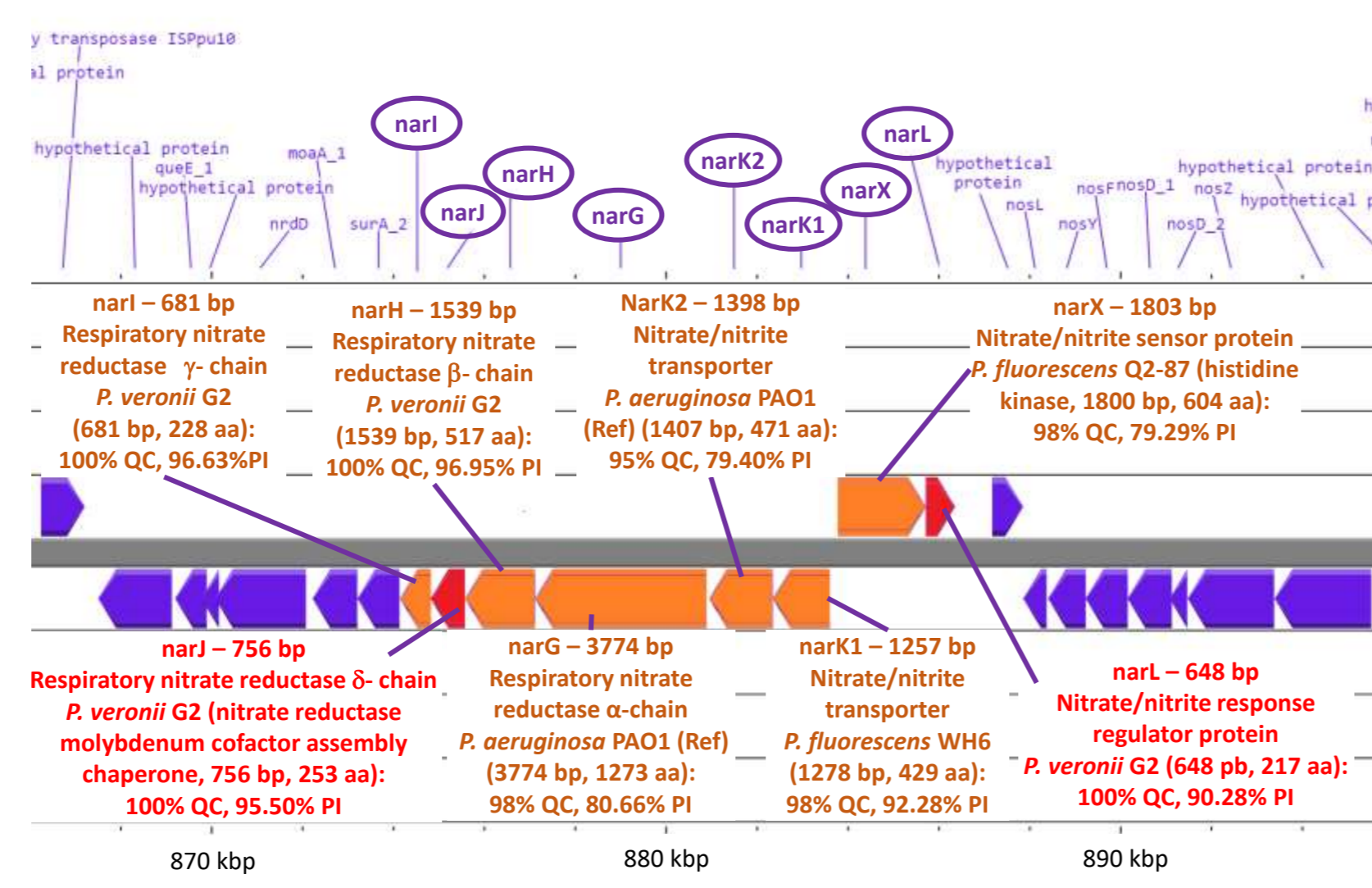
https://blast.ncbi.nlm.nih.gov/Blast.cgi?PROGRAM=blastn&PAGE_TYPE=BlastSearch&LINK_LOC=blasthome

Biosynthesis of Ag Nanoparticles

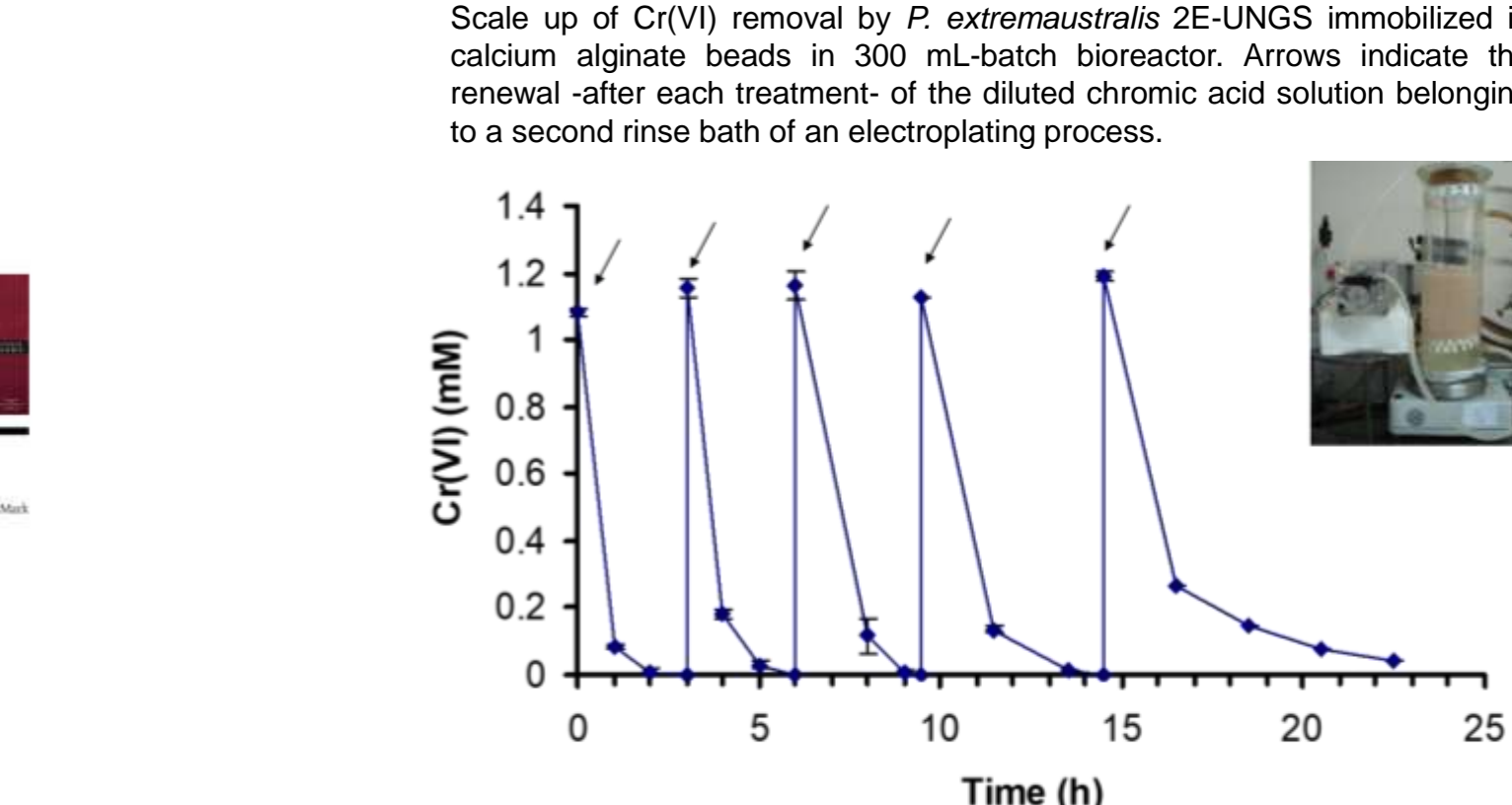
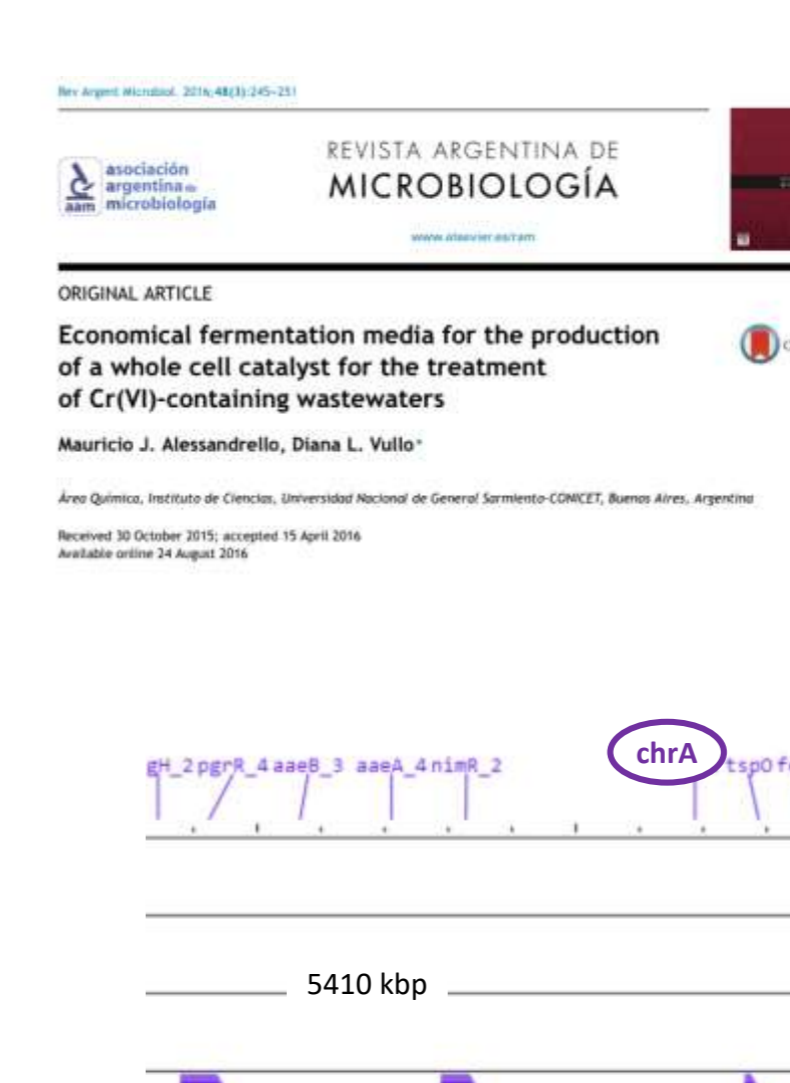


Nitrate reductase activity detected in cell-free culture supernatant from *P. extremaustralis* 2E-UNGS. NaNO_2 0.06 mg L⁻¹ (positive control), PYG broth (negative control) and ultrapure water (negative control). Positive reaction: development of pink colour (recorded at A_{600}).

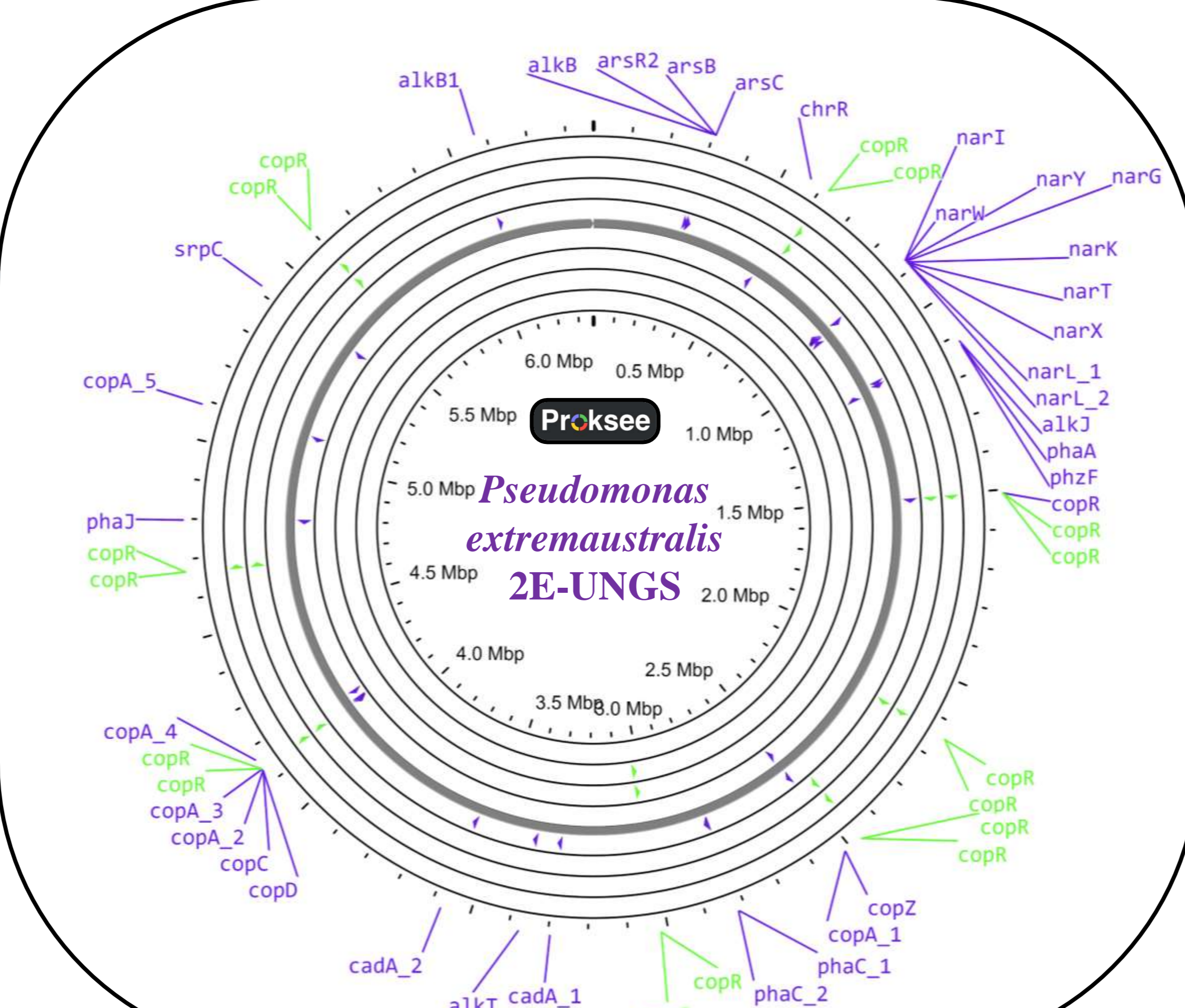
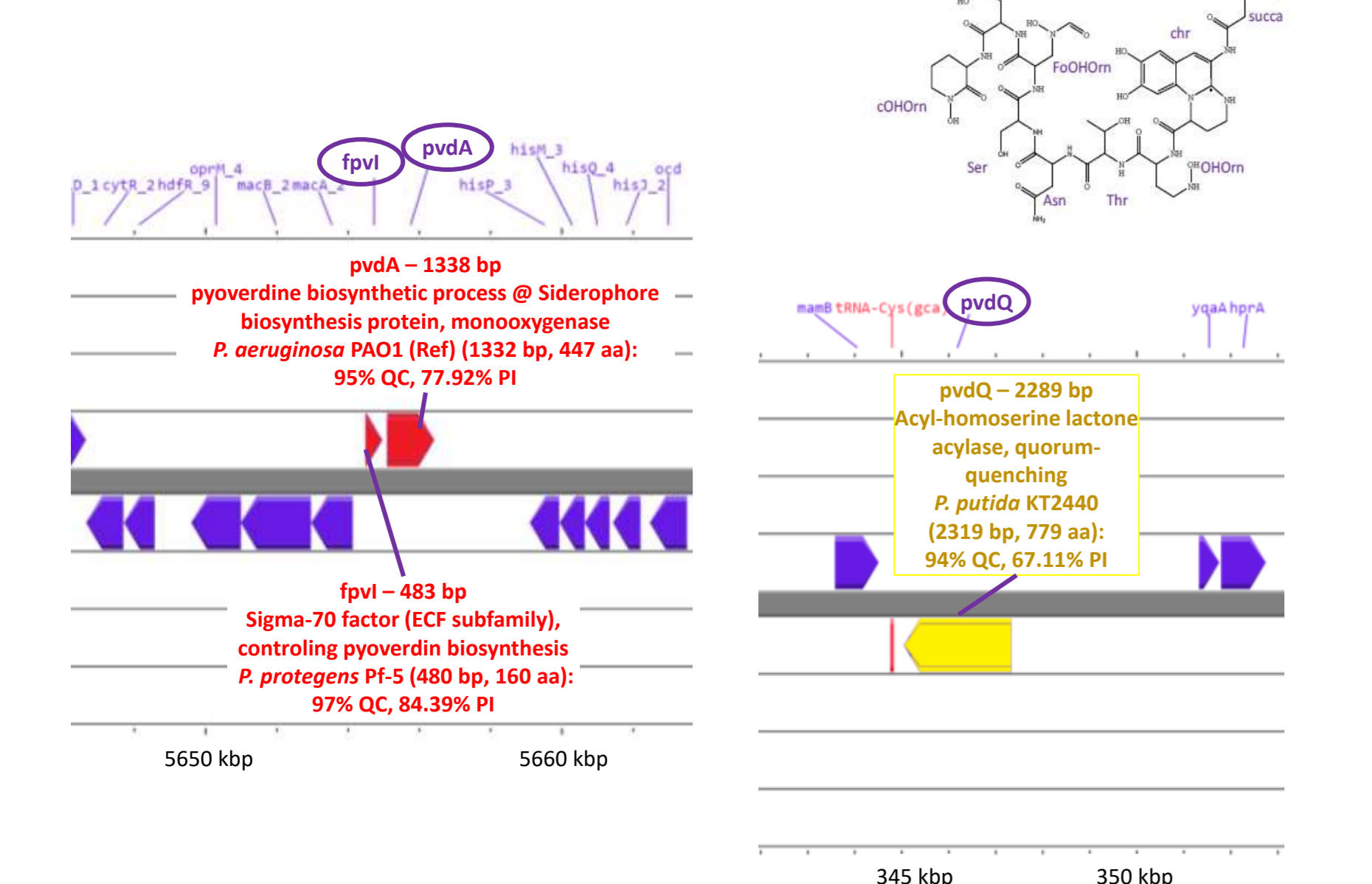
	No denaturation treatment	Heat denaturation	Acid denaturation	SDS denaturation
Cell-free supernatant from <i>P. extremaustralis</i> 2E-UNGS culture in PYG	+++	+	-	++
NaNO_2 solution (0.06 mg. L ⁻¹)	+++	+++	+++	+++
PYG broth	-	-	-	-
Ultrapure water	-	-	-	-



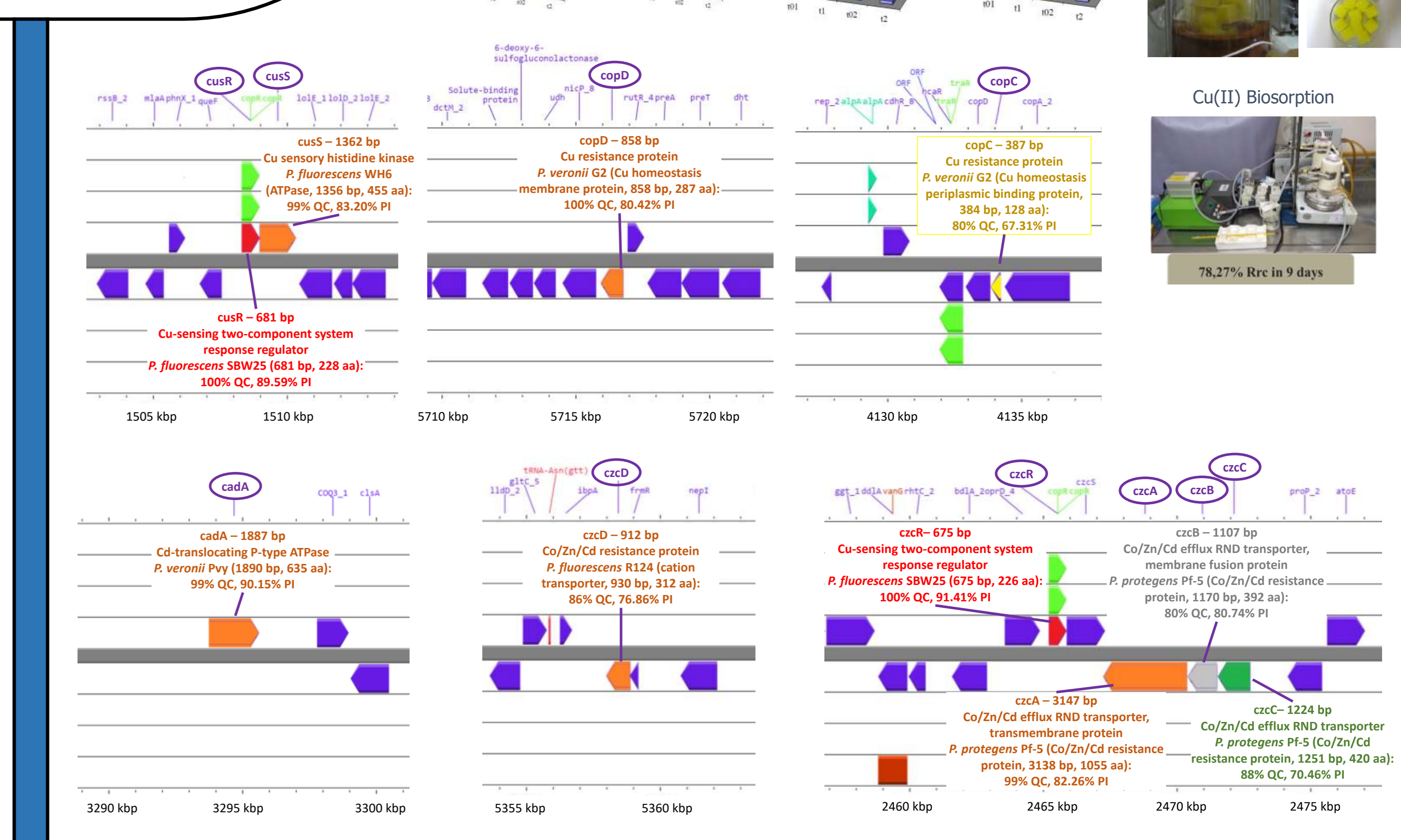
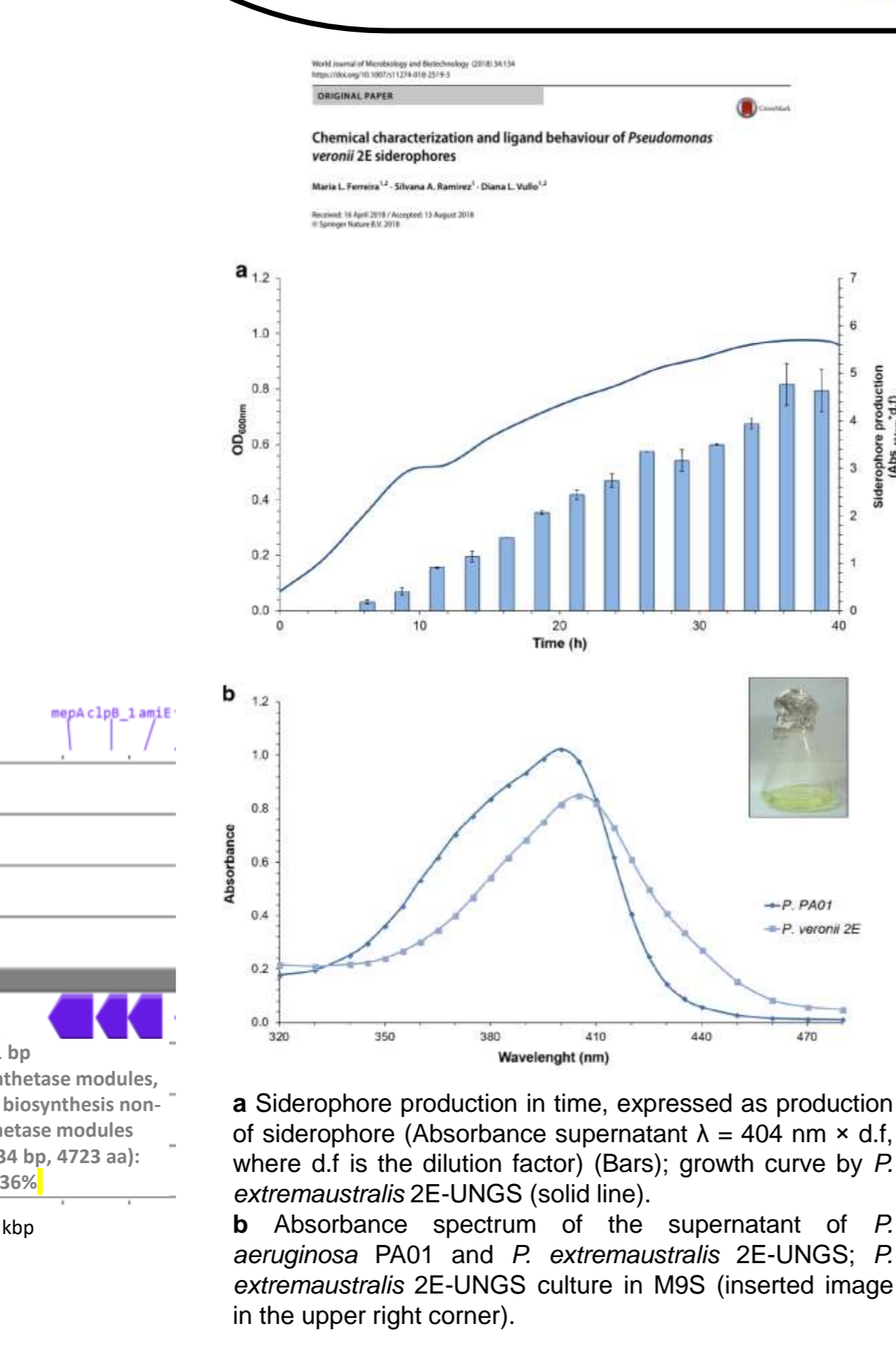
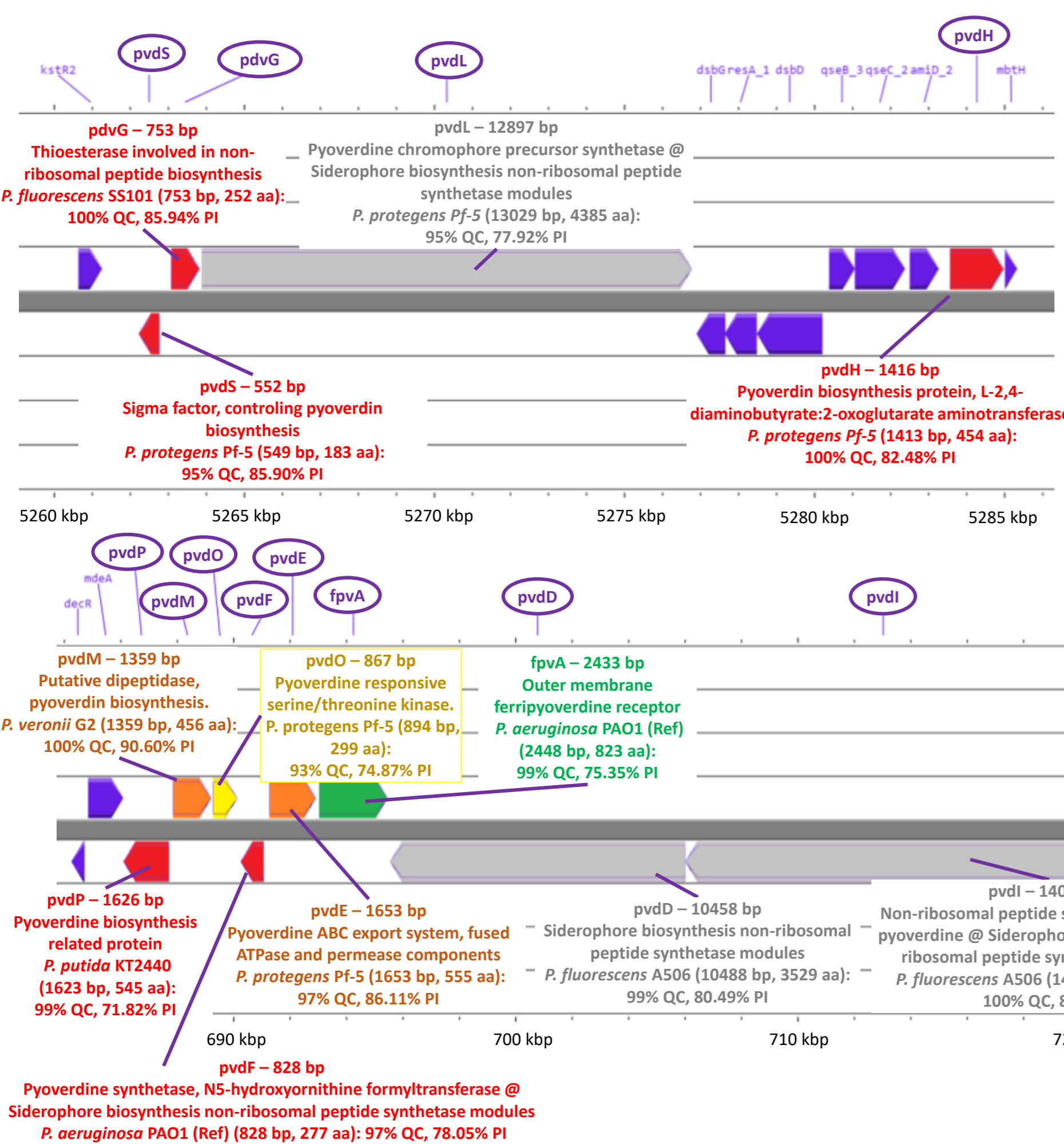
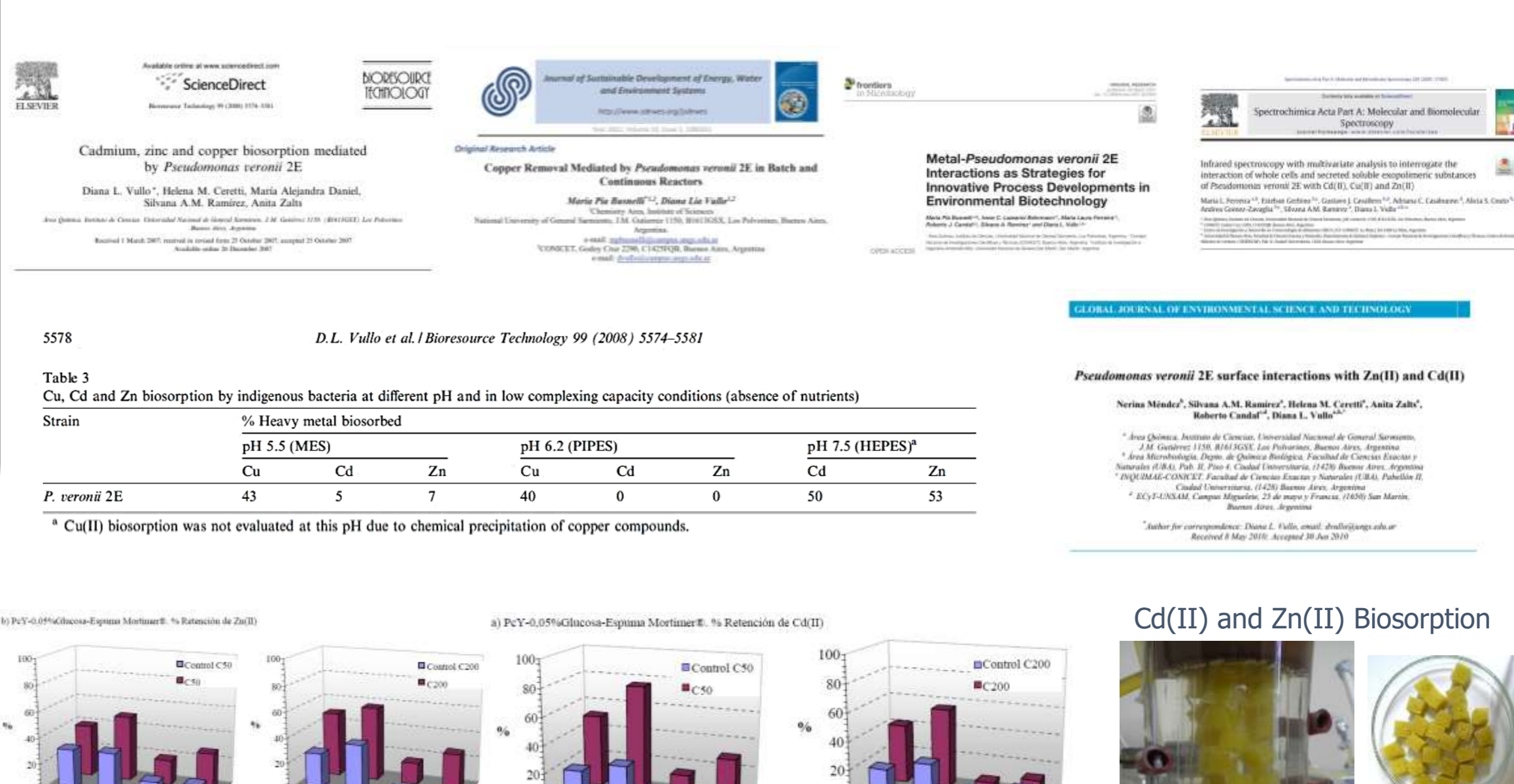
Chromium biotransformation



Pyoverdine production



Copper-cadmium-zinc interactions



Conclusions

- ✓ The complete cluster of nitrate reduction genes was identified associated with the proved biosynthesis of Ag-nanoparticles with antimicrobial and antibiofilm properties.
- ✓ Mono and dioxygenase genes were detected related to linear and aromatic hydrocarbon biotransformation respectively, consistent with the already registered industrial hydraulic oil degradation. In addition, auxin production genes were located.
- ✓ This battery of genes among others reveals the potential that *P. extremaustralis* 2E-UNGS contains in leading to the development of sustainable technologies for environmental restoration.