
IN the NAME
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GOD

Seminar Session

Analysis of Microbial cell-free DNA in Liquid Biopsies

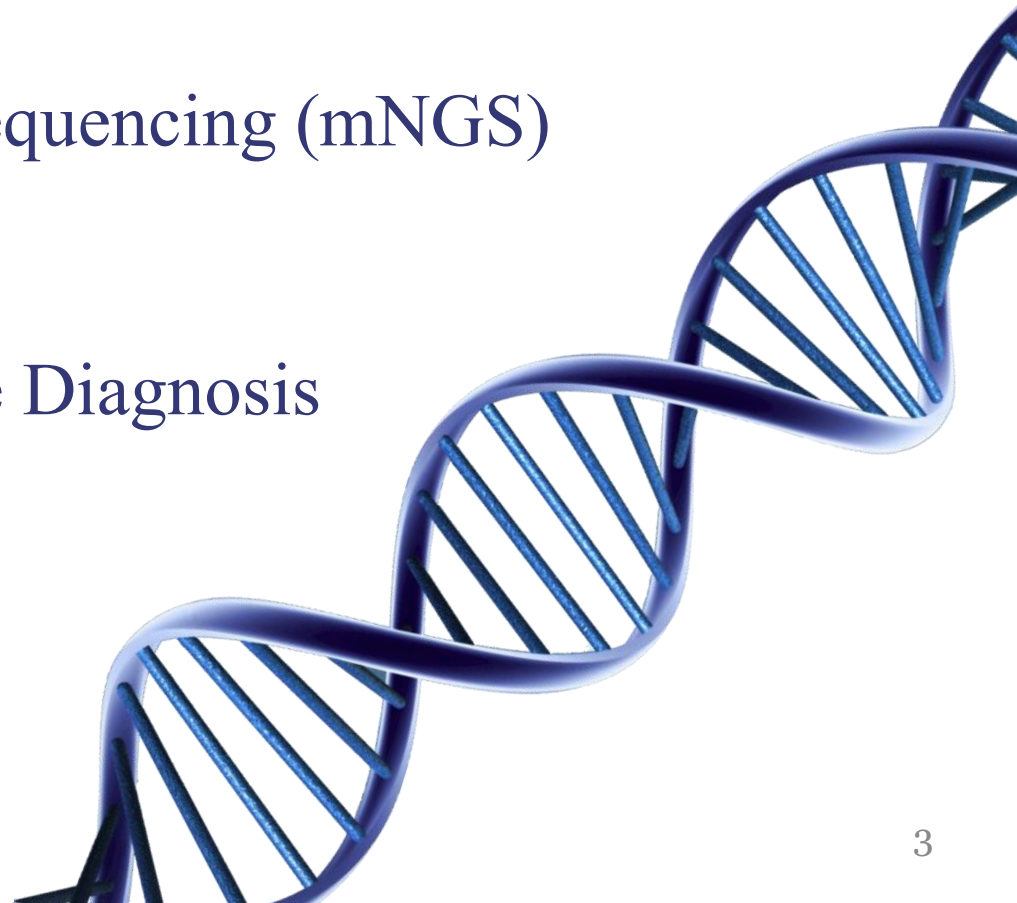
Advisor: Dr. Hossein Fazeli

Presenter: Arashk Emami



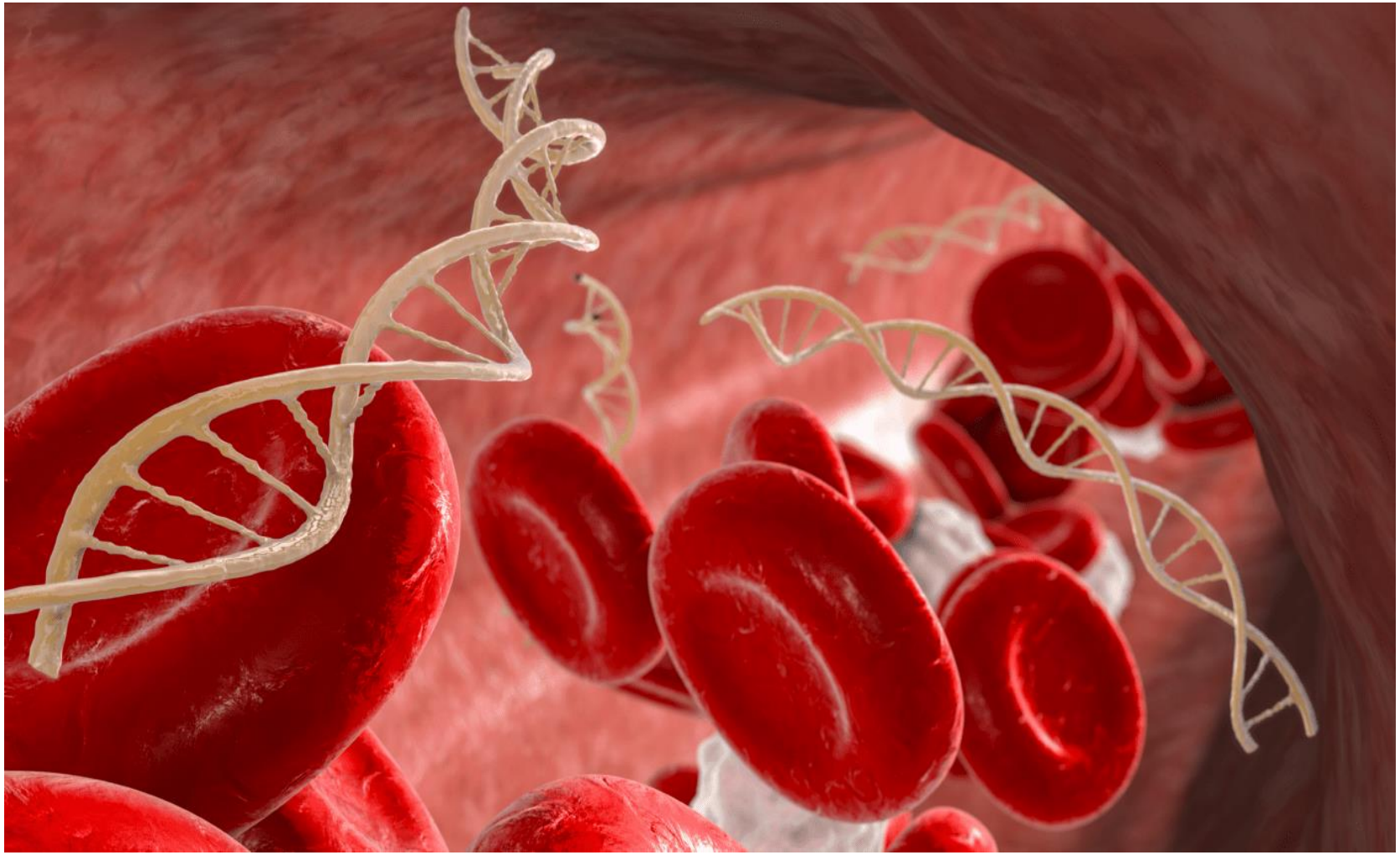
Presentation Outline:

- Introduction to Cell-Free DNA (cfDNA)
- Sources of Microbial cfDNA
- Metagenomic Next-Generation Sequencing (mNGS)
- Technical Workflow of mNGS
- Applications in Infectious Disease Diagnosis
- Clinical Applications in Cancer
- Future Perspectives



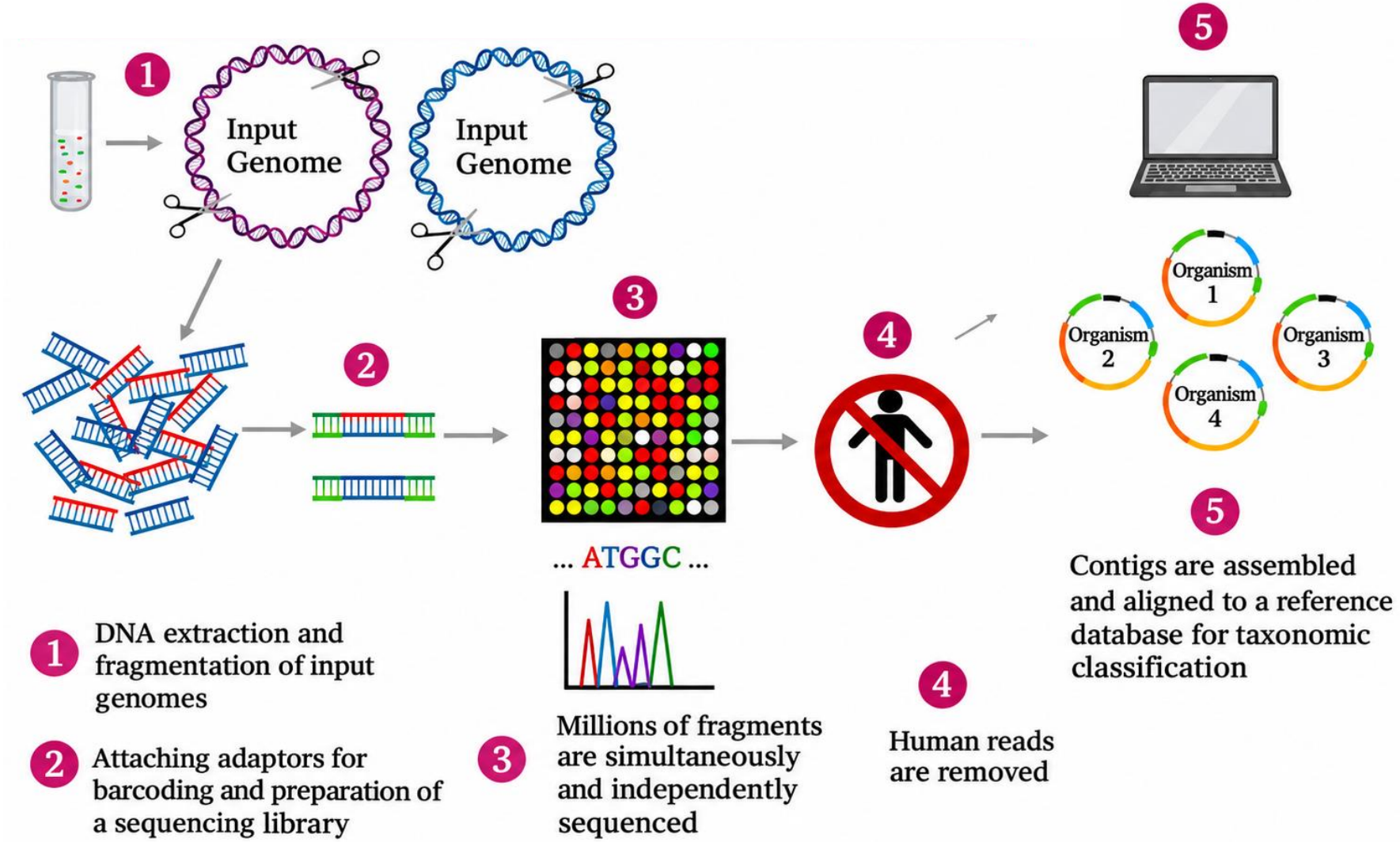
cell free DNA(cf DNA)

- Definition
- Sources
  - Cell death
  - ctDNA
  - Placenta in pregnant women
  - Infectious agents

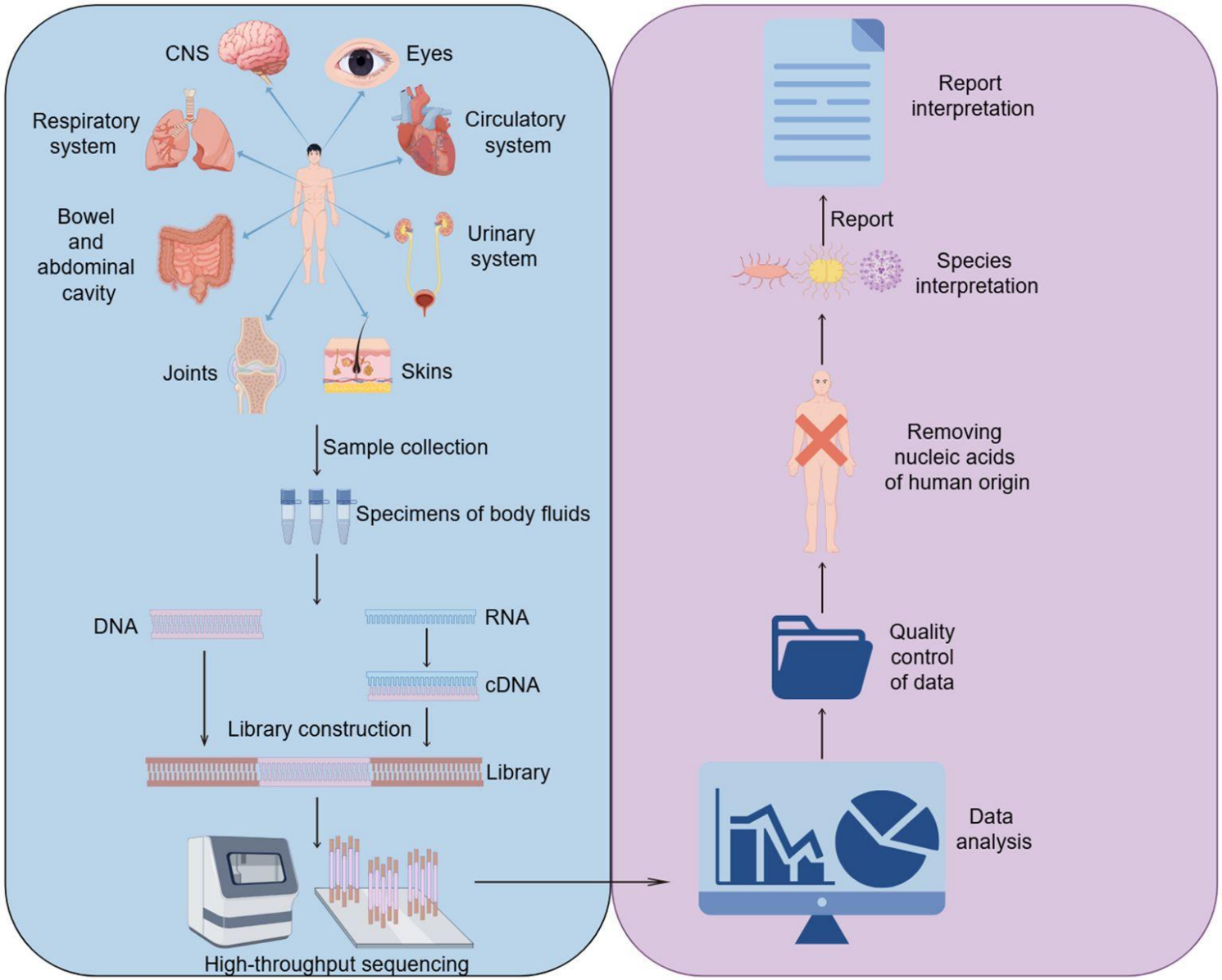


metagenomic Next Generation Sequencing(mNGS)

- Definition
- Main steps of performing mNGS
- Pros & Cons

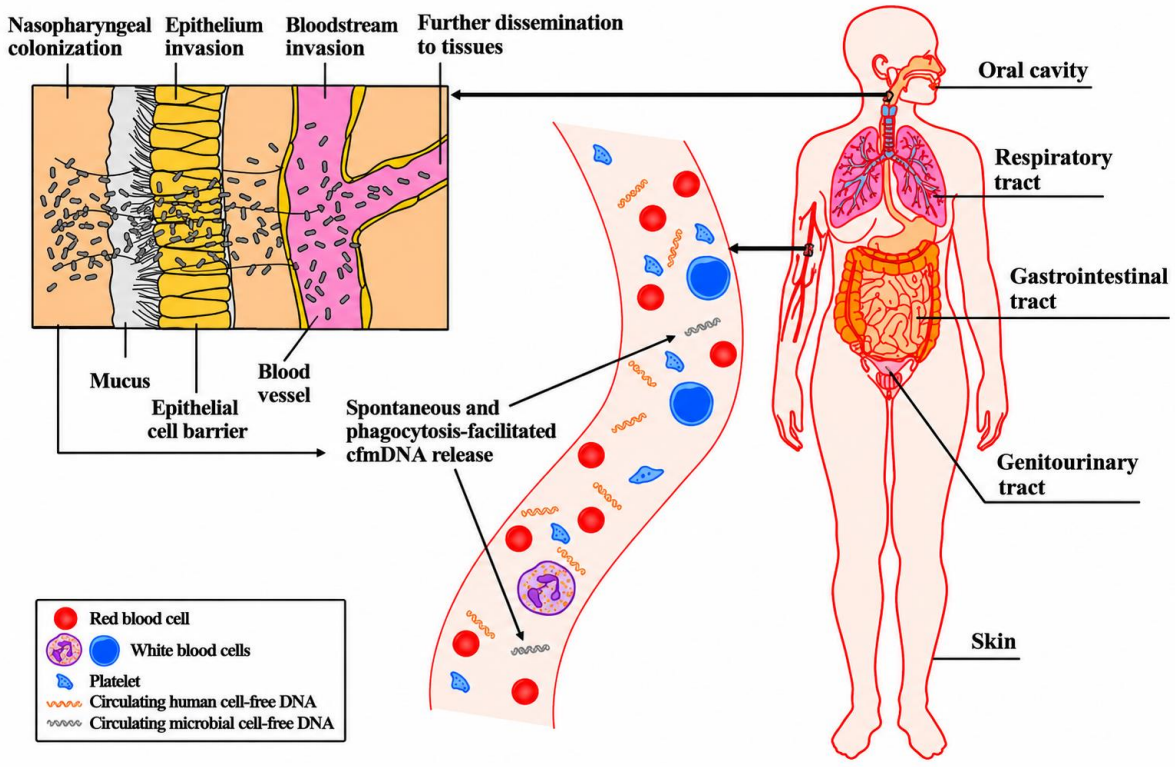


Technical principle in mNGS



Bacterial cell-free DNA (cfDNA) in body fluids originates from various sources:

- Local Infections
- Systemic Infections
- Gastrointestinal Tract
- Normal Microbiota
- kitome contamination



Applications of cf DNA

RESEARCH ARTICLE | BIOPHYSICS AND COMPUTATIONAL BIOLOGY |

Numerous uncharacterized and highly divergent microbes which colonize humans are revealed by circulating cell-free DNA

Mark Kowarsky, Joan Camunas-Soler, Michael Kertesz, +13, and Stephen R. Quake Authors Info & Affiliations

Contributed by Stephen R. Quake, July 12, 2017 (sent for review April 28, 2017; reviewed by Søren Brunak and Eran Segal)

August 22, 2017 | 114 (36) 9623-9628 | https://doi.org/10.1073/pnas.1707009114 IF: 9.4 Q1

26,614 | 130 PDF/EPUB



Applications of cf DNA



ORIGINAL RESEARCH article

Front. Cell. Infect. Microbiol., 27 September 2022
Sec. Clinical Microbiology
Volume 12 - 2022 |
https://doi.org/10.3389/fcimb.2022.951703 IF: 4.6 Q1

This article is part of the Research Topic
Clinical metagenomics-based diagnostics for infectious diseases

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Metagenomic next-generation sequencing of cell-free and whole-cell DNA in diagnosing central nervous system infections

Lili Yu[1†] Ye Zhang[2†] Jiemin Zhou[2] Yu Zhang[1] Xuejiao Qi[1]
Kaixuan Bai[1] Zheng Lou[2] Yi Li[1] Han Xia[2*] Hui Bu[1*]

[1] Department of Neurology, The Second Hospital of Hebei Medical University, Shijiazhuang, China
[2] Department of Scientific Affairs, Hugobiotech Co., Ltd., Beijing, China

Applications of cf DNA

Comparison of metagenomic next-generation sequencing using cell-free DNA and whole-cell DNA for the diagnoses of pulmonary infections

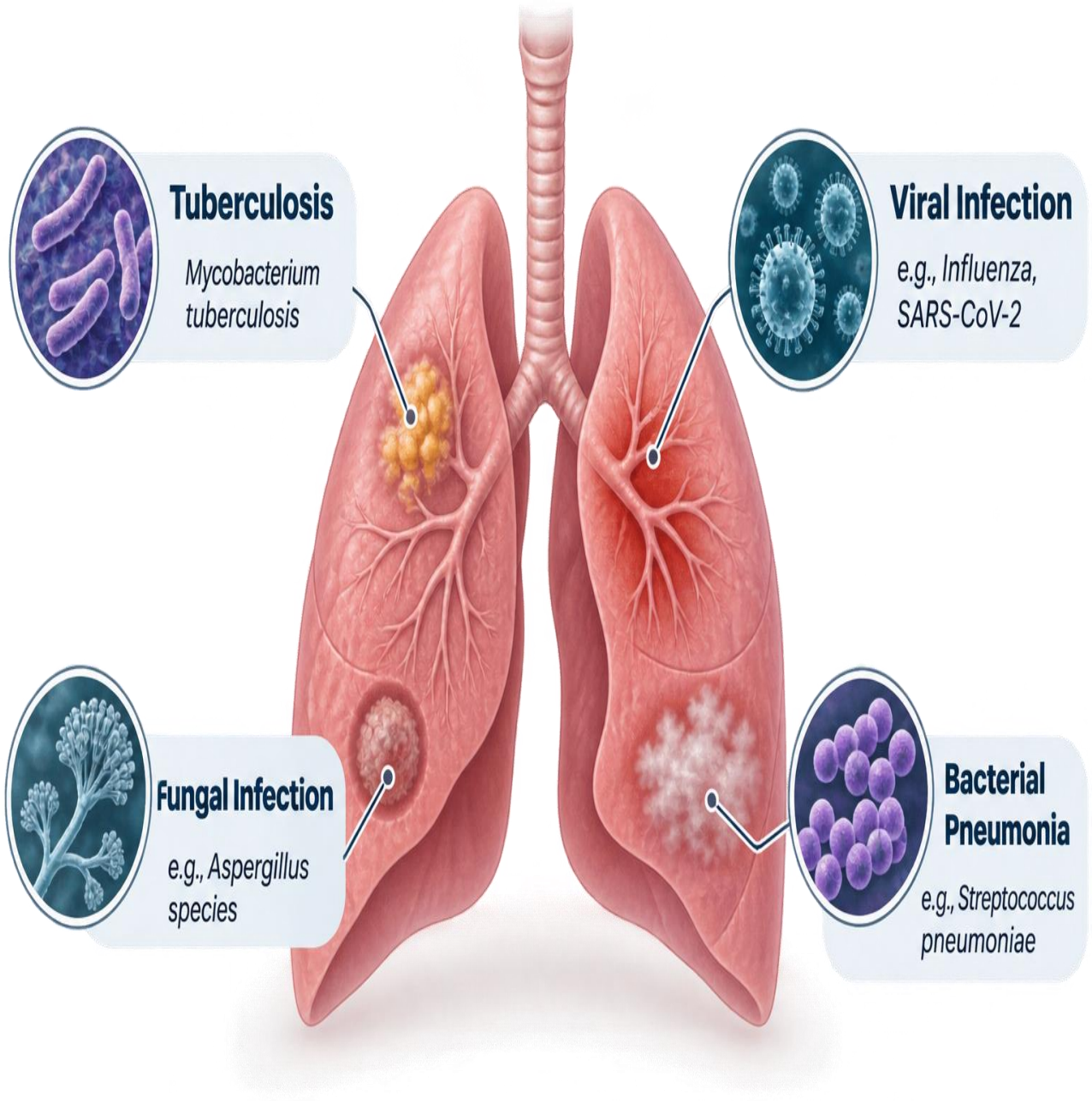
Ping He[1†] Jing Wang[2†] Rui Ke[1] Wei Zhang[1] Pu Ning[1]

Dexin Zhang[1] Xia Yang[1] Hongyang Shi[1] Ping Fang[1]

Zongjuan Ming[1] Wei Li[1] Jie Zhang[1] Xilin Dong[1] Yun Liu[1]

Jiemin Zhou[2] Han Xia[2*] Shuanying Yang[1*]

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Applications of cf DNA

JOURNAL ARTICLE

Performance of Metagenomic Next-Generation Sequencing of Cell-Free DNA From Vitreous and Aqueous Humor for Diagnoses of Intraocular Infections FREE

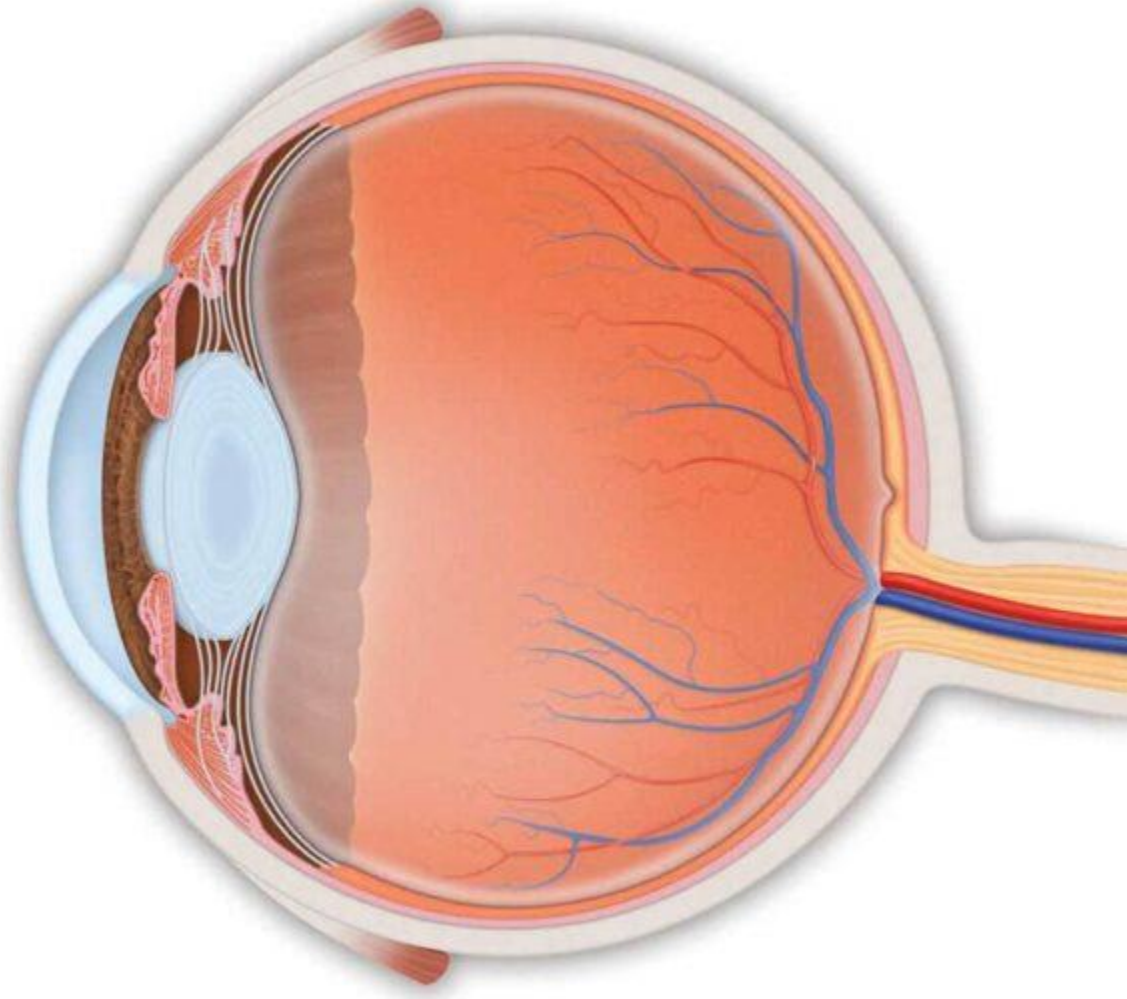
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Author Notes

The Journal of Infectious Diseases, Volume 229, Issue 1, 15 January 2024, Pages 252–261,

https://doi.org/10.1093/infdis/jiad363 IF: 5.0 Q1

Published: 26 October 2023 **Article history** ▾

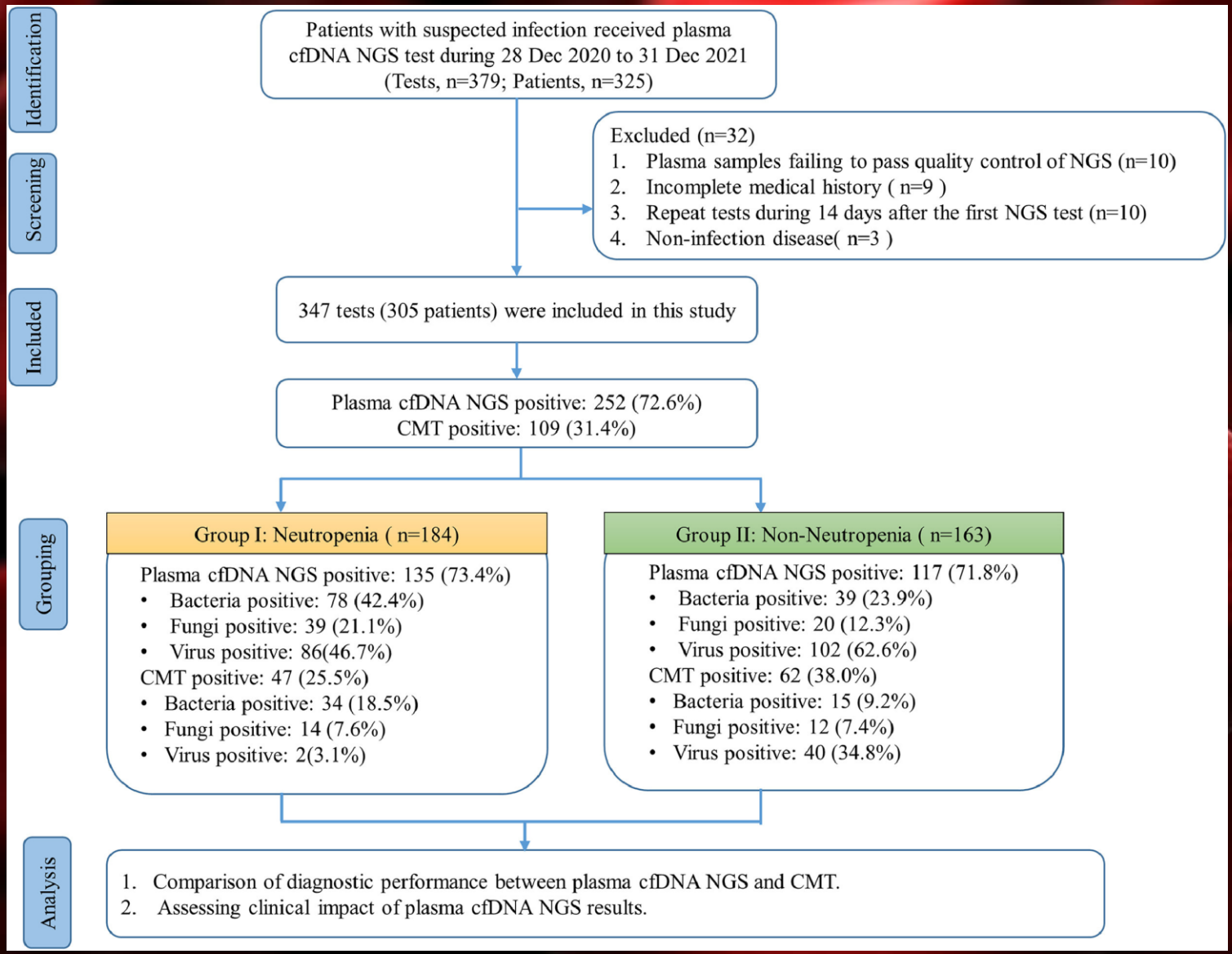


Applications of cf DNA

Utility of plasma cell-free DNA next-generation sequencing for diagnosis of infectious diseases in patients with hematological disorders

Chunhui Xu [a b 1], Xin Chen [a 1], Guoqing Zhu [a], Huiming Yi [a], Shulian Chen [a], Yuetian Yu [c], Erlie Jiang [a], Yizhou Zheng [a], Fengkui Zhang [a], Jianxiang Wang [a], Sizhou Feng [a]

Applications of cf DNA



Clinical applications of microbial cfDNA

▸ Cancer Biol Ther. 2023 Jul 27;24(1):2240084. doi: 10.1080/15384047.2023.2240084 IF: 4.4 Q2

The human microbiome and cancer: a diagnostic and therapeutic perspective

Shruthi Kandalai [a,b], Huapeng Li [c], Nan Zhang [a,b], Haidong Peng [a,b], Qingfei Zheng [a,b,c,d,✉]

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PMCID: PMC10376920 IF: 4.4 Q2 PMID:

Table 1. Summary table of selected diagnostic methods and their diagnostic ability based on area under receiver operating curve (AUROC) scores, as previously described.

Diagnostic method	Cancer type	Microbial marker(s)	AUROC score (out of 1.0)	Reference
Salivary microbiome	pancreatic	*N. elongata* and *S. mitis*	0.90	Farrell et al., 2011[83]
Salivary microbiome	squamous cell (lung)	*Capnocytophaga* and *Veillonella*	0.86	Yan et al., 2015[86]
Fecal microbiome	colorectal	*C. symbiosum*	0.73	Xie et al., 2017[90]
Fecal microbiome	colorectal	*F. nucleatum*	0.86	Liang et al., 2020[89]
Fecal microbiome	lung	various bacteria	0.76	Zheng et al., 2020[93]
Plasma cell-free DNA	various (20) types	various bacteria	0.90	Poore et al., 2020[98]
Plasma cell-free DNA	various (20) types	various fungi	0.80	Narunsky-Haziza et al., 2022[99]
Plasma cell-free DNA	various (20) types	various bacteria + fungi	0.92	Narunsky-Haziza et al., 2022[99]

Clinical applications of microbial cfDNA

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Analysis of microbial sequences in plasma cell-free DNA for early-onset breast cancer patients and healthy females

Research | Open access | Published: 13 February 2018

Volume 11, article number 16, (2018) Cite this article

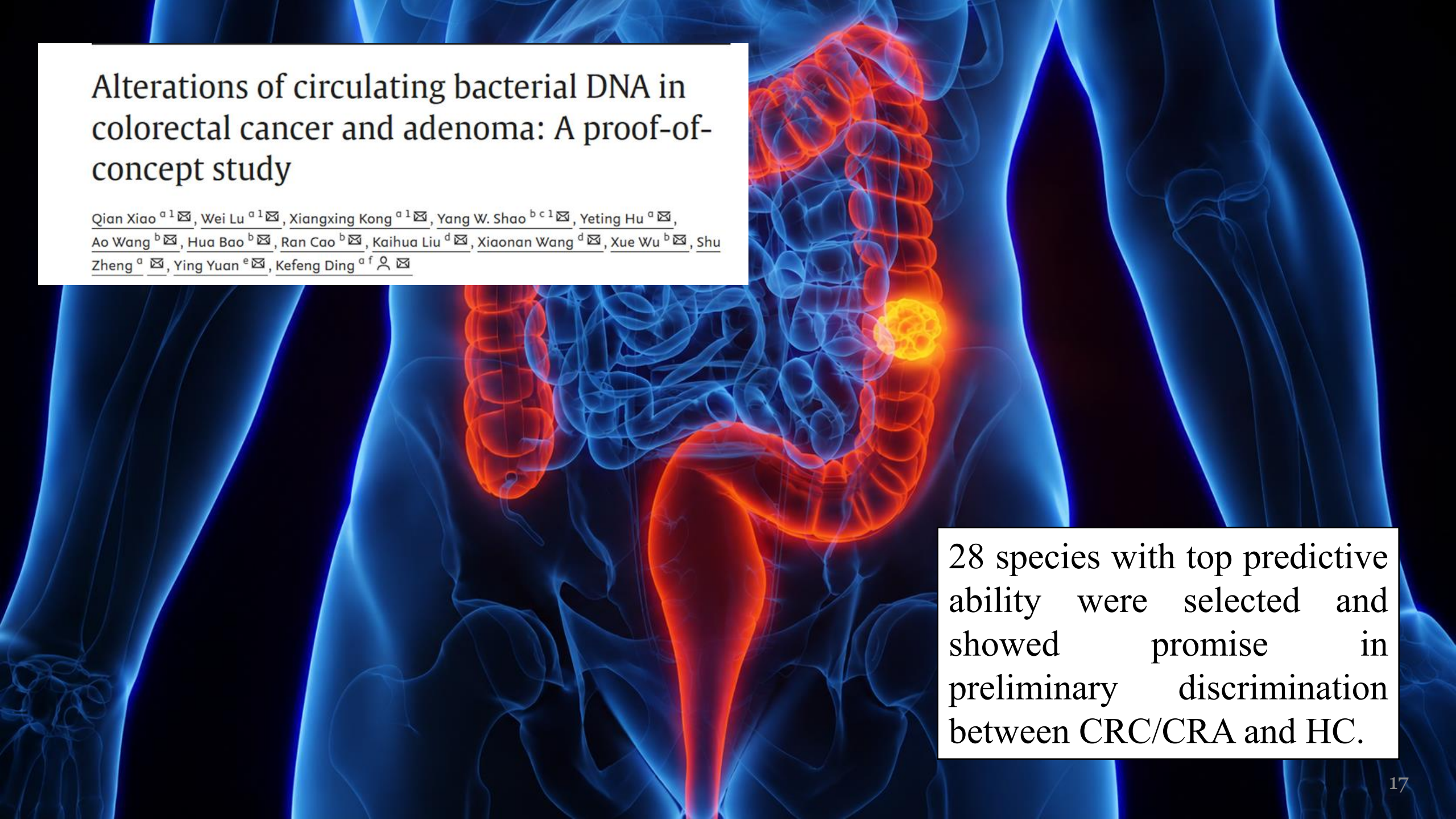
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Yu-Feng Huang, Yen-Ju Chen, Tan-Chi Fan, Nai-Chuan Chang, Yi-Jie Chen, Mohit K. Midha, Tzu-Han Chen, Hsiao-Hsiang Yang, Yu-Tai Wang, Alice L. Yu & Kuo-Ping Chiu

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Most bacterial cfDNA in healthy females are derived from Acinetobacter spp., while high titers of bacterial cfDNA in EOBC patients are derived from *Pseudomonas* or *Sphingomonas* spp.

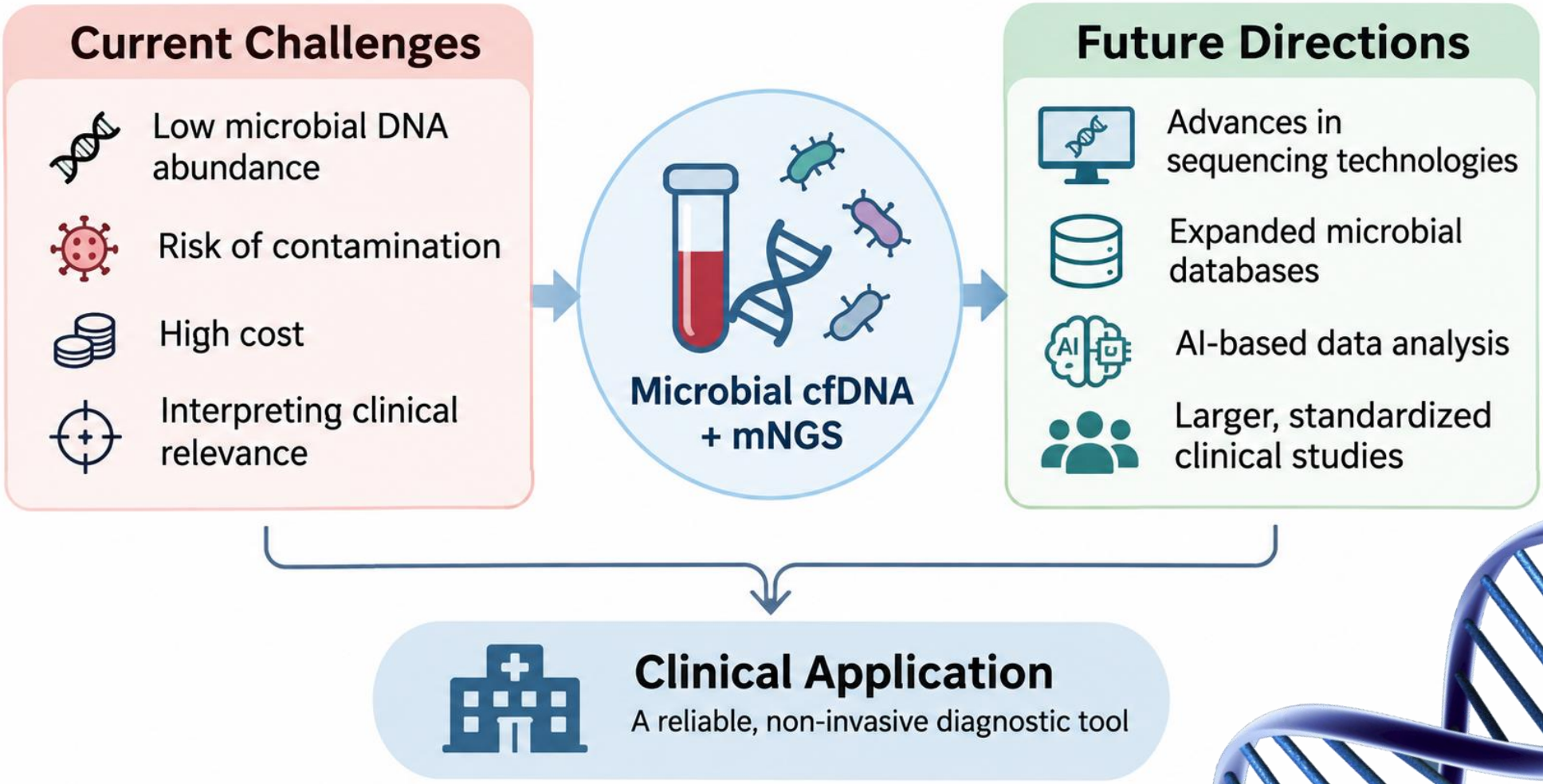


Alterations of circulating bacterial DNA in colorectal cancer and adenoma: A proof-of-concept study

Qian Xiao [a 1], Wei Lu [a 1], Xiangxing Kong [a 1], Yang W. Shao [b c 1], Yeting Hu [a], Ao Wang [b], Hua Bao [b], Ran Cao [b], Kaihua Liu [d], Xiaonan Wang [d], Xue Wu [b], Shu Zheng [a], Ying Yuan [e], Kefeng Ding [a f]

28 species with top predictive ability were selected and showed promise in preliminary discrimination between CRC/CRA and HC.

Perspective & Future Directions



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