### 2010 Environmental DNA

Schmidt et al. first reported environmental genomics by isolating and cloning environment DNA

## NGS sequencer

2005

First NGS sequencer released by Roche 454. Metagenomic study of the terms human gut virome

### 1998 Metagenome

metagenomics

## EMP project

1991

Handersman proposed The Earth Microbiome Project (EMP) is an initiative founded

**~**.....

### 2024+

More expectations +

## 2011

### PacBio RS sequencer

PacBio RS sequencer was released. read length beyond 10 kb

### 2014

## PacBio metagenome project

Wichmann et al. were the first to report the Exploring ARGs in dairy cow manure with PacBio RS sequencer

## 2014

### 2023 ONT MiniION sequencer

ONT released the MinION sequencer

#### 2015

### ONT metagenome project

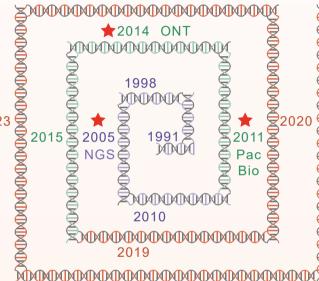
Greninger et al. were the first to report the utilization of real-time metagenomic detection for identifying viral pathogens in clinical specimens via MinION sequencing technology

### 2015

## PacBio Sequel sequencer

PacBio releases Seguel system, enhancing long-read metagenomic studies

## ★2022 ONT R10.4.1 Flowcell



2024

## Big deals in metagenome studies

### 2019 ONT Flongle, PromethION sequencer

ONT released Flongle (small-scale sequencing applications) and PromethIO-N(high throughput long-read sequencing. the R9.4.1 flowcell achive average accuracy of 92%

### 2020

### metaFlye assembler

The long-read metagenomic assembly software "metaFlye" was published in Nature Methods

### 2022

### PacBio Revio sequencer hifiasm-meta assembler

Pacbio Revio upgrade increases throughput and guarantees that Hifi reads attain a accuracy surpass Q30. Then "hifiasm-meta" was published in Nature Method

### 2024

### BASALT Long-read binners

BASALT (Binning Across a Series of Assembly Toolkit) released, which can binning and optimize short- or long-read metagenomic

### $\bigcirc$ 2023

### metaSVs tool

metaSVs (A pipeline combining long- and short-read to analyze structural variants in metagenomes) released

### 2023

### Long-read metagenomics --- a new milestone

Comment "Long-read metagenomics paves the way toward a complete microbial tree of life" was publish in Nature Method

# 2022

## ONT R10.4.1 Flowcell Q20 chemistry

Nanopore released Q20 chemistry and R10.4.1 flowcell. Long-read only metagenomics allows high quality genome reconstruction without illumina correction