



ZYMO RESEARCH

*The Beauty of Science is to Make Things Simple*

# A Complete Microbiomics Solution

## from Collection to Conclusion



# Standardizing Microbiomics



Standards



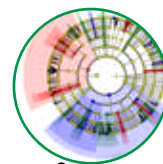
Collection



Isolation



Analysis



Services

## Optimizing Microbiomics Workflows

Advances in DNA sequencing and other genome-enabled technologies have lowered the cost and time requirements needed to sequence any organism. Next-Generation Sequencing of microbial communities has supercharged our ability to research and explore both human and environmental microbial ecosystems. This advancement in technology has allowed, for the first time, large-scale, multi-lab studies of microbial communities<sup>1</sup>.

Early quality control studies of microbiomic research suggest that this vast new frontier of research is littered with potential sources for error and bias. From collection to sequencing, the potential for variation at each step in the microbiomic workflow is enormous.

During the collection and transportation phase, depending on the quality of the method, microbes can continue to grow and decay. Nucleic acids can also degrade during this phase. These two factors can lead to overall misrepresentation of the original community profile, causing downstream bias. In the extraction phase, inferior forms of lysis can fail to extract DNA from tough-to-lyse microbes (e.g. Gram-positive bacteria and yeast), leading to the underrepresentation of tough-to-lyse microbes and overrepresentation of easy-to-lyse microbes (e.g. Gram-negative bacteria). During sequencing, different library preparation methods can cause biased coverage depending on the GC content of the organisms.

As multi-lab, longitudinal microbiomic studies become more common, there is an urgent need for standards to establish validated methods for reproducible data<sup>2</sup>.

At Zymo Research, we have made it our goal to eliminate bias across the entire microbiomic workflow. Our new product line, ZymoBIOMICS®, is a complete workflow, from collection to analysis, which offers streamlined collection, purification, and the first microbial community standards.

Zymo Research has endeavored to develop standards for the advancement and optimization of microbiomic workflows to allow researchers to have increased confidence in their microbiomics data. ZymoBIOMICS® Microbial Community Standards are groundbreaking community standards, containing a well-defined and characterized community of Gram-positive bacteria, Gram-negative bacteria and yeast. They are ideal for validating and optimizing microbiomics and metagenomic workflows from extraction to analysis.

At collection, DNA/RNA Shield® stabilizes nucleic acids and inactivates all organisms — including pathogens — in your sample, allowing for accurate community profiling. There is no degradation of nucleic acids, creating a perfect molecular snapshot of your sample at the time of collection.

Our ZymoBIOMICS® DNA Mini Kit ensures accurate community profiling by enabling total lysis from any sample, including feces, soil, water, biofilms, swabs, body fluid, etc. DNA extracted from this kit is ultra-pure, inhibitor-free, and ready for all downstream applications, including PCR 16S rRNA gene sequencing and shotgun sequencing.

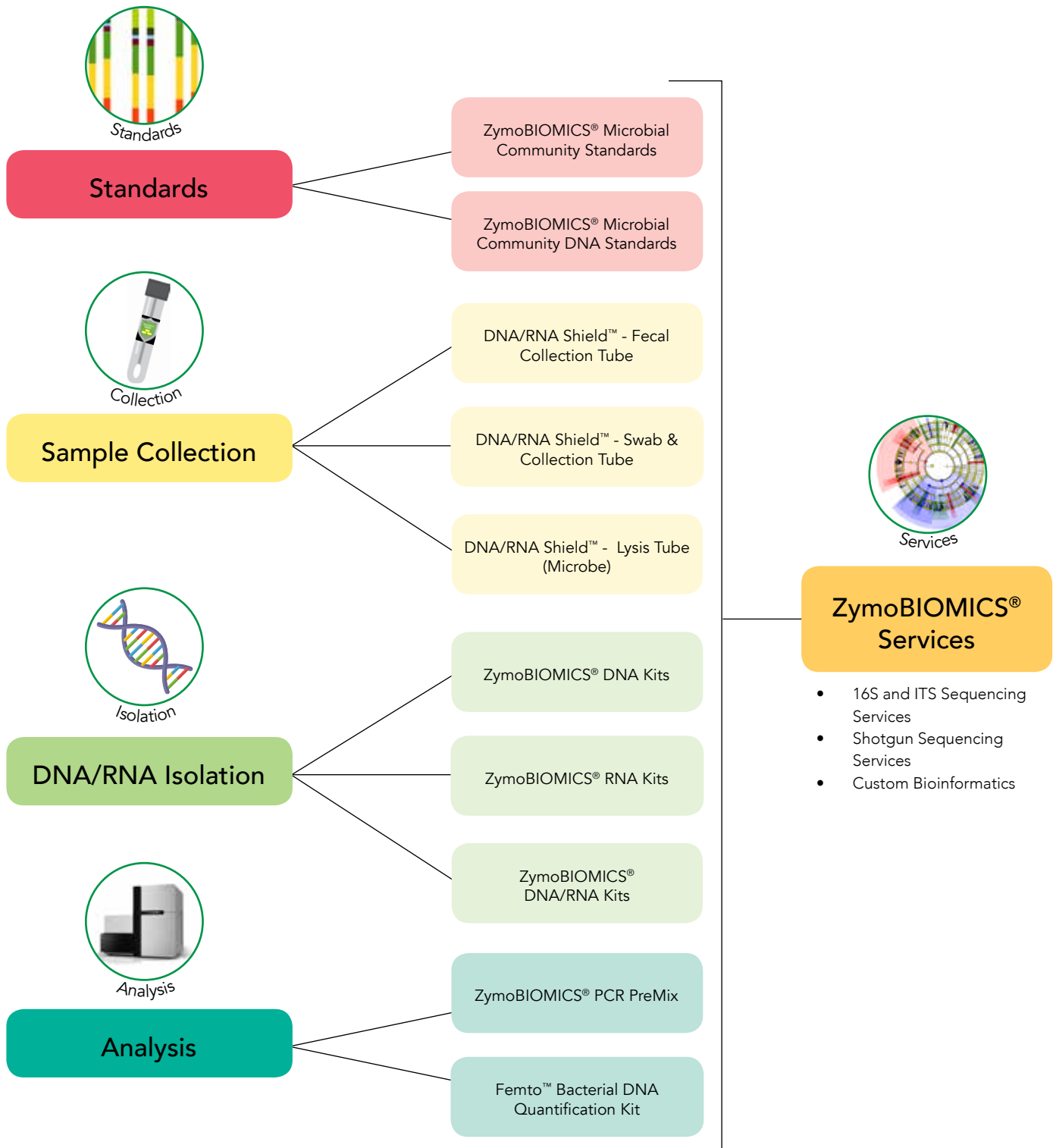
If you would prefer to leave the work to us, we offer a comprehensive list of ZymoBIOMICS® Services covering all steps of a microbiomics workflow from collection to analysis. Simply send us your sample and we will handle the rest. All workflows are validated to be non-biased using the ZymoBIOMICS® Microbial Community Standards and provide publication-ready data.

ZymoBIOMICS® - Standardizing Microbiomics

Learn more at [www.zymoresearch.com/zymbiomics-portfolio](http://www.zymoresearch.com/zymbiomics-portfolio)

1. Sinha, Rashmi, et al. "The microbiome quality control project: baseline study design and future directions." *Genome biology* 16.1 (2015)  
2. Stulberg, Elizabeth, et al. "An assessment of US microbiome research." *Nature Microbiology* 1 (2016): 15015.

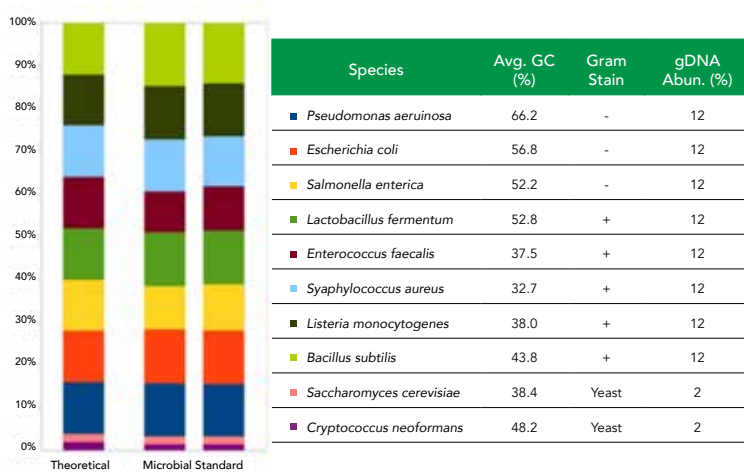
# A Complete Microbiomics Solution from Collection to Conclusion



# ZymoBIOMICS® Microbial Community Standard

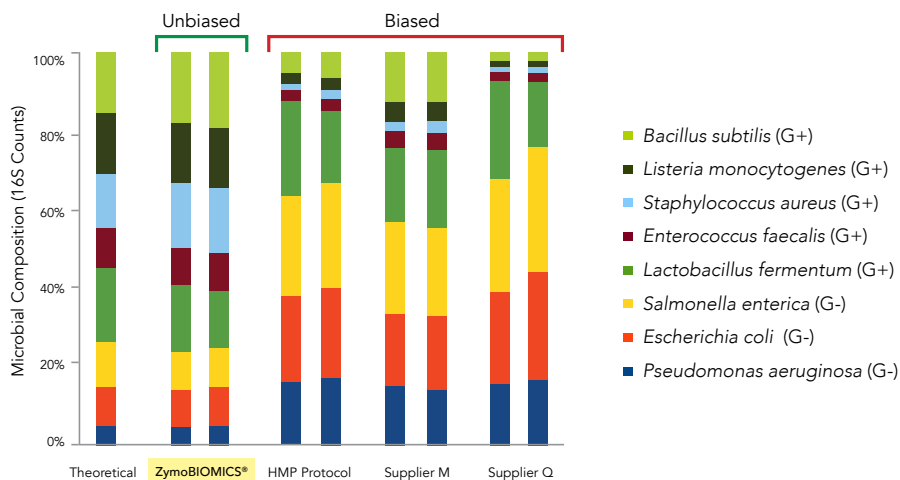
- Mock microbial community of well-defined composition.
- Ideal for the validation, optimization, and quality control of microbiomics and metagenomic workflows.
- Perfect for assessing bias of DNA extraction methods since it contains both tough and easy-to-lyse microbes.

## Accurate Characterization



Containing three easy-to-lyse Gram-negative bacteria, five tough-to-lyse Gram-positive bacteria, and two tough-to-lyse yeasts, the ZymoBIOMICS® Microbial Community Standard is perfect for assessing bias in various DNA extraction methods. The microbial standards are accurately characterized, with a wide GC range (15%-85%) and contain negligible impurities (<0.01%), enabling easy exposure of artifacts, errors, and bias in microbiomics or metagenomic workflows.

## Find Your Bias & Eliminate It



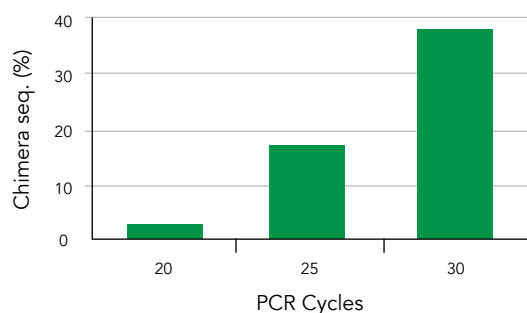
ZymoBIOMICS® Microbial Community Standard was used to compare different DNA extraction protocols. DNA samples were profiled by 16S rRNA gene targeted sequencing.

Product	Cat. No.	Size
ZymoBIOMICS® Microbial Community Standard	D6300	10 preps

# ZymoBIOMICS® Microbial Community DNA Standard

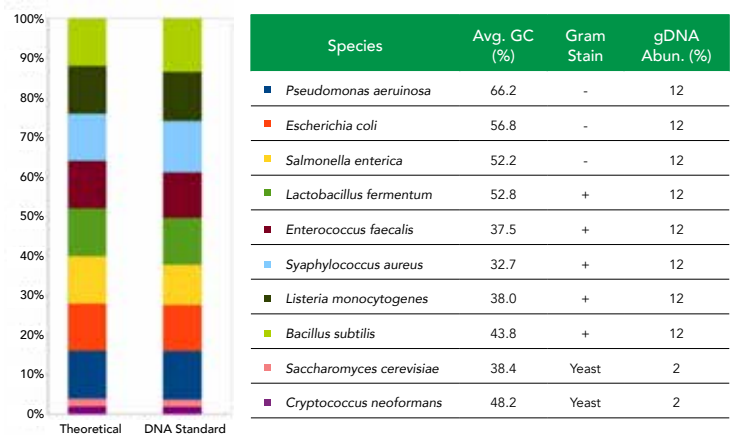
- A DNA standard of well-defined composition.
- Ideal for the validation, optimization, and quality control of microbiomics and metagenomics workflows.
- The DNA has a wide GC range of 15% – 85%.

## Address & Reduce PCR Chimera



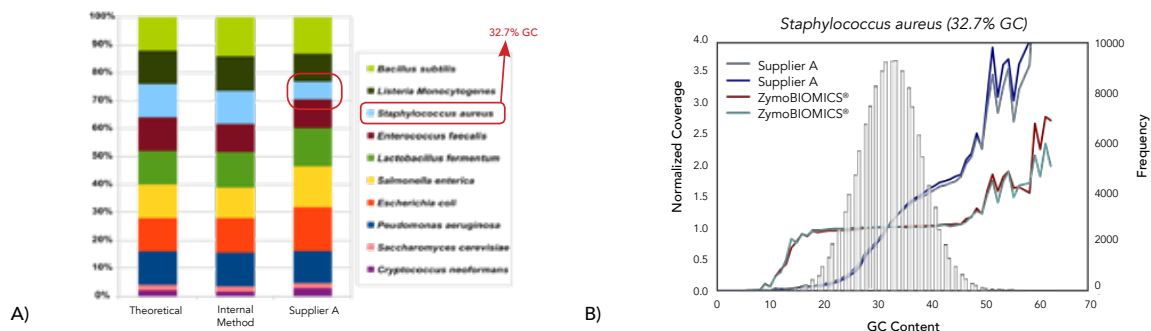
PCR chimera increase the number of PCR cycles during the library preparation process of 16S rRNA gene targeted sequencing. 20 ng ZymoBIOMICS® Microbial Community Standard was used as a template. The PCR was performed with ZymoBIOMICS® Taq PreMix master mix and with primers that target the v3-4 region of 16S rRNA gene. Chimera percentage was determined with Uchime and using the 16S rRNA genes of the 8 bacterial strains in the standard as reference.

## Accurate Characterization



DNA from Gram-negative bacteria, five Gram-positive bacteria, and two tough-to-lyse yeasts. The ZymoBIOMICS® Microbial Community Standards are perfect for assessing bias in popular extraction methods. The microbial standards are accurately characterized, with a wide GC range (15% – 85%) and contain negligible impurities (< 0.01%), enabling easy exposure of artifacts, errors, and bias in microbiomics or metagenomic workflows.

## Assess GC Bias & Eliminate It



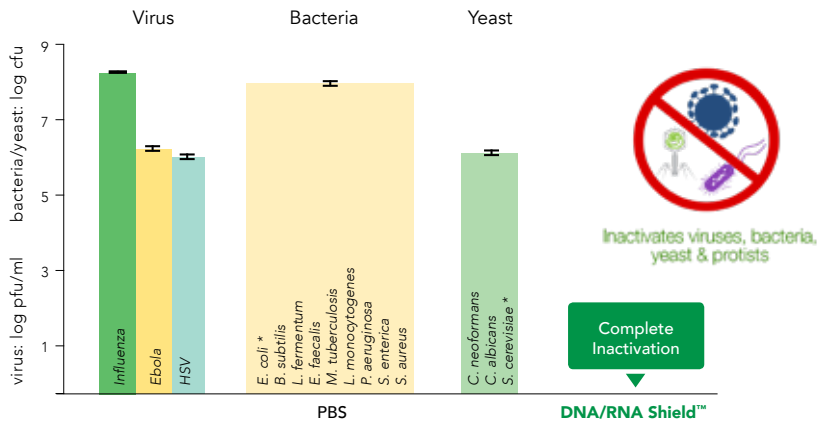
A) Assessing bias of two different library preparation processes in shotgun metagenomic sequencing using ZymoBIOMICS® Microbial Community DNA Standard. Compared to our ZymoBIOMICS® Services, the Supplier A kit has some bias due to GC content variation. Sequencing was performed on MiSeq (2 x 150 bp). B) Raw reads were mapped to the 10 microbial genomes to evaluate the potential effect of GC content on sequencing coverage. Normalized coverage was calculated by normalization with the average sequencing coverage of each genome.

Product	Cat. No.	Size
ZymoBIOMICS® Microbial Community DNA Standard	D6305 D6306	200 ng 2,000 ng

# DNA/RNA Shield™ Collection Devices

Take a molecular snapshot of your sample with DNA/RNA Shield™. This stabilization reagent breaks the cold chain and ensures nucleic acid stability during sample storage/transport at ambient temperatures. DNA/RNA Shield™ effectively lyses cells and inactivates nucleases and infectious agents, and it is compatible with various collection and storage devices (vacuum tubes, swabs (nasal, buccal, fecal), etc.).

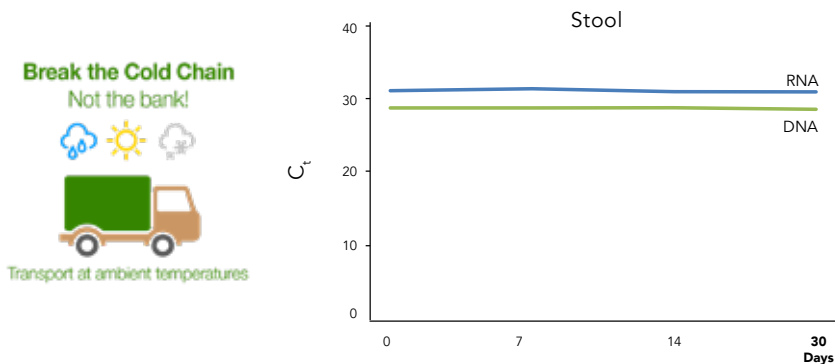
## Microbial Inactivation



Viruses, bacteria and yeast are effectively inactivated by DNA/RNA Shield™. Samples containing the infectious agent (virus, bacteria, yeast) were treated for 5 minutes with DNA/RNA Shield™ or mock (PBS). Titer (PFU) was subsequently determined by plaque assay. Validated by: Influenza A - D. Poole and Prof. A. Mehle, Department of Medical Microbiology and Immunology, University of Wisconsin, Madison; Ebola (Kikwit) - L. Avena and Dr. A. Griffiths, Department of Virology and Immunology, Texas Biomedical Research Institute; HSV-1/2 - H. Oh, F. Diaz and Prof. D. Knipe, Virology Program, Harvard Medical School; *E. coli*, *L. fermentum*, *B. subtilis*, *S. cerevisiae* – Zymo Research Corporation).

\*Disclaimer: This graph only displays results from *E. coli* inactivation. Each microbe was tested independently and were combined into one graph for brevity. Bacterial cultures were grown between  $10^8$  -  $10^9$  cells and yeast cultures were grown between  $10^7$  -  $10^8$  cells.

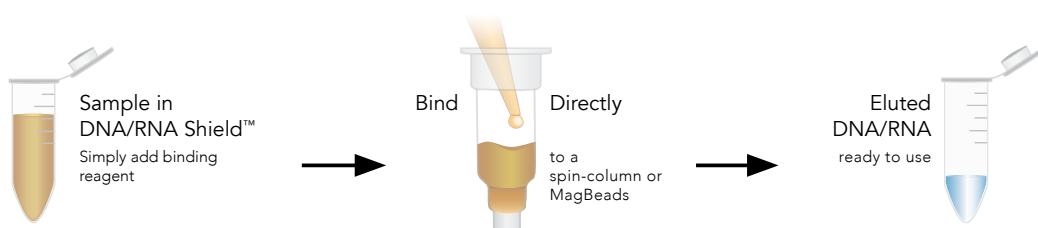
## Nucleic Acid Stabilization at Ambient Temperature



DNA and RNA in stool is effectively stabilized in DNA/RNA Shield™ at ambient temperature. Graphs show: DNA and RNA controls from stool purified at the indicated time points and analyzed by (RT)qPCR.

## Streamlined Purification

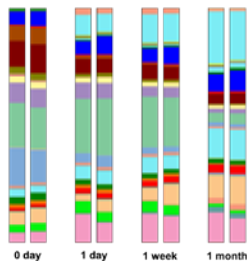
No Reagent Removal. Compatible with ZymoBIOMICS® Purification Products.



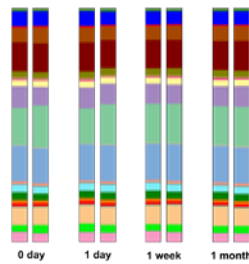
- Provides an accurate “molecular snapshot” of the sample at the time of collection by preserving nucleic acids at ambient temperature and inactivating microbes.
- Nucleic acid preservation (at ambient temperature; cold-free).
- Pathogen inactivation (bacteria, fungus, parasites & viruses).
- Streamlined purification (no reagent removal, universally compatible, automatable).

### DNA/RNA Shield™ Preserves Microbial Composition at Ambient Temperature

Without DNA/RNA Shield™ - Composition Changes



With DNA/RNA Shield™ - Accurate Composition



Microbial composition of stool is unchanged after one month at ambient temperature with DNA/RNA Shield™. Stool samples suspended in DNA/RNA Shield™ and stored at room temperature were compared to stool without preservative for one month. They were sampled at the indicated time points and processed with ZymoBIOMICS® DNA Mini Kit. The extracted DNA was then subjected to microbial composition profiling via 16S rRNA gene targeted sequencing. Samples stored with DNA/RNA Shield™ had a constant microbial composition while the samples stored without shifted dramatically.

### Available DNA/RNA Shield™ Devices for Microbial Studies



DNA/RNA Shield™ - Fecal Collection Tube (with scoop)



DNA/RNA Shield™ - Swab & Collection Tube



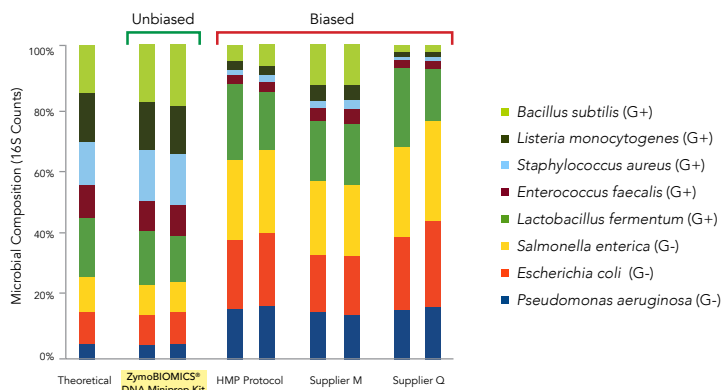
DNA/RNA Shield™ - Lysis Tube (Microbe)

Product	Cat. No.	Size
DNA/RNA Shield™ - Lysis Tube (Microbe)	R1103	50 pack
DNA/RNA Shield™ - Lysis Tube (Microbe) with Swab	R1104	50 tubes/50 swabs
DNA/RNA Shield™ - Swab & Collection Tube	R1106	10 pack (1 ml fill)
	R1107	50 pack (1 ml fill)
	R1108	10 pack (2 ml fill)
	R1109	50 pack (2 ml fill)
DNA/RNA Shield™ - Fecal Collection Tube	R1101	10 pack

# ZymoBIOMICS® DNA Kits

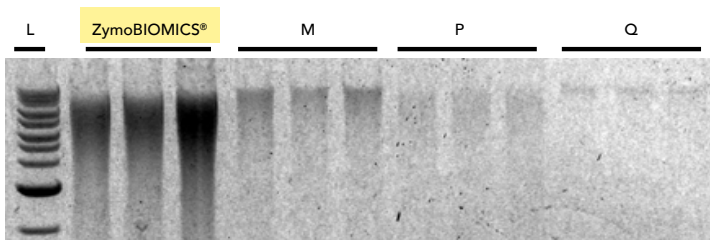
- Ultra-pure, inhibitor-free DNA from many microbiomic sample types (feces, soil, water, biofilms, swabs, body fluid, etc.) that is ideal for all downstream applications including PCR, arrays, 16S rRNA gene sequencing, and shotgun sequencing.
- Innovative lysis system enables efficient and unbiased lysis of microbes including Gram-positive/negative bacteria, fungus, protozoans, and algae for accurate microbial community profiling.

## Accurate Community Profiling



The ZymoBIOMICS® DNA Miniprep Kit provides accurate representation of the organisms extracted from the ZymoBIOMICS® Microbial Community Standard.

## Superior Yields



The ZymoBIOMICS® DNA Miniprep Kit provides superior yields when compared to Suppliers M, P, and Q.

## Streamlined Workflow



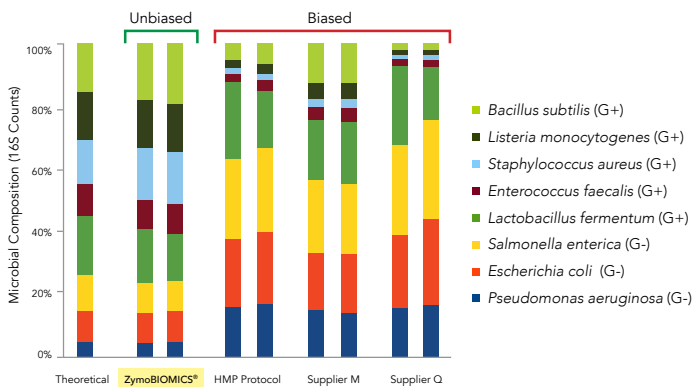
Product	Cat. No.	Size
ZymoBIOMICS® DNA Miniprep Kit	D4300 D4300T	50 preps 10 preps
ZymoBIOMICS® DNA Miniprep Kit (Lysis Matrix Not Included)	D4304	50 preps
ZymoBIOMICS® DNA Microprep Kit	D4301	50 preps
ZymoBIOMICS® 96 DNA Kit (includes ZR BashingBead™ Lysis Rack)	D4303	2 x 96 preps
ZymoBIOMICS® 96 DNA Kit (includes ZR BashingBead™ Lysis Tubes)	D4309	2 x 96 preps
ZymoBIOMICS® 96 DNA Kit (Lysis Matrix Not Included)	D4307	2 x 96 preps



# ZymoBIOMICS® 96 Magbead DNA Kit

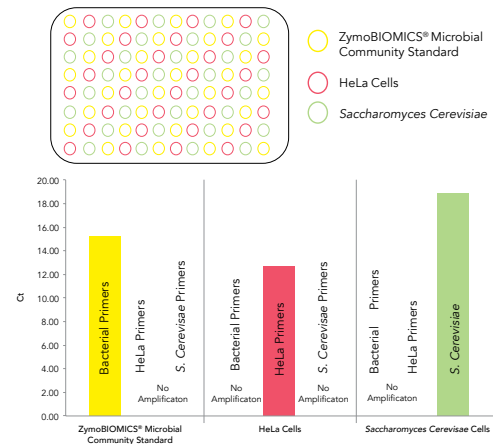
- High-throughput purification of high quality, inhibitor-free DNA from any sample including feces, soil, water, biofilms, swabs, saliva, and body fluids.
- The ZymoBIOMICS® innovative lysis system enables efficient and unbiased lysis of microbes including Gram-positive/negative bacteria, fungi, protozoans, algae, etc.
- The automation friendly workflow enables samples to be processed in as little as 90 minutes for 96 preps.

## Accurate Profiling



The ZymoBIOMICS® 96 MagBead Kit provides accurate representation of the organisms extracted from the ZymoBIOMICS® Microbial Community Standard.

## No Cross-Contamination



The ZymoBIOMICS® 96 MagBead DNA Kit provides cross-contamination free samples across a standard 96-well plate purification performed on a liquid handler. Samples were evaluated using quantitative PCR with primer sets targeted at the bacterial 16S gene, the human LINE gene, and the fungal ITS gene. PCR was performed in technical duplicates.

## No Precipitation or Centrifugation Required

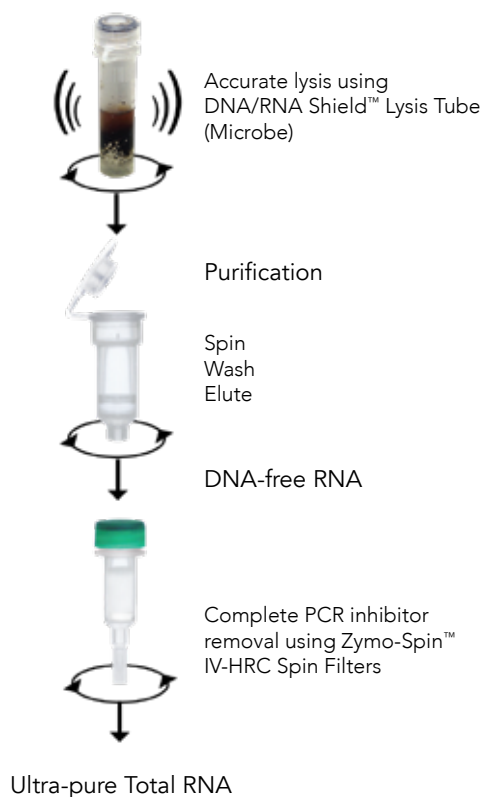


Product	Cat. No.	Size
ZymoBIOMICS® 96 MagBead DNA Kit (includes ZR BashingBead™ Lysis Rack)	D4302	2 x 96 preps
ZymoBIOMICS® 96 MagBead DNA Kit (Lysis Matrix Not Included)	D4306	2 x 96 preps
ZymoBIOMICS® 96 MagBead DNA Kit (includes ZR BashingBead™ Lysis Tubes)	D4308	2 x 96 preps

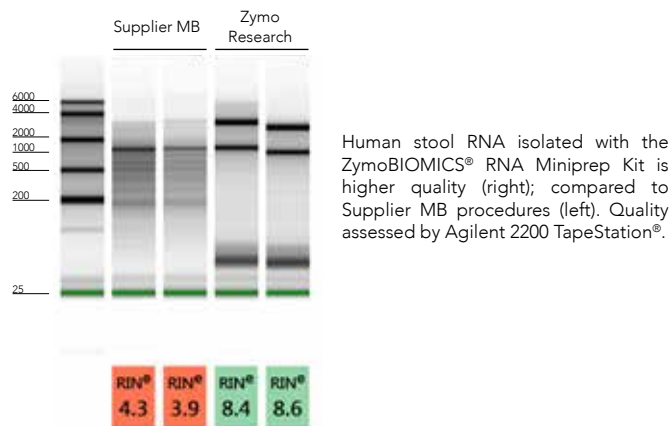
# ZymoBIOMICS® RNA Kits

- Rapid, robust, and simple purification of high quality, inhibitor-free total RNA (including small/micro RNAs) from any sample including feces, soil, water, biofilms, swabs, saliva, and body fluids, etc.
- ZymoBIOMICS® innovative lysis system enables efficient and unbiased lysis of microbes including Gram-positive/negative bacteria, fungus, protozoans, algae, viruses, etc.
- DNA-free RNA is ready for use in any downstream application. DNase I included.

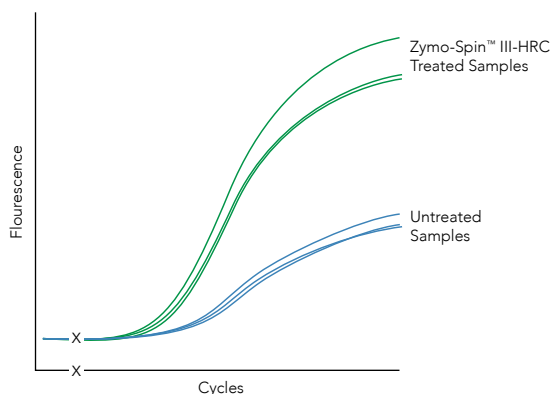
## Streamlined Workflow



## Ultra-pure RNA from Inhibitor-rich Samples



## Ultra-pure RNA from Inhibitor-rich Samples



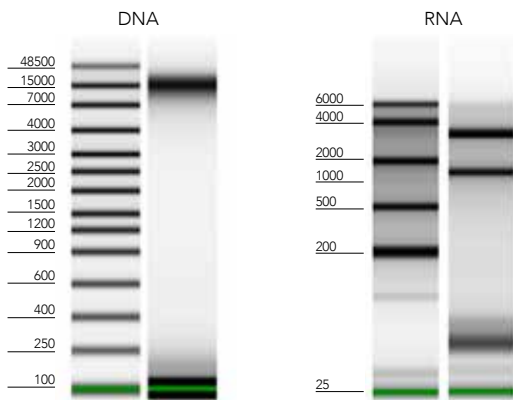
Total RNA isolated from human stool with or without inclusion of the Zymo-Spin™ IV-HRC Spin Filter during the ZymoBIOMICS® RNA Miniprep Kit protocol. Earlier amplification cycles indicate complete removal of PCR inhibitors.

Product	Cat. No.	Size
ZymoBIOMICS® RNA Miniprep Kit	R2001	50 preps

# ZymoBIOMICS® DNA/RNA Miniprep Kit

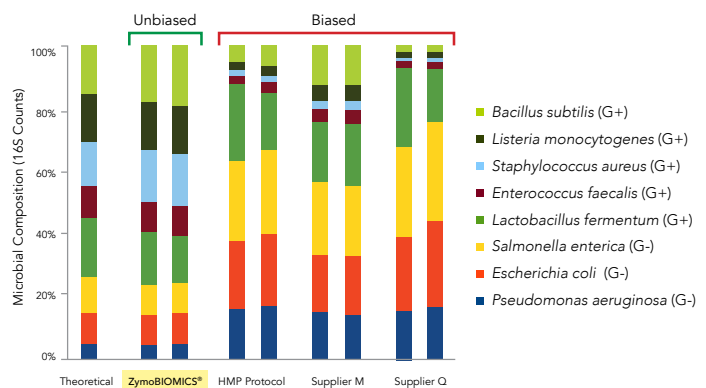
- Rapid, robust, and simple purification of high quality, inhibitor-free DNA and total RNA (including small/micro RNAs) from any sample including feces, soil, plant, water, biofilms, swabs, saliva, body fluids, etc.
- ZymoBIOMICS® innovative lysis system enables efficient and unbiased lysis of microbes including Gram-positive/negative bacteria, fungus, protozoans, algae, viruses, etc.
- High-quality DNA and DNA-free RNA is ready for use in any downstream application. DNase I included.

## Superior Yields



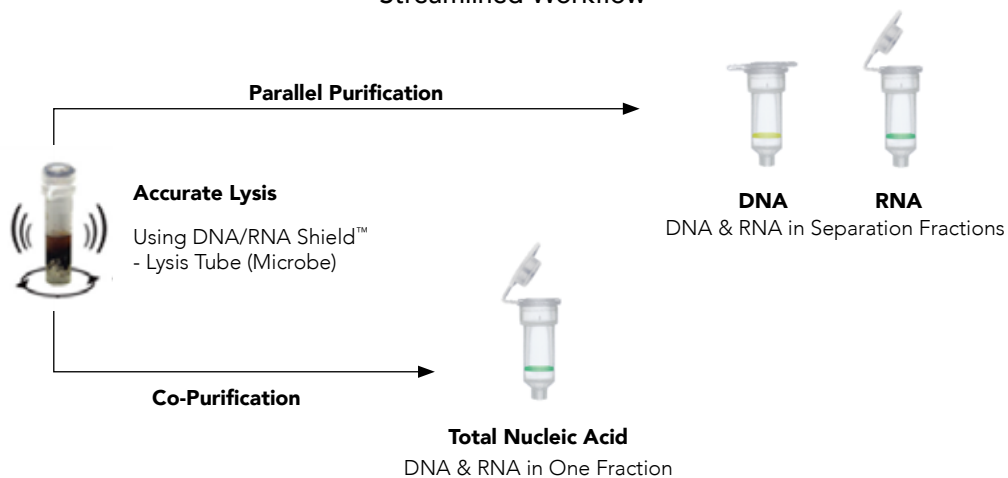
Human stool genomic DNA and total RNA isolated with the ZymoBIOMICS® DNA/RNA Miniprep Kit is highly intact. Quality assessed by Agilent 2200 TapeStation®.

## Accurate Community Profiling



The ZymoBIOMICS® DNA/RNA Miniprep Kit provides accurate representation of the organisms extracted from the ZymoBIOMICS® Microbial Community Standard.

## Streamlined Workflow

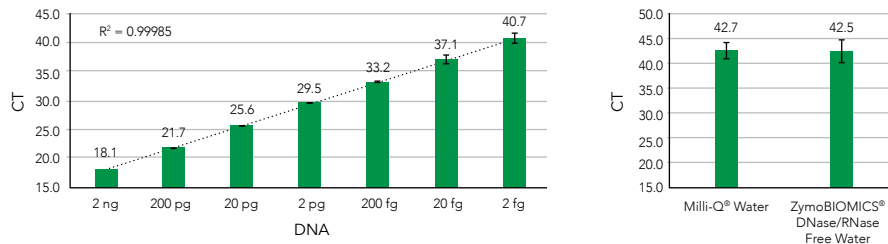


Product	Cat. No.	Size
ZymoBIOMICS® DNA/RNA Miniprep Kit	R2002	50 preps

# ZymoBIOMICS® PCR PreMix

- Simply add water, DNA, primers and go!
- Certified low-bioburden.
- Robust amplification for the detection of low copy DNA.
- Ideal for highly sensitive applications.

## Sensitive Detection Range Free of Bacterial DNA

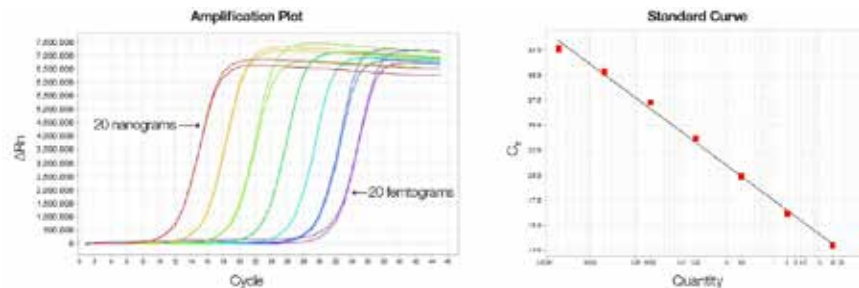


Quantification of no template controls (NTCs) via real-time PCR was determined by amplification of the 16S rRNA gene, after the addition of 2.5  $\mu$ M SYTO® 9 to a 20  $\mu$ l reaction volume. Real-time PCR was performed for 45 cycles to determine the amount of bacterial contamination. NTCs include Millipore filtered water and DEPC treated Millipore filtered water.

# Femto™ Bacterial DNA Quantification Kit

- Quantify as little 20 femtograms of DNA in as little as 1  $\mu$ l of sample.
- High specificity and sensitivity for DNA in a background of non-target DNA.
- Fast and simple: add samples to the PreMix... and quantify.

## Reliable Quantification



Reliable standards for the qualification of bacterial DNA: Bacterial DNA Standards (measured in duplicates) comprise a 10-fold dilution series ranging from 20 ng to 20 fg.

Product	Cat. No.	Size
ZymoBIOMICS® PCR Premix	E2056	50 rxns
	E2057	200 rxns
Femto™ Bacterial DNA Quantification Kit	E2006	100 rxns

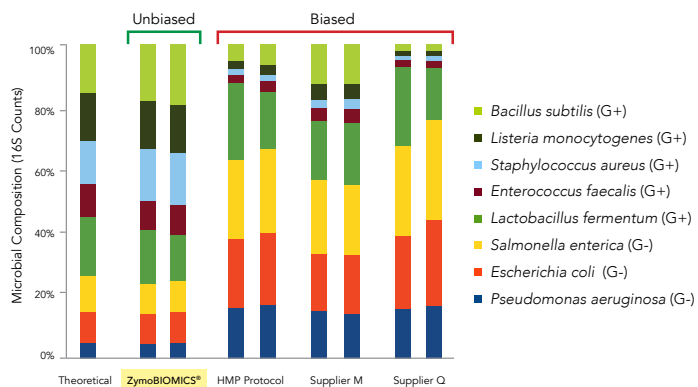
# ZymoBIOMICS® Services

- Zymo Research offers the most comprehensive services for 16S rRNA and Shotgun sequencing from any sample type.
- ZymoBIOMICS® Services are validated using the ZymoBIOMICS® Community Standards to ensure accurate, publication-quality data.
- Services include low-bioburden processing and DNA/RNA isolation using the ZymoBIOMICS® product line for the most accurate taxonomic profiling.

## A Comprehensive Solution for Microbiomics and Metagenomics

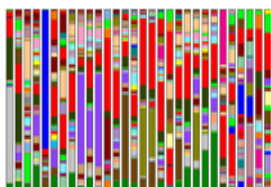


## Validated, Accurate Workflows from Collection to Analysis

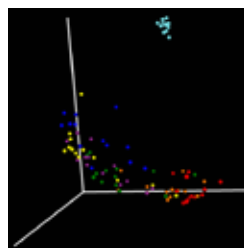


ZymoBIOMICS® Services are validated using the ZymoBIOMICS® Microbial Community Standards for unbiased, accurate community profiling

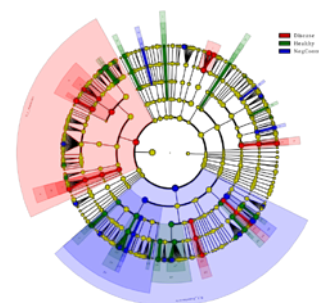
## Comprehensive, Customizable Bioinformatics & Data Analysis



Composition Barplots



Beta-Diversity



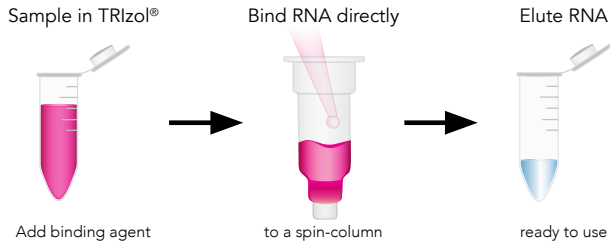
LEfSe Cladogram

For inquiries about our ZymoBIOMICS® Services, visit [www.zymoresearch.com/zymbiomics-portfolio](http://www.zymoresearch.com/zymbiomics-portfolio)

# Related Products

## Direct-zol™ RNA Kits

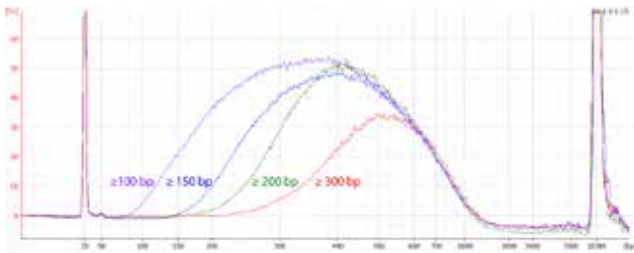
From TRIzol® to high-quality RNA in 7 minutes without phase separation



Product	Size	Cat. No.
Direct-zol™ RNA Miniprep Plus	50 preps 200 preps	R2070; R2071* R2072; R2073*
Direct-zol™ RNA Miniprep	50 preps 200 preps	R2050; R2051* R2052; R2053*
Direct-zol™ RNA Microprep	50 preps 200 preps	R2060; R2061* R2062; R2063*
Direct-zol™-96 RNA Miniprep Plus	2 x 96 preps 4 x 96 preps	R2054; R2055* R2056; R2057*

\*Supplied with TRI Reagent®

## Select-a-Size DNA Clean & Concentrator® Kits



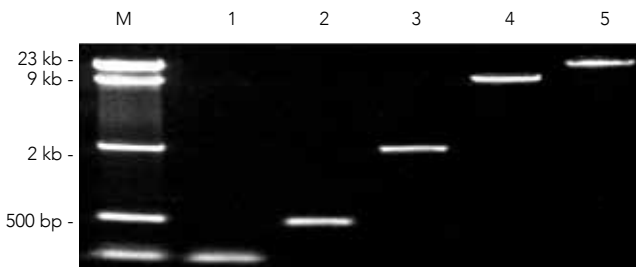
Select-a-Size DNA Clean and Concentrator® allows for selection at  $\geq 300$  bp,  $\geq 200$  bp,  $\geq 150$  bp,  $\geq 100$  bp and  $\geq 50$  bp.

Select for DNA species  $\geq 50$  bp,  $\geq 150$  bp,  $\geq 200$  bp,  $\geq 300$  bp,  $\geq 700$  bp or perform double size selection

Product	Size	Cat. No.
Select-a-Size DNA Clean & Concentrator®	25 preps	D4080

## Zymoclean™ DNA Gel Recovery

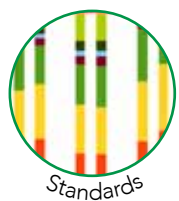
Boost recoveries from agarose gels to > 80%



DNA fragments recovered from an agarose gel using the Zymoclean™ Gel DNA Recovery Kit. Lanes: M: DNA Ladder; 1-5: individual ladder DNA fragments.

Product	Size	Cat. No.
Zymoclean™ Gel DNA Recovery Kit (uncapped)	50 preps 200 preps	D4001 D4002
Zymoclean™ Gel DNA Recovery Kit (capped)	50 preps 200 preps	D4007 D4008
ZR-96 Zymoclean™ Gel DNA Recovery Kit	2 x 96 preps 4 x 96 preps	D4021 D4022
Zymoclean™ Large Fragment DNA Recovery Kit	25 preps 100 preps	D4045 D4046

# ZymoBIOMICS® Products



Product	Cat. No.	Size
ZymoBIOMICS® Microbial Community Standards	D6300	10 preps
ZymoBIOMICS® DNA Standards	D6305 D6306	200 ng 2,000 ng



Product	Cat. No.	Size
DNA/RNA Shield™ Reagent	R1100-50 R1100-250	50 ml 250 ml
DNA/RNA Shield™ Reagent (2X concentrate)	R1200-25 R1200-125	25 ml 125 ml
DNA/RNA Shield™ - Lysis Tube (Microbe)	R1103	50 pack
DNA/RNA Shield™ - Lysis Tube (Microbe) with Swab	R1104	50 tubes/50 swabs
DNA/RNA Shield™ - Swab & Collection Tube	R1106 R1107 R1108 R1109	10 pack (1 ml fill) 50 pack (1 ml fill) 10 pack (2 ml fill) 50 pack (2 ml fill)
DNA/RNA Shield™ - Fecal Collection Tube	R1101	10 pack



Product	Cat. No.	Size
ZymoBIOMICS® DNA Miniprep Kit	D4300	50 preps
ZymoBIOMICS® DNA Microprep Kit	D4301	50 preps
ZymoBIOMICS®-96 Magbead DNA Kit	D4302	2 x 96 preps
ZymoBIOMICS®-96 DNA Kit	D4303 D4304	2 x 96 preps 4 x 96 preps
ZymoBIOMICS® RNA Miniprep Kit	R2001	50 preps
ZymoBIOMICS® DNA/RNA Miniprep Kit	R2002	50 preps



Product	Cat. No.	Size
ZymoBIOMICS® PCR Premix	E2056 E2057	50 rxns 200 rxns
Femto™ Bacterial DNA Quantification Kit	E2006	100 rxns
Femto™ Human DNA Quantification Kit	E2005	100 rxns
Femto™ Fungal DNA Quantification Kit	E2007	100 rxns



For inquiries about our ZymoBIOMICS® Services and any other related products, visit [www.zymoresearch.com/zymbiomics-portfolio](http://www.zymoresearch.com/zymbiomics-portfolio)



**ZYMO RESEARCH**

*The Beauty of Science is to Make Things Simple®*

Cat. No. B1007 Version 03

The **BEAUTY** of **SCIENCE** is to Make Things **SIMPLE**®



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