

Athens 2014 Sustainable Solid Waste Management

12th–14th June 2014, Athens - Greece



Metagenomic analysis of *cadA* gene as a powerful management tool for the remediation of cadmium-polluted sites

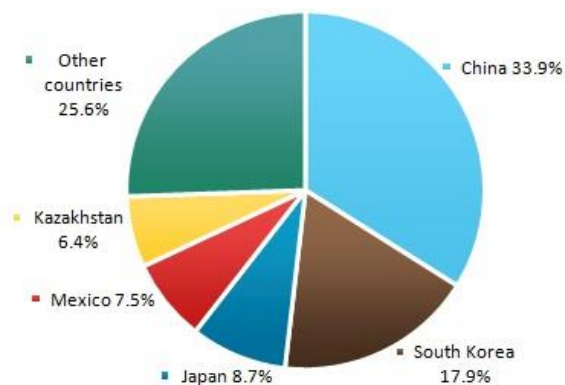
by

Assoc. Prof. Bulent ICGEN

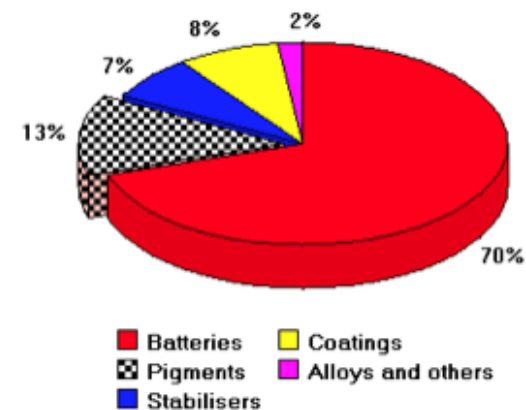
Middle East Technical University, Department of Environmental Engineering, Ankara-Turkey

Uses of cadmium

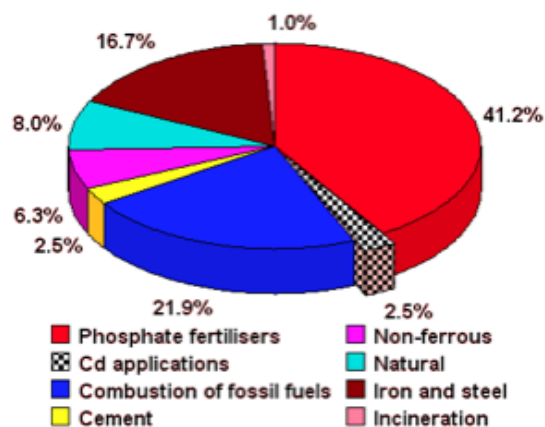
Global Cadmium Production in 2013



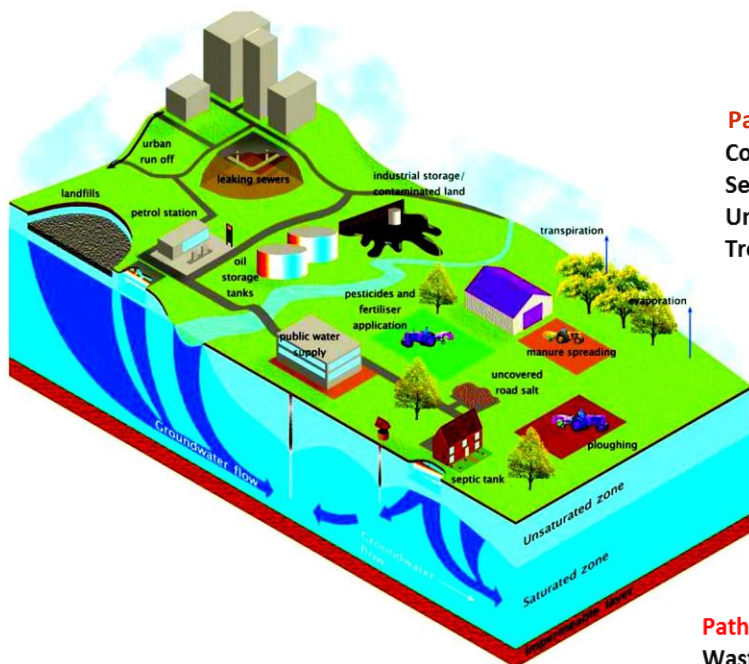
Western world cadmium consumption



Sources of human exposure to cadmium

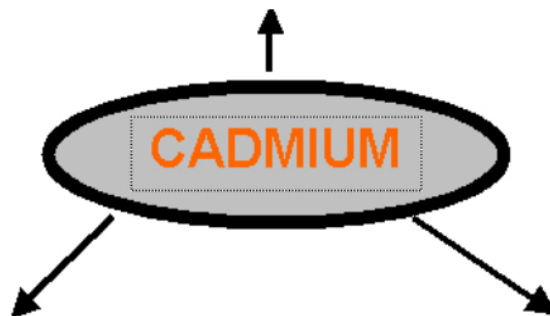


Pathways of cadmium to the environment



Pathways to Atmosphere

Combustible waste to municipal waste incineration plants
Sewage sludge incineration
Uncontrolled waste burning at dumpsites
Treatment of scraps and Ni-Cd battery



Pathways to Aquatic Environment

Waste water and Industrial Effluent
Uncontrolled dumping of waste to water bodies
Leachate from landfill and Dumpsite
Runoff from recycling operations

Pathways to Terrestrial Environment

Application of sewage sludge or organic waste to soil
Uncontrolled dumping of waste on land
Use of phosphate fertilizers

Natural and anthropogenic sources are the major categorized sources of cadmium missions to the environments such as air, water and soil.

Cadmium toxicity



Cadmium toxicity

Research has shown that cadmium affects the developing brain in children. Here are some other parts of the body it can effect.

RELATED HEALTH ISSUES

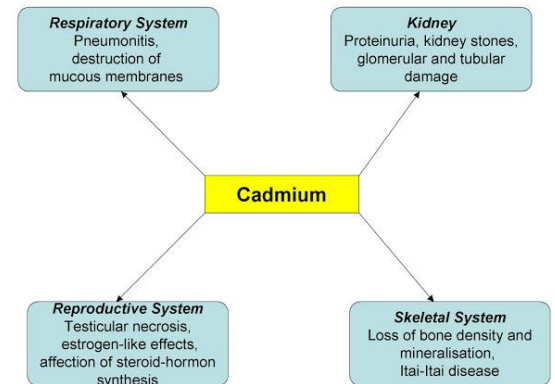
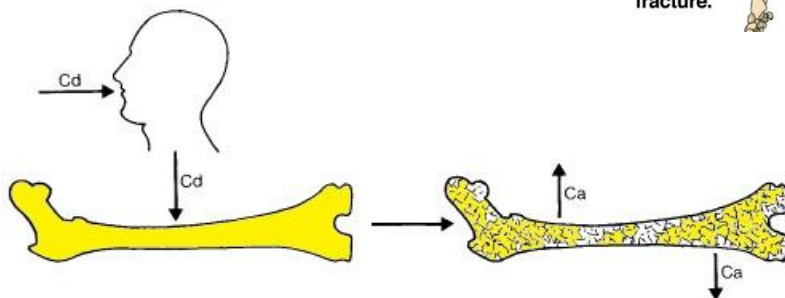
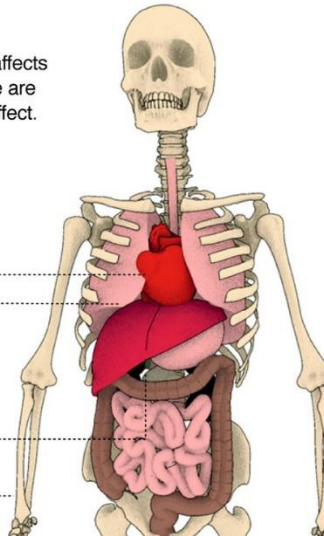
A recent study has linked it to breast cancer.

Cardiovascular disease

Obstructive pulmonary disease

The kidneys lose function, which can also cause gout, a form of arthritis.

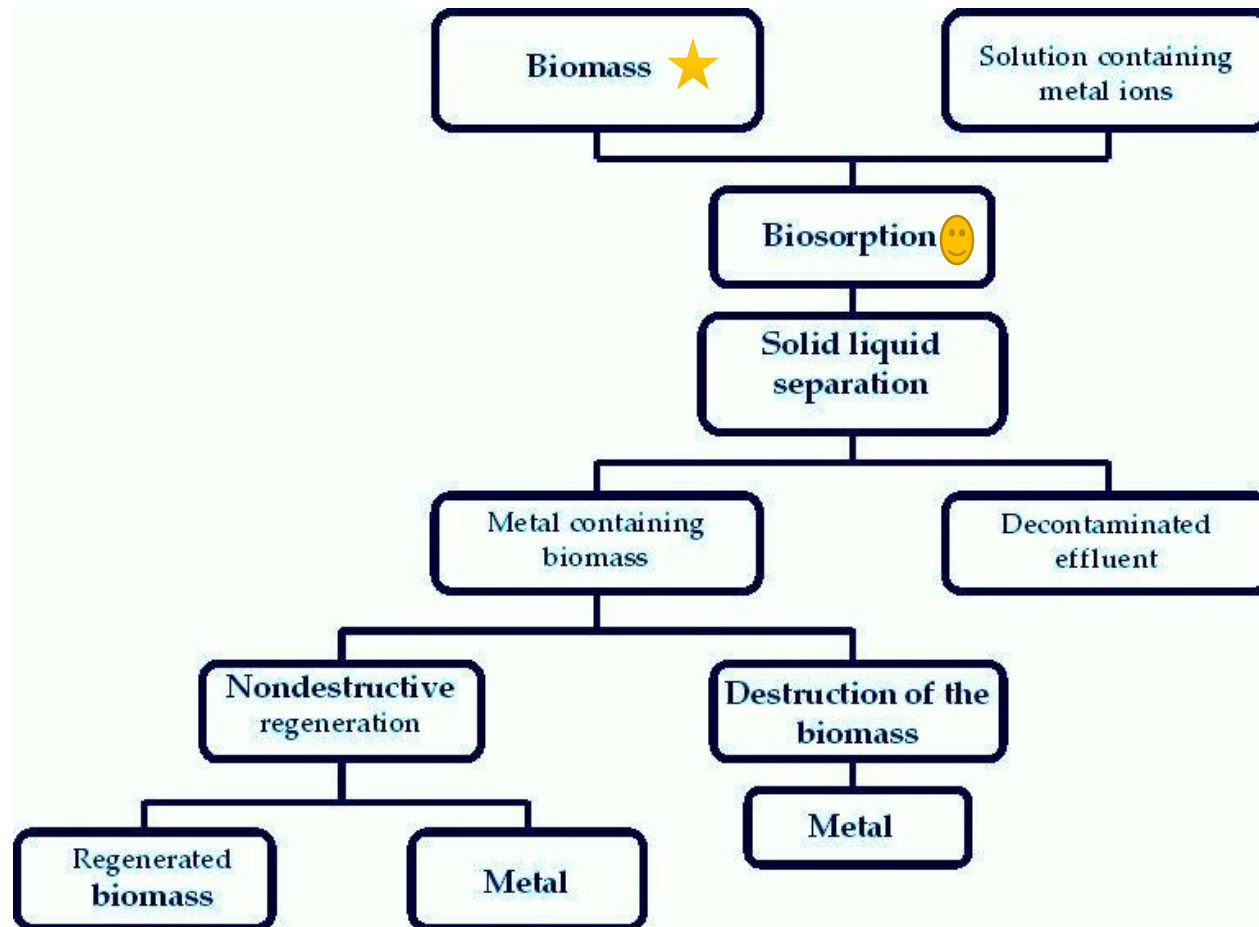
Bones lose density and fracture.



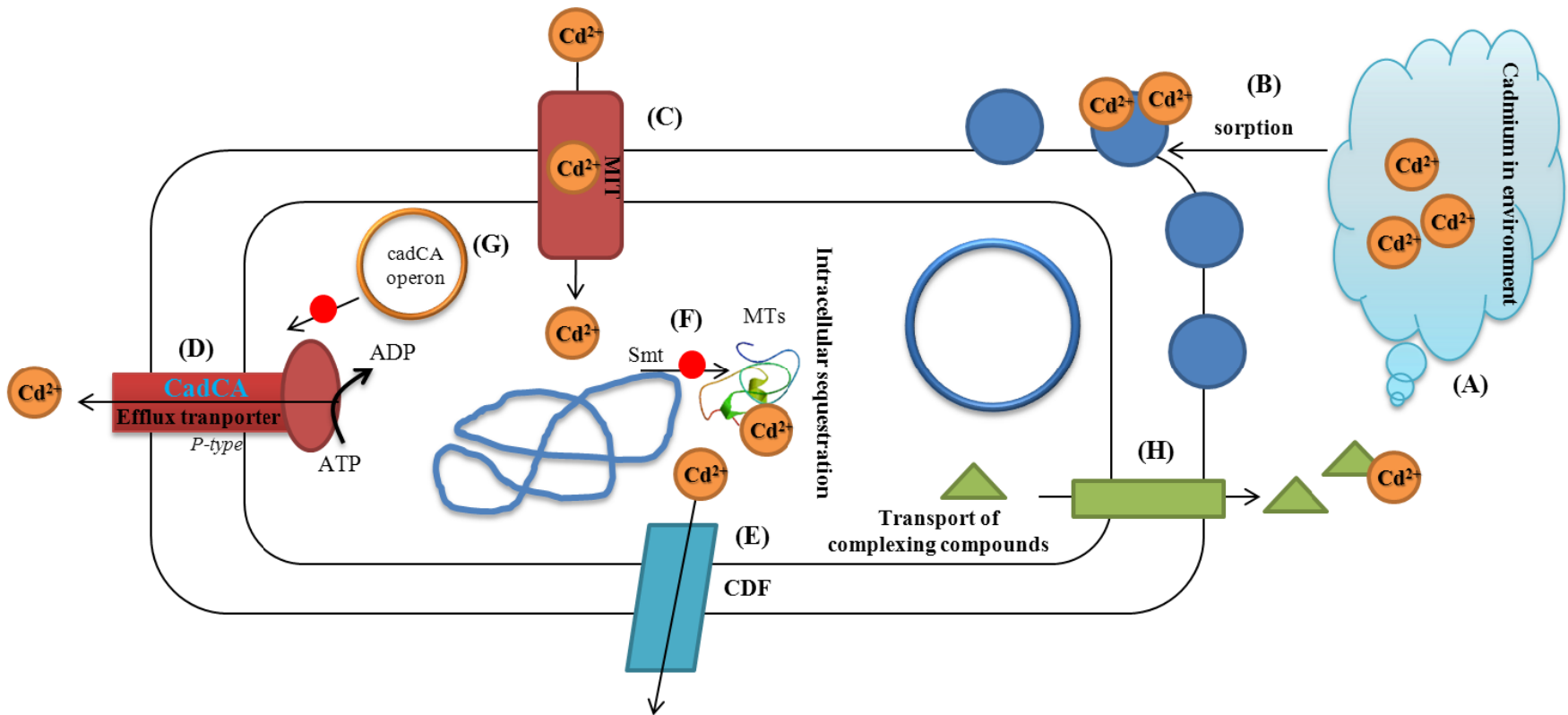
Removal of cadmium



Biosorption of cadmium



Bacteria cadmium interaction

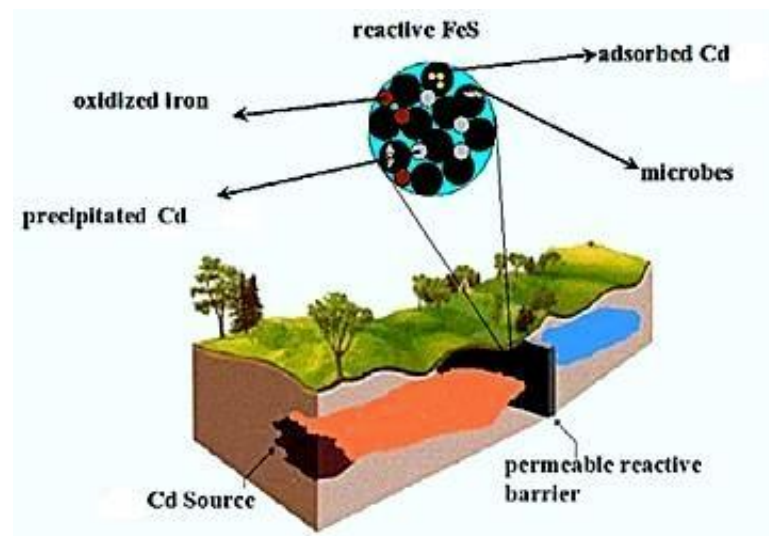


Purpose & methodology

❑ **Purpose:** For the efficient management of cadmium-polluted sites the cadmium resistance encoding gene *cadA*-specific primers and DNA probes were used to identify and screen cadmium biosorbents in the cadmium-polluted river waters through polymerase chain reaction (PCR) and fluorescein *in situ* hybridization (FISH).

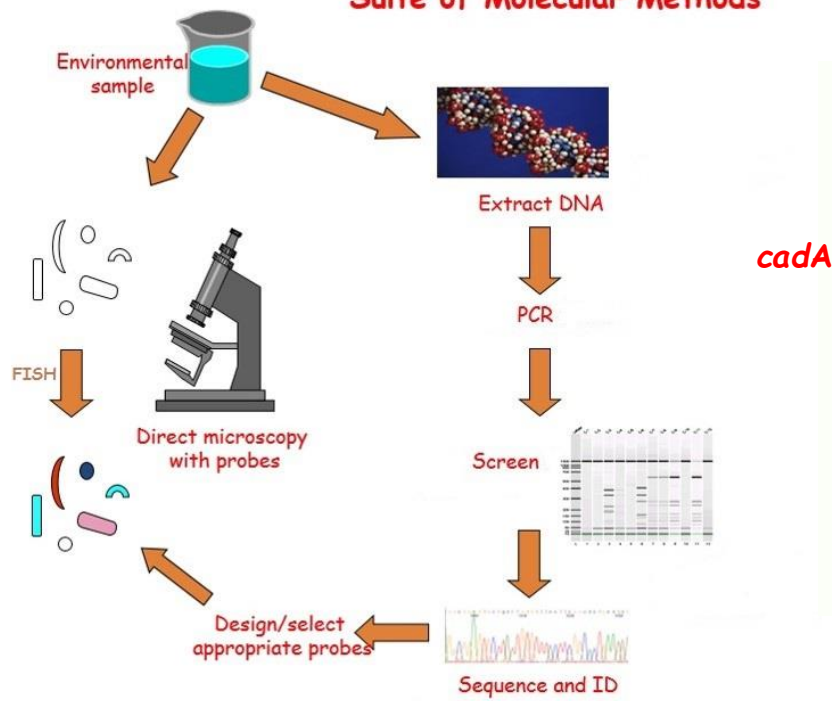
❑ **Methodology:**

- Collection of river water & measurement of cadmium
- Extraction of DNA from the polluted water samples
- Screening of cadmium biosorbents by using *cadA*-specific primers through polymerase chain reaction (PCR),
- Identification of cadmium biosorbents by using 16S rRNA sequencing
- *In situ* screening of cadmium biosorbents in the cadmium-polluted river waters through fluorescein *in situ* hybridization (FISH)

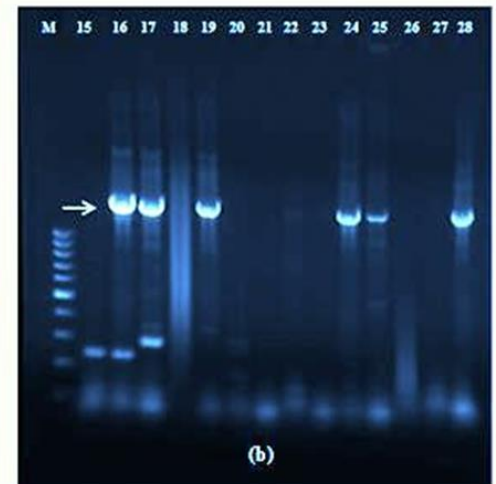
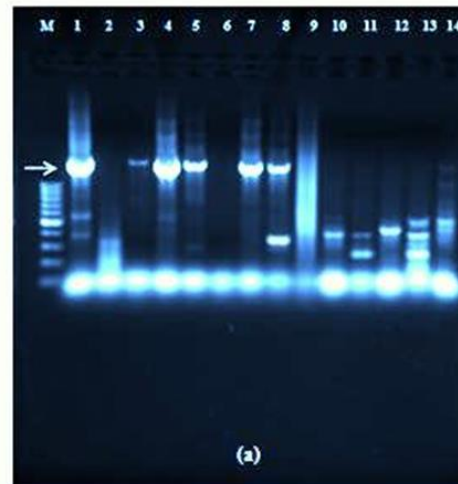


PCR amplification of *cadA*

Suite of Molecular Methods

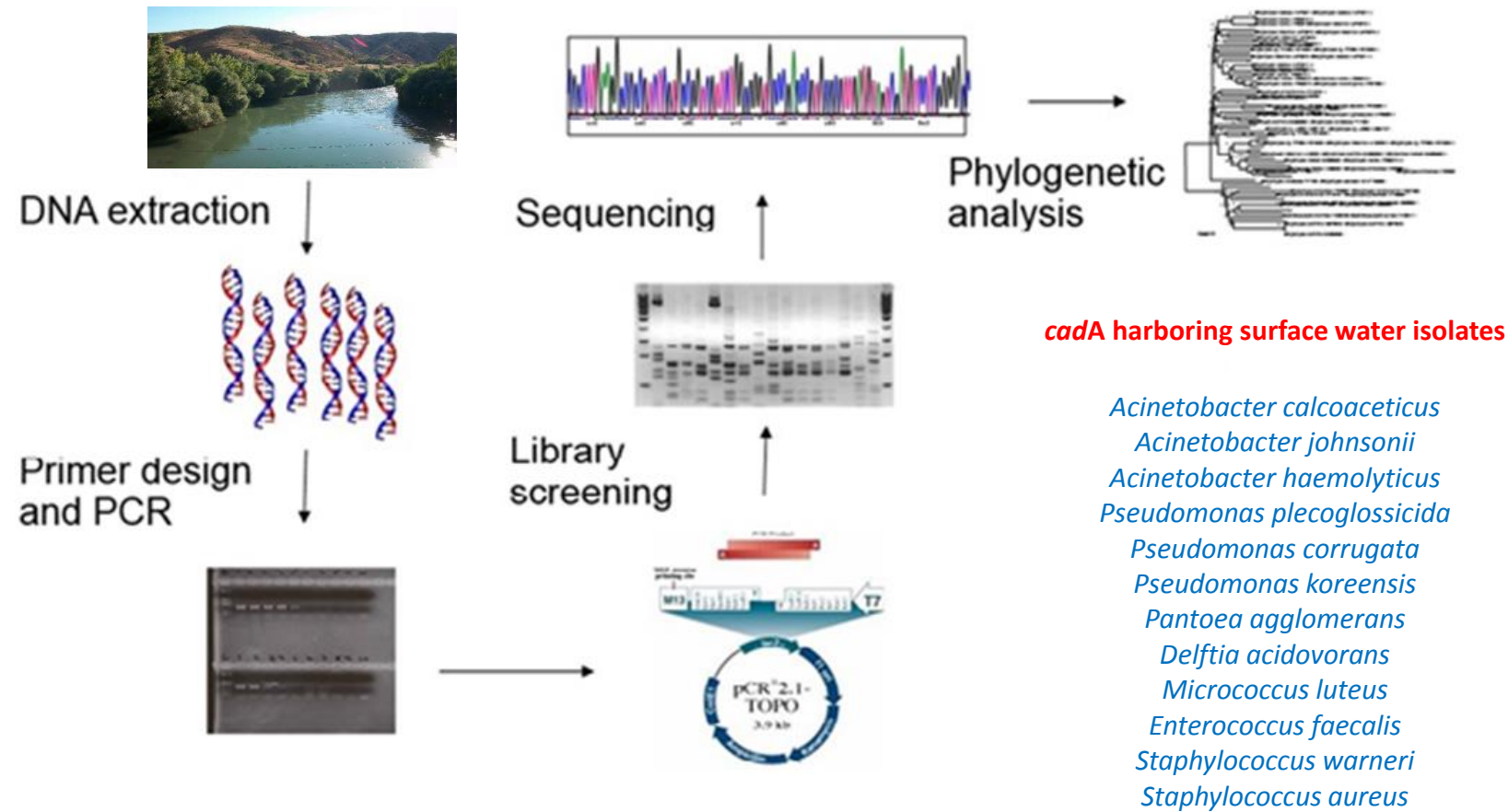


cadA



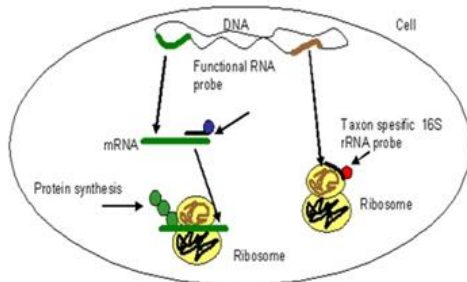
cadA harboring surface water isolates

Identification of *cadA* harboring isolates



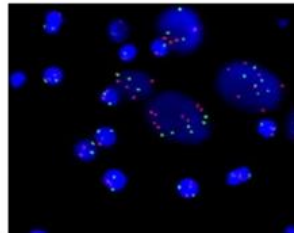
In situ monitoring of *cadA*

Fluorescent *in situ* Hybridization (FISH)

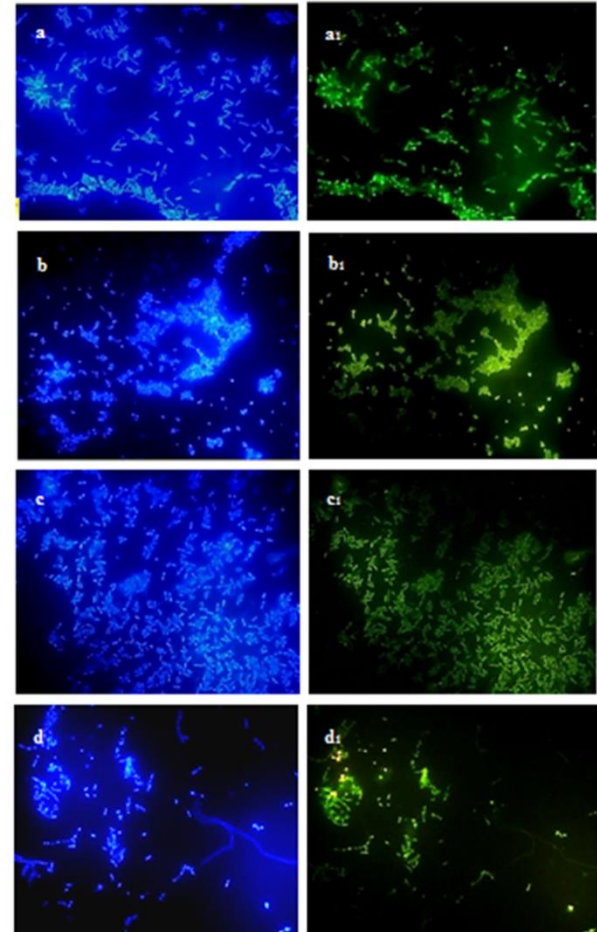
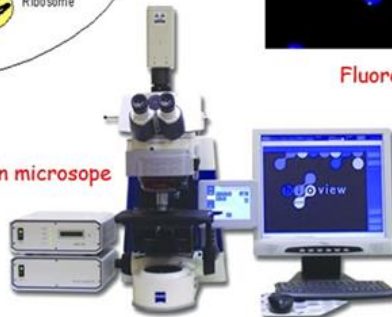


FISH

Fluorescein microscope



Fluorescein image



In brief

The use of primers and DNA probes specific for *cadA* gene seems to be powerful management tools for the selection and *in situ* screening of potential cadmium biosorbents to use in the remediation of cadmium-polluted sites. However, the relative importance of these isolates in the efficient biosorption of cadmium in soil, sewage and wastewater treatment plants remains to be assessed.

To get in touch



Assoc. Prof. Bulent ICGEN

Middle East Technical University
Department of Environmental Engineering
Dumlupinar Bulvari 06800
Cankaya Ankara/TURKEY

Phone : +90 312 210 5858

Fax : +90 312 210 2646

E-mail : bicgen@metu.edu.tr

Web : <http://www.metu.edu.tr/~bicgen>