[Amazing Samples: Spit, Spat, Sputum](http://blog.fisherbioservices.com/amazing-samples-spit-spat-sputum)

Posted by [Jaydeb Mukherjee](http://blog.fisherbioservices.com/author/jaydeb-mukherjee) on Jul 15, 2015 10:30:00 AM

The word “phlegm” itself dates back to the ancient Greek humoralist theory of medicine. At the time, it was believed that just as all matter was made up of combinations of the four elements, so were all body parts made up of specific mixes humors: the heart was primarily blood and air, the liver yellow bile (kholé) and fire, the spleen black bile (melaina kholé) and earth, and the brain was phlegm and water. Many health conditions were attributed to an imbalance of the humors, both physiological and psychological, and such words have remained in the English language since, such as cholera (yellow bile) and melancholy (black bile), and sanguine or phlegmatic personalities.



Hey, it sounded good at the time. And remember, it was only a couple hundred years ago that Germ Theory really picked up.

Now, phlegm has a very different meaning, describing a more concrete class of mucus than the abstract role it originally had. From sputum---phlegm specifically expectorated (read: spat up) from the lungs---to the heavily diluted aqueous solution of saliva, the things we spit out of our mouths are useful for a large range of non-invasive diagnostic applications, and high-potential samples for many[cohort studies](http://blog.fisherbioservices.com/of-biomarkers-and-beaches-the-uk-household-longitudinal-study). Last time in our [Amazing Samples blog series](http://blog.fisherbioservices.com/topic/amazing-samples) we discussed the importance of [collecting dirt samples](http://blog.fisherbioservices.com/amazing-samples-digging-up-new-findings-on-soil), but this time let’s explore the value of spit and mucus.

**Diagnostic Voodoo**

Once the scientific community acknowledged that germs were the source of disease, it easily followed that a culture of the infectious agent could be grown from the infected area. Correspondingly, many respiratory infections, such as tuberculosis (TB), have traditionally been diagnosed with sputum tests, but the limiting factor on this had always been speed. Even now, the “standard” sputum test will take between [four days and twelve weeks](http://www.cdc.gov/tb/education/corecurr/pdf/chapter4.pdf) to grow enough to give a definitive call on the patient’s status. The obvious problem with this is that in that time, it’s possible that an infected patient could spread the disease to a number of other individuals, and particularly TB has too many drug-resistant strains to give any antibiotics before determining the infection’s nature. While we do not have many cases of TB in the United States, many developing countries do, and especially in densely populated areas, or areas with substantially immune-compromised populations, there was a need for faster diagnosis to determine the appropriate treatment.

Enter the Foundation of Innovative New Diagnostics (FIND) and Cepheid, who 5 years ago developed a [rapid sputum test](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2947799/) that cut tuberculosis diagnosis time (for both presence and drug resistances) down from a number of weeks to two hours. This was huge news for many parts of the world, and according to the [World Health Organization](http://who.int/tb/laboratory/mtbrifrollout/en/), 116 of the 145 countries eligible for concessional pricing of the technology had acquired at least one unit as of the end of 2014. If this rapidity technology could be extended to other traditionally slow-paced diagnoses, it would be able to greatly reduce both patients’ suffering and the potential hospital occupancy should the condition be at a more severe stage.[*Image courtesy of World Health Organization*](http://who.int/tb/laboratory/mtbrifrollout/en/)

Comparatively, spit doesn’t have quite the same type of utility in diagnostics. Sure, there are certain oral conditions that can be identified with saliva-based cultures, but many of them can already be seen just by looking in a patient’s mouth – the value of sputum is how much easier it is to obtain than to actually look inside someone’s lungs. Primarily, saliva is used to measure hormone levels – many studies specifically look at salivary cortisol levels as a function of other variables (e.g. familial stability), and as increased cortisol is a potential aggravator of various health conditions, this makes it a valuable sample for any [longitudinal study](http://blog.fisherbioservices.com/bid/349827/Video-Sample-Collection-for-Clinical-Trials-Longitudinal-Studies-Bulk-Supplies-VS-Collection-Kits).

However, early detection of oral cancer is still a [very attractive research topic for some researchers](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3945802/), since its five-year survival rate is only 62%, which is low even for cancer. For example, University of Miami’s Dr. Elizabeth Franzmann and Florida-based biotech Vigilant Biosciences [have developed a diagnostic collection kit](http://www.miamiherald.com/living/article1964660.html) where patients only have to spit out an oral rinse for the test to indicate the presence of squamous cell carcinoma, based off the ratio of CD44 to total protein. This will allow the detection of cancer cells before any growths would be visible to the naked eye, and early treatment would substantially increase the survival rate.

For more research being done on saliva, take a look at the [Institute for Interdisciplinary Salivary Bioscience Research’s website](http://iisbr.asu.edu/research-table/).

**Spitting is Therapeutic**

Saliva isn’t just useful for research and diagnosis, it turns out. Dr. Eva Helmerhorst of Boston University’s Goldman School of Dental Medicine has [discovered an enzyme in human saliva](http://www.bu.edu/research/articles/secret-in-the-spit/) that has the potential to be a therapy for celiac disease. While stomach acid and other digestive enzymes in our gut are not very efficient at breaking down the large wheat protein, this bacterial enzyme specifically targets gluten for digestion. The difficulty will be in isolating the enzyme for a higher-purity dietary supplement, though potentially the bacteria could be isolated and transformed into bioreactors to create large amounts of the enzyme.

And human spit isn’t the only saliva that could be harnessed for therapeutic purposes. Only ten years ago, a [compound found in Gila monster venom](http://www.ncbi.nlm.nih.gov/pubmed/21194543) was isolated and commercialized as an anti-diabetic agent (Byetta), and is one of the commonly used treatments for type 2 diabetes. And even now, [various animals’ venoms are being researched](http://www.medicaldaily.com/venom-medicine-how-spiders-scorpions-snakes-and-sea-creatures-can-heal-328736) for viability as therapy for a range of conditions from cancer to autoimmune diseases.