HEMMERA

Genomic Tools for Improving Passive Mitigation of Mine Drainage

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Outline

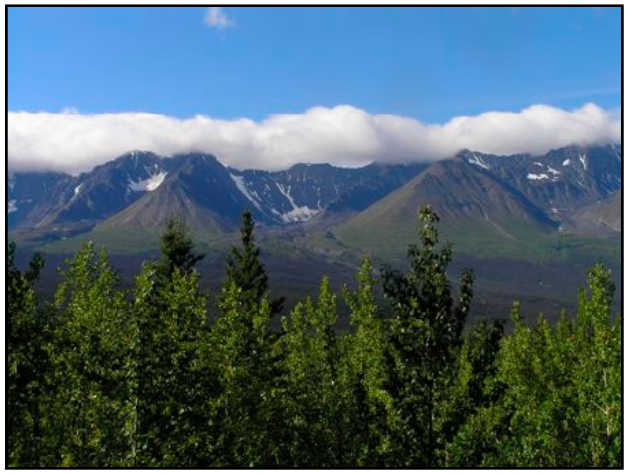
- Who is Hemmera
- Bioremediation in Mining
- Genomics Research
- Genome BC Project

Who is Hemmera?

- Environmental Sciences & Engineering
- Planning & Management
- Full mine life-cycle environmental services
  - Baseline Studies, EIA, Permitting, First Nations and Community Consultation, Mine Site Remediation and Clean-up

Bioremediation

- Certain microbes play a growing role in the clean-up of pollution
- Just as trees transform carbon dioxide into life-giving oxygen, some microbes take pollutants and turn them into harmless chemical products
- ‘Pollution eating microbes’ are widely used in the treatment of contaminated soils and groundwater, and are being used increasingly in mining



Mining Opportunities

- Huge potential for bioremediation to be used more in treatment of mine waste
- Mine waste treatment can be one of the largest costs faced by a company, and poses difficult challenges

Mine Wastewater

- *(As you may know…)*
- Sulphide minerals are weathered through exposure to air and water
- Sulphide weathering produces sulfuric acid
- Sulfuric acid leaches metals
- Metals can accumulate in plant and animal tissues
- Pose major long-term financial and environmental liabilities for mine developers

Wastewater Treatment

- Current water treatment methods require expensive chemical plants, operating over long periods of time, to remove metals while generating a toxic sludge

- With bioremediation, you can decontaminate water using natural systems

The Challenge

- Challenge in using bioremediation for mining is understanding the complex interactions of the many different bacteria and environmental conditions under which they optimally perform the clean-up functions we desire
- These microbes often don't perform their reactions as quickly as we would hope nor in the ways we understand
- Need to better understand how to optimize their ability to eat up contaminants

The Challenge

Optimization – What makes them happy?

- Ph levels
- Temperature
- Feedstock
- Effects of other microbes

What can this do for mining?

- Research could yield valuable insight into the balance and composition of microbial communities at bioremediation sites
- Help us better design mine treatment facilities ex: ponds, wetlands and seeding rivers

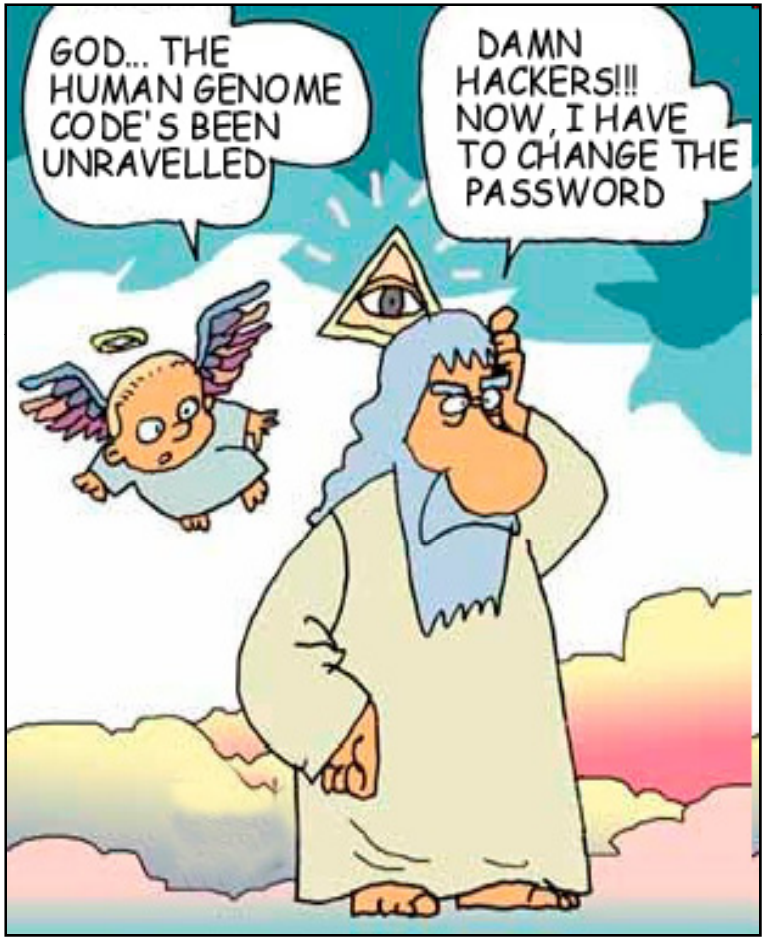
The Challenge

- Scientists around the world working to learn more about pollution eating microbes through genomics research, and how we can speed up the rate at which they can metabolize / process harmful chemicals

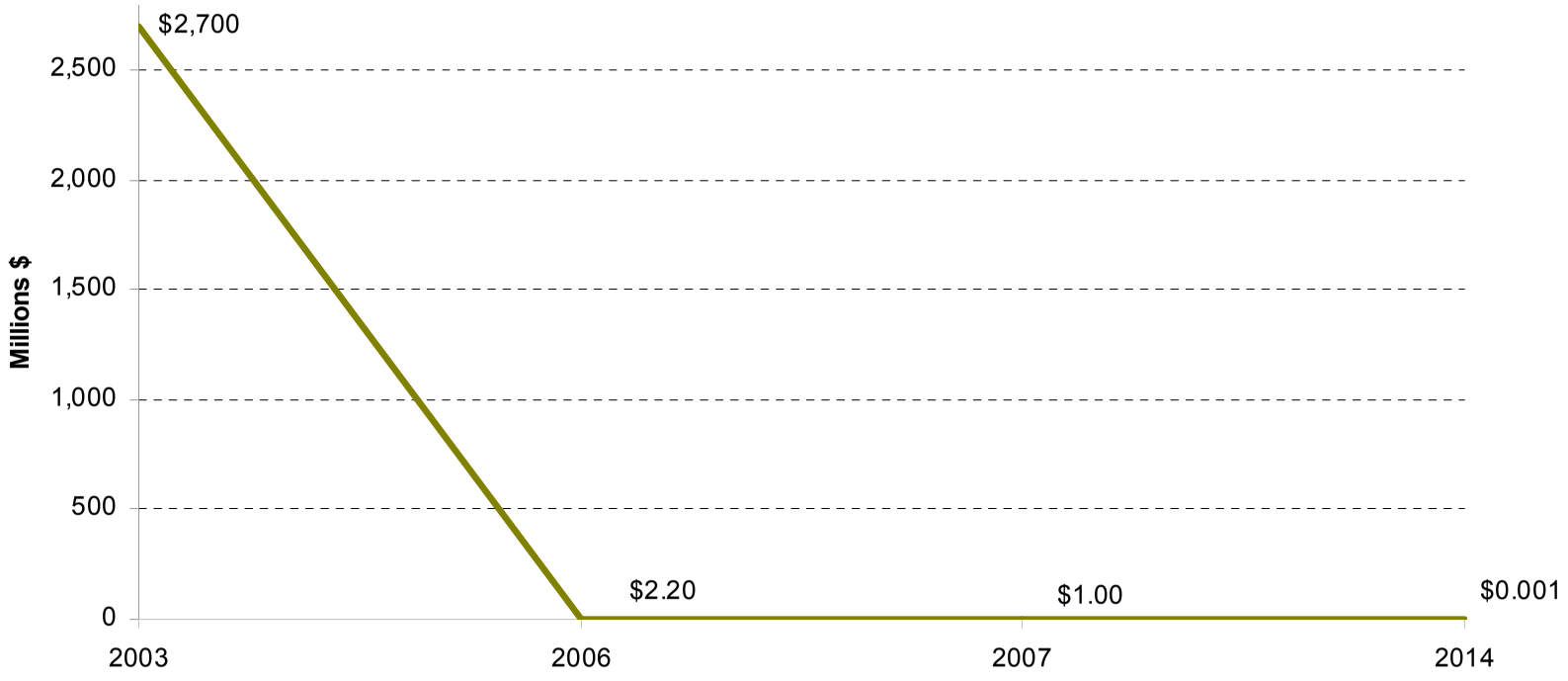
- Leading genomics research is occurring right here in BC

Genomics

- Is the study of the complete genome of an organism (not genetically modifying organisms)
- Researchers are using the science of genomics to better understand what optimizes the microbes ability to metabolize contaminants
- Yielding new understanding of basic biochemical mechanisms of microbes
  - Aiding in development of novel techniques for analyses of their environmental roles



The falling cost of sequencing



Genome BC Project

- Susan Baldwin PhD, UBC / Teck/ Imperial Metals
- Research will characterize the complex microbial communities during bioremediation of mining waste water
- Understanding the complex interactions of the microbial community is essential to implement effective bioremediation and passive treatment systems

Genome BC Project

- In order to fully understand the complex interactions of microbial flora at bioremediation sites, the group will profile the communities using genomic technology

- Will assess both diversity of the different types of microbial species as well as impact of changing environments on community composition

Moving Forward

- Important research like this will develop bioremediation as the preferred method of treating runoff from mine sites
- Major innovative step for the mining industry:
  - Improved metal recovery
  - Significantly reduced waste treatment costs
  - Reduced environmental liabilities
  - Reduced financial liabilities

Questions?

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