

# Periodontitis

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# **1 Introduction**

## **1.1 Microbiome**

## **1.2 Ribosomal RNA**

Ribosomal RNA (rRNA)

## **1.3 16S rRNA Gene Sequencing**

## **1.4 Periodontitis**

# **2 Materials**

## **2.1 16S rRNA Gene Sequencing**

- 100 Healthy samples
- 50 Chronic Early Periodontitis Sample
- 50 Chronic Moderate Periodontitis Sample
- 50 Chronic Severe Periodontitis Sample

# **3 Methods**

## **3.1 QIIME2 Workflow**

QIIME2 is a capable, expandable and distributed microbiome analysis package with transparent analysis (Bolyen et al., 2019, 2018). A theoretic overview of QIIME2 workflow is shown as figure 2.

### **3.1.1 Denoising techniques**

There are two denoising techniques provided by QIIME2: DADA2 (Callahan et al., 2016) and Deblur (Amir et al., 2017). Major difference between DADA2 and Deblur is a strategy, the strategy used to divide as different species.

### **3.1.2 Taxonomy Classification**

There are two taxonomy classification databases which provided by QIIME2: Greengenes (GG) (DeSantis et al., 2006) and SILVA (Pruesse et al., 2007).

### **3.1.3 Rarefaction**

### **3.1.4 Alpha-diversity**

### **3.1.5 Beta-diversity**

### **3.1.6 ANCOM**

ANCOM (Analysis of composition of microbiomes) can be used for analyzing the composition of microbiome in multiple populations (Mandal et al., 2015).

## **3.2 Python Packages**

### **3.2.1 Pandas**

Pandas is a Python package of rich data structures and tools for analyzing with structured data sets (McKinney et al., 2011).

### **3.2.2 Scikit-learn**

Scikit-learn grants state-of-the-art implementation of many machine learning algorithms, while controlling an easy-to-use interface tightly integrated the Python code (Pedregosa et al., 2011).

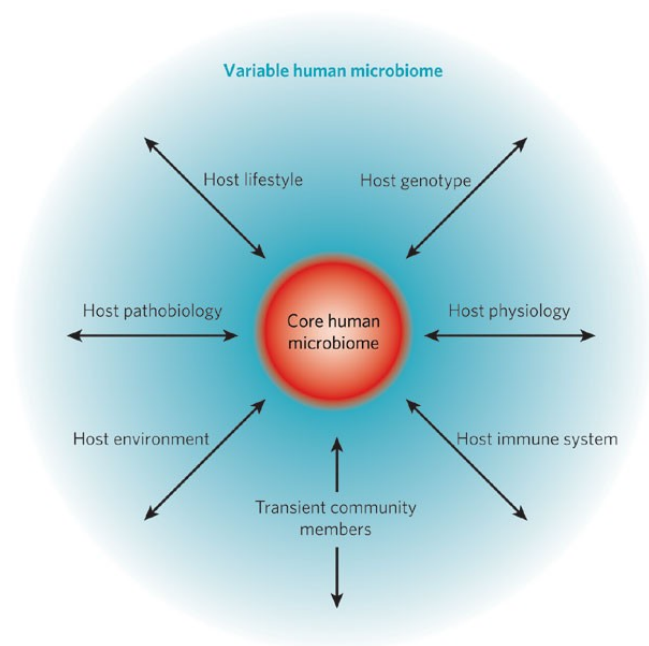


Figure 1: Concept of a Core Human Microbiome (Turnbaugh et al., 2007)

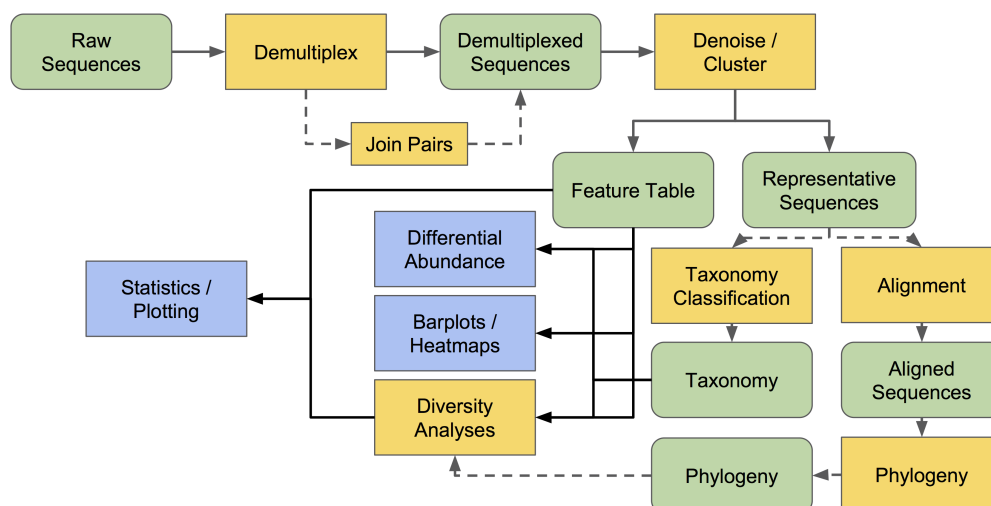


Figure 2: A Theoretic Overview of QIIME2 Workflow (Bolyen et al., 2019, 2018)

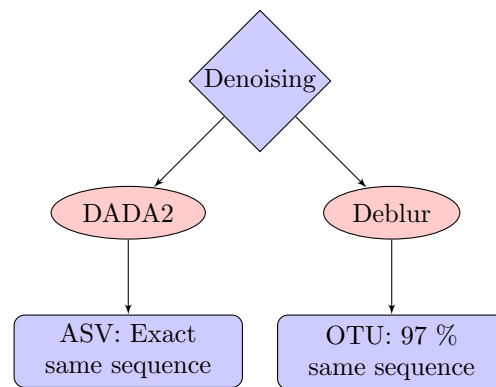


Figure 3: Denoising Techniques which provided by QIIME2

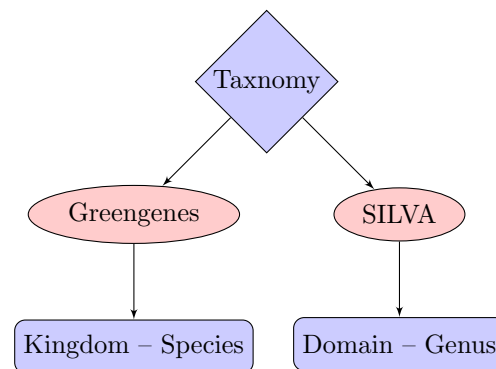


Figure 4: Taxonomy Classification which provided by QIIME2

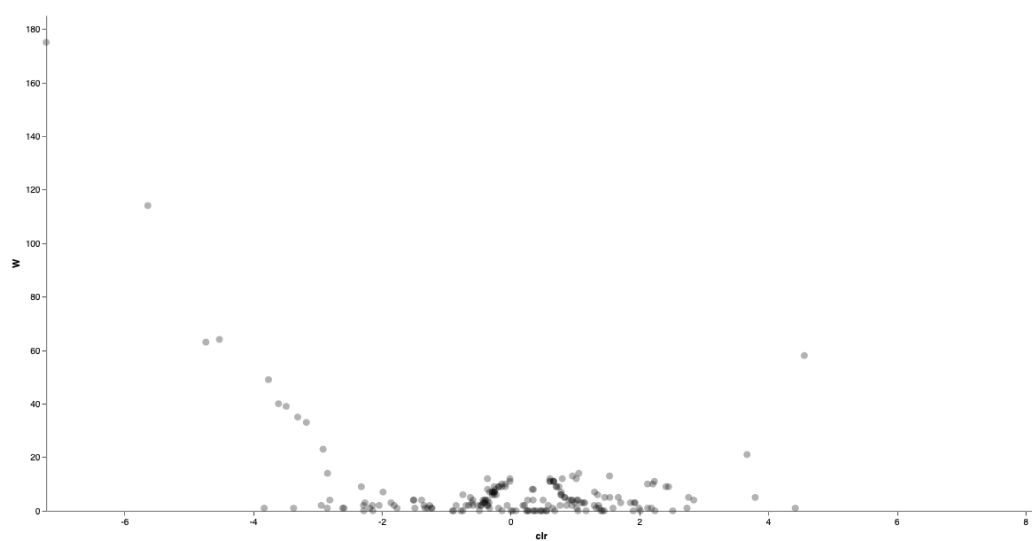


Figure 5: Example ANCOM Volcano Plot which Provided by QIIME2 (Bolyen et al., 2019, 2018)

### 3.2.3 Matplotlib

Matplotlib is a Python graphics package which used for application development, interactive scripting and publication quality image generation (Barrett, Hunter, Miller, Hsu, & Greenfield, 2005). Matplotlib, also, is designed to create simple plots with a few commands (Hunter, 2007).

### 3.2.4 Seaborn

Seaborn is a Python data visualization package which based on matplotlib, allows a high-level interface for displaying engaging and descriptive statistical graphics (Waskom & the seaborn development team, 2020).

## 4 Results

## 5 Discussion

## 6 References

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