Leo's Oral Health Report
Dental disease affects 50-90% of cats over the age of four.

Fortunately, most dental diseases are preventable with a good oral healthcare routine and are mostly treatable, if caught early. The microbes in a cat's mouth can inform us of developing oral health issues before they become visible, since they cannot always be seen with the naked eye during routine checkups. By the time disease symptoms present, the condition has usually reached an advanced stage. The Basepaws Oral Health test for cats screens for microbial signatures associated with three of the most common conditions that affect oral health in cats: periodontal disease, tooth resorption, and halitosis (bad breath).

The oral microbiome

Environmental factors and various food sources make the feline oral cavity a fascinating place, characterized by unique interactions between a cat's mouth and the microbes within it (the oral microbiome). The almost constant exposure to foreign microbial organisms has made the oral microbiome fiercely competitive.

Once in a while, pathogenic microbes manage to colonize parts of the oral cavity, which can be associated with problems that affect oral health. The microbial composition of a cat's mouth can reveal information about developing oral health and general issues.
Oral Health Summary

How does this test work? We used our oral microbiome database of healthy cats and of cats known to be suffering from periodontal disease, tooth resorption, or halitosis to identify a set of predictive microbes whose compositional abundance is associated with each condition. Based on these results, we developed a 0 - 10 risk score system for each condition, where 0 - 3.3 reflects a ‘low’ risk, 3.4 - 6.6 a ‘medium’ risk, and 6.7 - 10 a ‘high’ risk. The results below show Leo’s overall risk for each of the three conditions, as well as a breakdown of the proportions of predictive microbes whose compositional abundance in the mouth is associated with high, medium, or low risk for each oral health condition (denoted by the colors red, yellow, and green, respectively). The purple line and the number next to it indicate your cat’s risk score for each condition.

Risk for periodontal disease
Periodontal disease affects the tissues surrounding the teeth. Initial stages are classified as gingivitis, while advanced cases are known as periodontitis.

![Risk for periodontal disease graph]

Risk for tooth resorption
Tooth resorption is a relatively common condition characterized by progressive dentin erosion.

![Risk for tooth resorption graph]

Risk for bad breath (halitosis)
When bad breath is a persistent problem for a cat, this could be indicative of more serious general health issues.

![Risk for bad breath (halitosis) graph]

What’s next?
- You are strongly advised to adopt a daily oral healthcare routine for Leo
- Consider supplementing Leo’s routine with products accepted by the Veterinary Oral Health Council
- Schedule an appointment with your veterinarian in the next month

NEXT RECOMMENDED oral health test in: 3 months
What else does your cat eat?

Do you know everything that goes into your cat’s mouth? We analyzed Leo’s sample for trace DNA from a wide variety of plants and animals to see if there was any evidence of non-microbial organisms.

Does any of this surprise you?

Wow, what does this mean?

There are many possible explanations for these results:

• They may reflect organisms not included in Leo’s meals that are provided by you

For example, if Leo is an indoor/outdoor cat, these results may include traces of animals, plants, and other things that they find and consume outside, or things that get inside your house from the outside.

• Leo could be sampling from your meals when you are not looking or picking up crumbs from the floor

This means that we may have detected an organism that is not a typical part of Leo’s diet because they ate something without your knowledge right before the sample was collected.

TO DO: Test Leo again in 3 months to see if the results have changed
Health implications

Great news!

Currently, it is unlikely that your cat’s oral health is negatively affecting their general health. Cats with good oral health are less prone to developing chronic kidney disease, diabetes mellitus, cardiovascular problems, and some autoimmune diseases.

What can you do?

• It is important to regularly assess a cat’s oral health to address emerging issues earlier and minimize chances of negative effects on general health.

• Adopting a thorough and consistent oral healthcare routine at home can significantly reduce the chance of developing dental diseases, which can help reduce the likelihood of developing more serious general health problems.
Periodontal disease

Periodontal disease (PD) is a group of inflammatory disorders affecting the tissues surrounding the teeth. Periodontal disease is initiated by the buildup of plaque on the surface of the teeth, resulting in inflammation of the gingiva or “gingivitis”. Without an effective oral healthcare regimen, inflammation can begin to destroy the structures that support the tooth which leads to periodontitis. Periodontal disease affects up to 80 percent of the adult feline population. This section explains the composition of your cat’s oral microbiome as it relates to risk of having periodontal disease.

We analyzed Leo’s oral microbiome to establish the compositional abundance of 110 microbes predictive of periodontal disease. We ranked each microbe’s abundance on a scale from 1 to 5, where 1 represents abundance levels close to a healthy control population and 5 represents abundance levels close to cats with periodontal disease. Below are Leo’s TOP 3 most significant microbes associated with high, medium, and low risk, respectively.

Currently, Leo’s abundance levels for 20 out of 108 microbes are consistent with having periodontal disease (19%).

Top 3 high risk microbes
Tessaracoccus timonensis
Desulfovibrio sp. G11
Saccharomyces eubayanus

Top 3 medium risk microbes
Actinomyces israelii
Histophilus somni
Actinomyces sp. ZJ750

Top 3 low risk microbes
Bacteroides heparinolyticus
Bacteroides xylanisolvens
Capnocytophaga cynodegmi
Tooth resorption

Every tooth is composed of a root canal (containing nerves, blood, and lymphatic vessels) and bony substances called dentin and enamel. When a cat suffers from tooth resorption, the dentin of the affected tooth progressively erodes. Unfortunately, tooth resorption is relatively common, affecting 20-60 percent of all cats and over 70 percent of cats over the age of five. This section explains the composition of your cat’s oral microbiome as it relates to risk of having tooth resorption.

We analyzed Leo’s oral microbiome to establish the compositional abundance of 70 microbes predictive of tooth resorption. We ranked each microbe’s abundance on a scale from 1 to 5, where 1 represents abundance levels close to a healthy control population and 5 represents abundance levels close to cats with tooth resorption. Below are Leo’s TOP 3 most significant microbes associated with high, medium, and low risk, respectively.

Currently, Leo’s abundance levels for 12 out of 74 microbes are consistent with having tooth resorption (16%).

Top 3 high risk microbes
Corynebacterium xerosis
Psychrobacter sp. PRwf-1
Actinobacillus pleuropneumoniae

Top 3 medium risk microbes
Pasteurella dagmatis
Fusobacterium gonidiaformans
Parvimonas micra

Top 3 low risk microbes
Lachnoanaerobaculum umeaense
Ottowia oryzae
Streptobacillus moniliformis
Bad breath (halitosis)

Occasional bad breath is usually not something you should worry about. However, when bad breath is a persistent problem, it may be indicative of a more serious issue. The most common cause of bad breath is periodontal disease. Different types of bad breath can also indicate general health problems, such as kidney disease, diabetes, and some liver disorders. This section explains the composition of your cat’s oral microbiome as it relates to risk of having halitosis.

We analyzed Leo’s oral microbiome to establish the compositional abundance of 138 microbes predictive of bad breath. We ranked each microbe’s abundance on a scale from 1 to 5, where 1 represents abundance levels close to a healthy control population and 5 represents abundance levels close to cats with bad breath. Below are Leo’s TOP 3 most significant microbes associated with high, medium, and low risk, respectively.

**Currently, Leo’s abundance levels for 79 out of 182 microbes are consistent with having bad breath (43%).**

### Top 3 high risk microbes
- Acidovorax sp. JS42
- Delftia tsuruhatensis
- Acidovorax carolinensis

### Top 3 medium risk microbes
- Enterobacter roggenkampii
- Comamonas testosteroni
- Stenotrophomonas indicatrix

### Top 3 low risk microbes
- Moraxella ovis
- Cutibacterium acnes
- Capnocytophaga sp. H4358
What's next

At-home oral healthcare

To improve your cat’s oral health, adopt a daily care routine (if you don’t already have one). If you already have a routine but want to learn more about effective implementation, consider some of the suggestions below.

While tooth brushing is the most effective component of any at-home oral healthcare routine (when done properly), we understand that cats have varying levels of tolerance. This is especially true if your cat shows any signs of discomfort and pain (dropping food, loss of appetite, favoring one side over the other when chewing, drooling). We teamed up with some of the world’s top veterinary dentistry professionals to provide you with support and innovative solutions on how to approach brushing your cat’s teeth and to share other helpful tips for good oral hygiene.

Watch the video to learn how to tailor your routine to your cat's personality and comfort level.

Since, your cat’s report results indicate that there is a high likelihood that dental disease is already present, it is important that you learn how to routinely perform ‘flip the lip’ exams at home. These exams will help you identify any visible changes in your cat’s teeth and gums. You should alert your veterinarian if you see any worrying signs such as ulcers, red or swollen gums, discolored teeth or anything else out of the ordinary. In addition, pay attention for behaviors such as pawing at the mouth, drooling, and problems eating. These are strong indicators that your cat is experiencing mouth pain and needs medical attention.

You can also read about some effective ways to maximize the benefits of your cat’s oral healthcare routine in this article.

Finally, consider incorporating some of the products accepted by the Veterinary Oral Health Council (VOHC) in your cat’s oral healthcare routine. These products have demonstrated efficacy in fighting plaque and tartar buildup, which are the root cause of many problems affecting oral health. However, in more advanced stages of dental disease, these products can help slow disease progression, but will not reverse it. In such instances, VOHC recommended products are a great complement to routine at-home oral healthcare and the treatments prescribed by your cat's veterinarian.
Veterinary oral health exam

We have identified some signs of dental disease in your cat’s mouth.

We recommend scheduling an appointment with your veterinarian for a general and oral health assessment within the next month. Please be sure to also share this report with your veterinarian by clicking here.

Have a question for Basepaws?

If you have a question about any part of this report, you can send us an email at: meow@basepaws.com

Want to discuss your results with other cat parents? Join our Facebook group!

Would you like to tell us more about your cat’s oral and general health? Contribute to feline oral health research by filling out this survey.

Next oral health test recommended in: 3 - 6 months
Appendix

Sequencing and analysis methodology

Most direct-to-consumer microbiome tests use a technique called ‘16S rRNA gene sequencing’.

This technique can only provide information about the bacteria present in the microbiome. However, it is well known that the microbiome is also composed of viruses, protozoa, fungi, and archaea species, in addition to bacteria. This means that the 16S approach zooms in on just one part of the microbiome, ignoring the rest. Additionally, 16S sequencing does not provide sufficient resolution to reliably and consistently go beyond the genus level of bacterial classification.

Therefore, in most cases, we don’t know the exact species of bacteria in the microbiome, making analysis somewhat vague and relying on approximation.

To address these problems, Basepaws uses metagenomic sequencing instead of 16S sequencing. Our method allows us to capture organisms across all domains of life, not restricting us to only bacteria. In addition, we can reliably identify organisms to the species or even the strain level, making our analysis more accurate and improving our confidence in the results. These results paint a richer, unbiased picture of your feline companion’s mouth. We used pairwise log ratio transformation to estimate the compositional abundance of microbial species, and Gaussian mixture modeling to determine your cat’s risk for periodontal disease, tooth resorption, and bad breath.

Limitations

The Basepaws oral microbiome report is based on our ability to identify thousands of microbial species with each test.

Our large oral microbiome reference database allows us to identify a multitude of novel associations between microbes found in the mouth and a variety of diseases, as well as confirm previously reported findings. However, the field of feline oral microbiome science is extremely young and understudied, which is why we report only on conditions and microbes where previous knowledge exists, and/or if we see a particularly strong signal coming through in our data.

As we accumulate more data and conduct more analyses, we will continuously enrich this report to provide even more helpful insights. We want to emphasize that the identification of a certain microbial signature associated with a dental disease does not constitute a diagnosis. Conversely, if a particular microbial signature is not detected, it does not exclude the possibility of an unknown disease-causing pathogen being present, or that a dental disease could be caused by something other than pathogenic microbes. This report does not aim to substitute a diagnosis by a professional.
Health and Wellness

Visit your veterinarian

Be proactive and have your kitty examined regularly. Annual (semi-annual for older cats) wellness exams and routine lab tests can help veterinarians look for and treat some health conditions before they become life-threatening. Regular wellness visits are especially important for cats, who are excellent at hiding pain and discomfort that could be symptoms of illness.

Keep your cat at a healthy weight

Obesity is as dangerous for cats as it is for people. It puts them at risk for health problems such as diabetes, high blood pressure, and heart and lung disease. It can even increase their risk of developing cancer. Talk to your veterinarian about what a healthy weight means for your cat.

Polish those pearly whites

Unlike humans, cats can't brush their teeth. Collaborate with your veterinarian on an oral health plan. The bacteria that collect on your cat’s teeth can also enter their bloodstream, contributing to a range of health issues and other systemic diseases.

Provide clean water daily

If your kitty isn't drinking enough water, they could become dehydrated or develop a urinary tract disease. Always make sure that you provide a constant supply of clean water. If they are finicky about water, try providing an intriguing fountain or feed them wet canned food to add more water to their diet.

Give your cat mini exams at home

Petting and brushing your cat is about more than minimizing hairballs and showing your kitty love. Regular exams at home help you to notice changes such as lumps, bumps, or growths sooner and get them checked out right away. It’s important to look for changes in behavior, stool/urine output and quality, coat condition, and weight. Know what’s normal for your sweet kitty, and check them regularly as a part of your at-home health regimen.

Proper nutrition can increase life expectancy

Aging includes a multitude of factors: environment, breed characteristics, nutrition, and genetics. To help your cat live their best life, they need a high-moisture, species-appropriate diet. How much and how often your cat eats is also important, and you can discuss their diet with your veterinarian. Additional Tips: If you have more than one cat, feed them separately to reduce their stress and monitor their consumption.
Thank you!
Stay healthy.