



Genome Alberta

# PETROLEUM METAGENOMICS

In 2006 Genome Alberta gathered together Canadian and U.S. representatives from industry, government, and academia for a workshop to determine whether genomic tools could be a viable technology for developing Alberta's hydrocarbons reserves to their full potential. The answer was yes.

Since then preliminary ad hoc projects have indicated that genomics can be a practical means to improve oil sands and conventional well recovery rates, manage tailings ponds, make more efficient use of water resources, and aid in CO<sub>2</sub> capture—all through natural, biological means. Further discussions and business case studies have brought us to the point where we have developed a 12 million dollar proposal to address the science and apply it to industry.

Metagenomics is the science that looks at the entire genomic makeup of a population of organisms. In this case Petroleum Metagenomics simply means looking at the naturally occurring microbial community within oil wells, oil sands deposit, tailings ponds, or even coal beds.

## The Genome Alberta Metagenomics Approach to Petroleum Development

The completion of the International Human Genome Project gave the research community the tools, techniques, and equipment to isolate, sequence, and interpret the DNA present in Alberta's energy deposits. In essence we will sequence the genome of oil deposits. This in itself will be a landmark development in understanding what lies beneath so much of Alberta's surface, and will position the province at the forefront of international metagenomics research and innovation.

With this sequencing information in hand we can find ways to harness the microbial communities that are already there to significantly reduce the cost of production, make better use of water resources, and generally add to a more environmentally sound and sustainable oil industry.

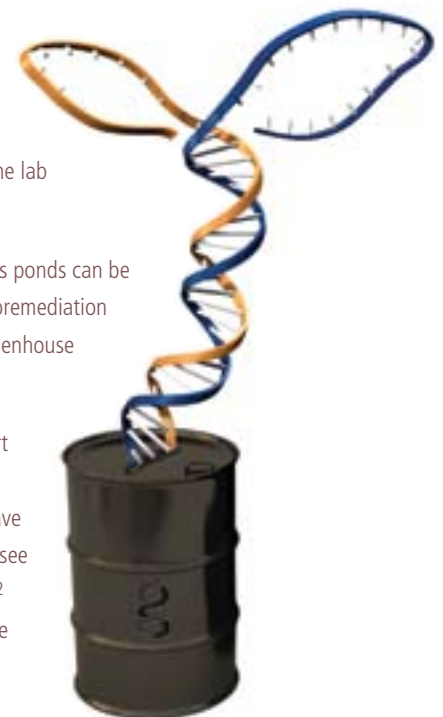
- We can use the available microbial communities in oil sands to reduce the viscosity so it is easier to remove through more conventional oil sands extraction.
- 50% to 80% of the available oil is often left unrecovered in conventional oil wells and metagenomics can be applied to increase production while reducing environmental impact.

Though not generally well known to the public, the industry has long known that microbial communities play a key role in all hydrocarbon deposits:

- Sour gas is produced as a result of the activity of microbes. Based on understanding of these communities a simple solution was found to reduce/eliminate the sour gas production. This work was pioneered in Calgary.
- Methane producing bacteria are known to be responsible for the production of methane gas coming from the tailing ponds.
- Alberta scientists have demonstrated that it is possible to convert difficult to recover fossil fuel underground by stimulating microbes to convert this energy into methane and extract the methane as an energy source.
- Microbial activity has been demonstrated to be an important contributing factor to several natural gas pipeline breakages.

The potential of metagenomics lies in uncovering *who is there, what they are doing, and how can we steer their actions to our advantage.*

- Research is already underway to convert hydrocarbon deposits to more easily extractable methane and it is time to take that work out of the lab and into the field.
- Microbial populations in tailings ponds can be manipulated to improve the bioremediation properties while decreasing greenhouse gas emissions.
- Bacteria, like plants, can convert CO<sub>2</sub> into less harmful or more useful by-products. Once we have the genome sequences we foresee the ability to 'chew up' the CO<sub>2</sub> and increase the carbon capture capability in the province.





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## The Opportunity is Now

Alberta has talked about alternative and enhanced oil recovery technology for some time now and metagenomics has recently become part of that discussion. On his recent visit to the oil sands, world renowned geneticist Craig Venter made it clear he is already interested in working on the problem. Alberta stands to be not only left behind on the commercial and industrial fronts, but on the intellectual front as well. Arguably there is no 'tomorrow' in this scenario. With pressure on the world's oil supply and on Alberta to improve its environmental record, now is the ideal time to gather together industry, government, and academic resources to deal with the issues in a very short time frame.

Genome Alberta feels an initial investment of \$12 million dollars is needed to move ahead of the rest of the world in enhanced petroleum research and extraction. More importantly this is an ideal opportunity to not only deal with the environmental impact of developing oil and oil sands resources, but to be recognized as a leader in environmentally sound practices.

Alberta has the intellectual capacity, a great deal of the infrastructure is in place, and most importantly we are sitting on one of the world's largest oil reserves, so we should be leading and developing, not following and preparing to 'buy back' the technology.

Genome Alberta was established through an initiative between the Government of Alberta and federally funded Genome Canada. Genome Alberta's mandate is to provide leadership in setting priorities, coordinating and enabling internationally competitive genomics research and partnerships that have ongoing social and economic benefits for Alberta and Canada.

Nothing could be timelier for this organization and for the province than to take leading edge genomics research and apply it to Alberta's existing leadership in oil technology to create a more economic and environmentally friendly extraction process.

