



COUNTY OF SAN LUIS OBISPO

PUBLIC HEALTH LABORATORY

# Messenger

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Whole Genome Sequencing at the County of San Luis Obispo Public Health Laboratory

## Whole Genome Sequencing at the County of San Luis Obispo Public Health Laboratory

### What is whole genome sequencing?

Whole Genome Sequencing (WGS—also called Next Generation Sequencing or NGS) is a laboratory method that determines the entire DNA sequence of nucleotide bases (adenine, thymine, guanine, cytosine) for a microbe, overnight—a task that in past years took months or weeks. Now the County of San Luis Obispo Public Health Laboratory (SLO PHL) has a desktop instrument and the high-tech reagents that allow staff to determine the DNA sequence of an organism like *E. coli*, with three to six million nucleotide bases, overnight and economically.

### Why are you doing it?

The SLO PHL staff has been using biochemical identification methods at the lab bench similar to those used in clinical laboratories, but we often encounter microbes that defy our efforts to accurately identify them. If we cannot identify these cultured microbes, we have no way to gauge what threat they might pose to the people of our county. An accurate identification of a microbe is only the start of our tasks. We need to then see if any others of the same species have also been identified and whether they are from the same clone—i.e., might be related and the cause of illness for more than just one patient. WGS helps us in each part of this process.

### What will this method do?

The SLO PHL and public health laboratories around the world are adopting this new technology because it will provide virtually all the information that public health authorities need: the accurate identification of microbes, the epidemiologic type—to the point that we will know whether two cultures of the same microbe are linked by transmission, what antibiotics the microbe is resistant to and what genes it possesses that might cause severe illness—and more. For example: We currently identify Shiga-toxin producing *E. coli* culture isolates, but the isolates must be referred to the state laboratory for epidemiologic typing and analysis to determine whether this isolate is linked to an outbreak. With WGS, we can get the same information we would get from the state lab, but two to three weeks sooner!

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**How can we afford something like this?**

Costs of both the instrument and the reagents needed to perform WGS have fallen dramatically in the past decade and continue to do so. Top-of-the-line instruments available today cost a tenth of what they did five years ago. Many companies are competing for this marketplace and new discoveries become new, better, and less expensive products each month.

**So what is the catch?**

Our bright staff scientists cannot read and analyze three to six million nucleotide bases that look a string of characters (like: ATGGCTCACTGGACT...) by hand. They need special software programs to do this. The choices for these programs are many, and the training is intensive. The new field is called Genomic Informatics and we are just beginning to learn.

**What can we expect in the future of WGS?**

Within a few years, we may not even need to culture microbes. We may use what is being called metagenomic WGS analysis and obtain the same information by testing only the specimen taken from the patient—or the environment. With growth of expertise in WGS, we will be able to tell not only what agent (bacteria, virus, fungus, yeast, mycobacteria) is infecting or colonizing a patient, but also what plants or animals they had contact with—or consumed!

**What are the next steps here in San Luis Obispo County?**

Our scientists will be working with clinical and hospital staff, environmental experts and public health experts to bring the promise of this new technology to fruition—and allow the provision of rapid, accurate, and complete information so that the health officer, county leaders, and the medical community have the information they need to protect the public, guide medical treatment, and protect the environment.

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