Opening Up the Next Chapter in Clinical Laboratories

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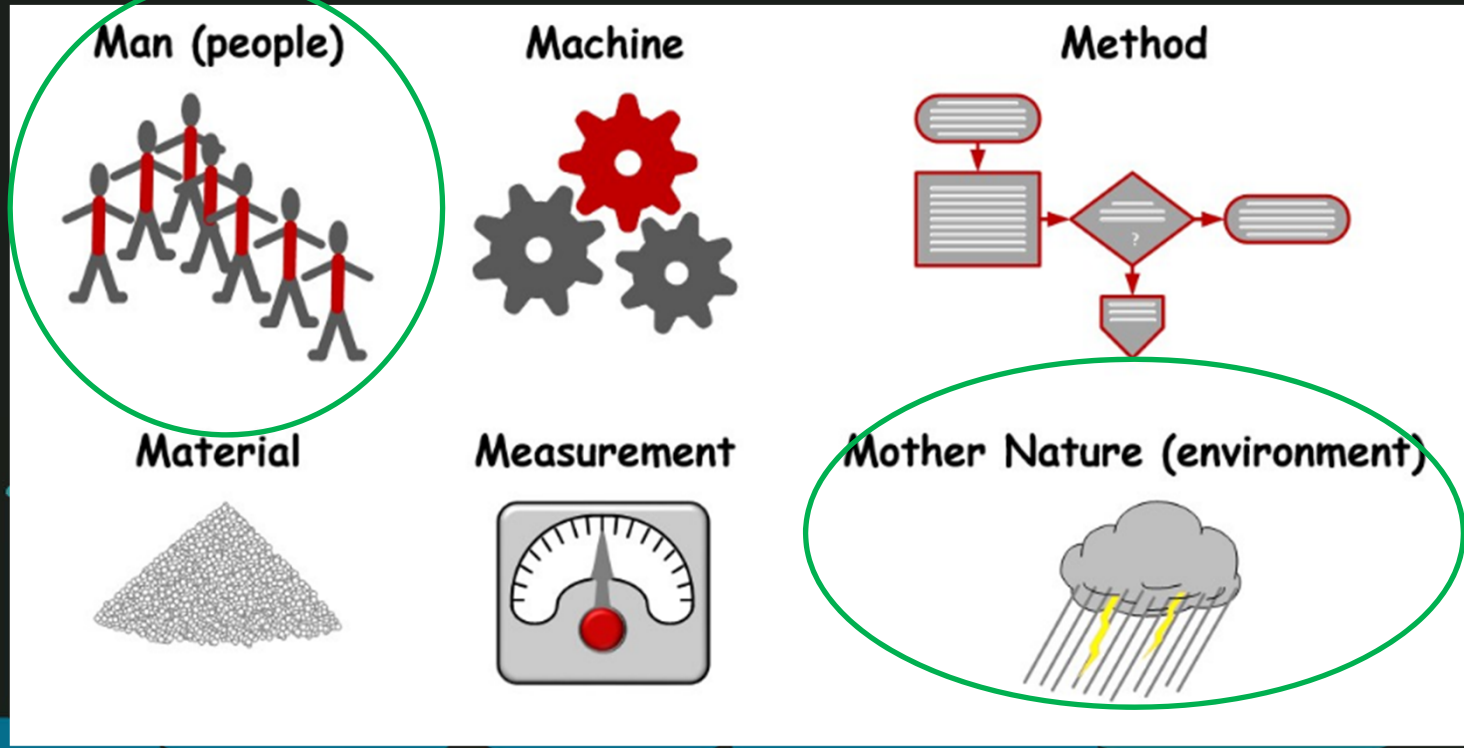
Chief of Service (Pathology), PMH/NLTH

Guangdong second provincial people's hospital

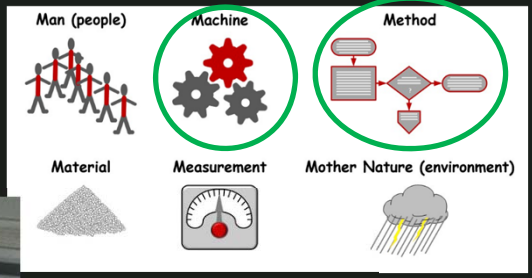
- 1730 beds
- Total staff 3006, post-graduate qualification 935
- master tutors 107
- PHD tutors 13

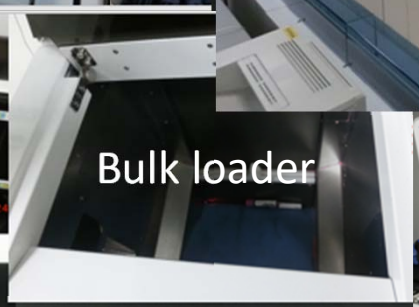
- A Biosafety Level 3 laboratory
- >2000m^3 medical laboratory
- >1000 m^3 animal laboratory

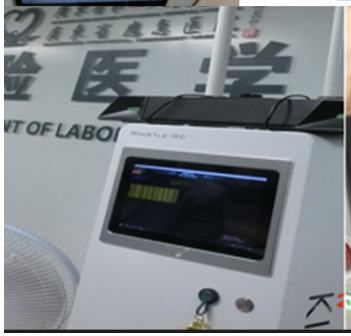
Research and publications, patent application as important resources for hospitals



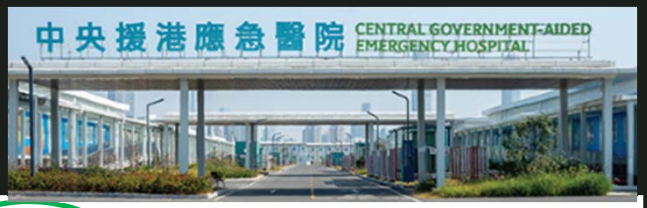
Automation & paperless workflow
- from specimen collection to reporting, storage & QC

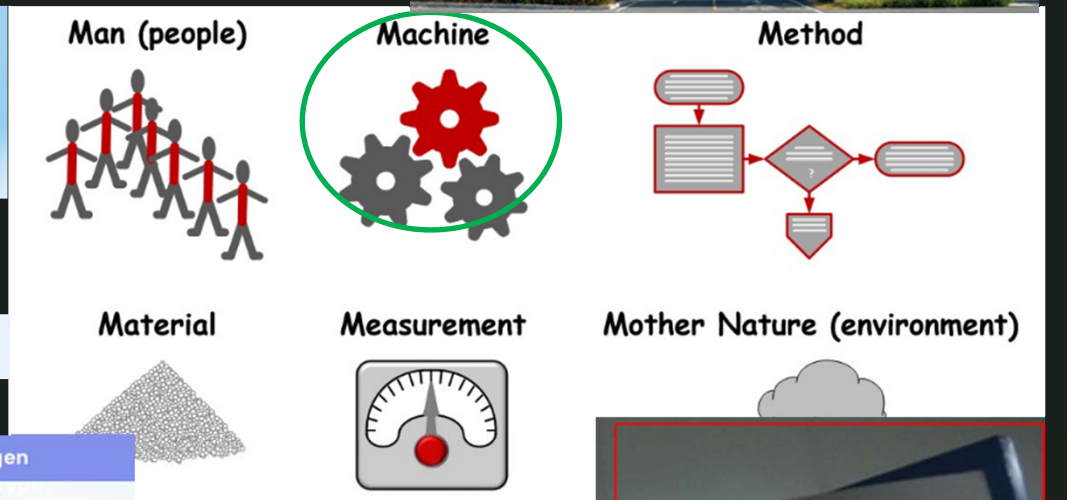




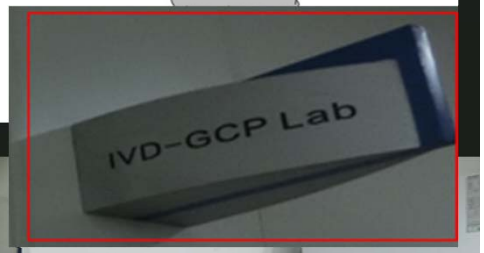


Financial initiatives to evaluate new machines from industries

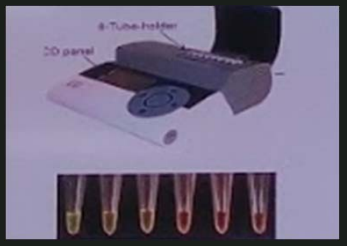




Category	Product Name	Target Pathogen
Respiratory Infections	Respiratory 7 Types Pathogen Multiplex Nucleic Acid Detection Kit	FluA, FluB, RSV, ADV, HRV, HPIV and MP
	Respiratory 8 Types Pathogen Multiplex Nucleic Acid Detection Kit	FluA, FluB, RSV, ADV, HRV, HPIV, MP and SARS-CoV-2
	Respiratory 17 Types Pathogen Multiplex Nucleic Acid Detection Kit	FluA, FluA/H1, FluA/H3, FluB, RSV, ADV, HRV,HPIV1, HPIV2/4, HPIV3, CP, MP, CorHKU1/OC43, CorNL63/229, HMPV, HBoV and SARS-CoV-2
Gastrointestinal Infections	Gastrointestinal Bacteria Virulence Gene Nucleic Acid Detection Kit	21 types of common gastrointestinal bacteria virulence genes including ipaH, cdtA, aggR, eae, O1rfb, ompW, cdtB, stIa, stx2,SEN1383, invA, cdtC, ETEC—lt, tlh, O139rfb, ctxA, foxA, stIb, stxI, STY4669, STM0159
Sexually Transmitted Infections	Human Papilloma Virus (HPV) Multiplex Genotypes Nucleic Acid Detection Kit	18 types of HPV including 16, 18, 26, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68, 73 and 82
	Sexually Transmitted Infections Multiplex Nucleic Acid Detection Kit	9 types of STIs including CT, NG, UU, TV, MG, MH, UP, HSVI, HSVII



Point of Care of Tests (POCT)



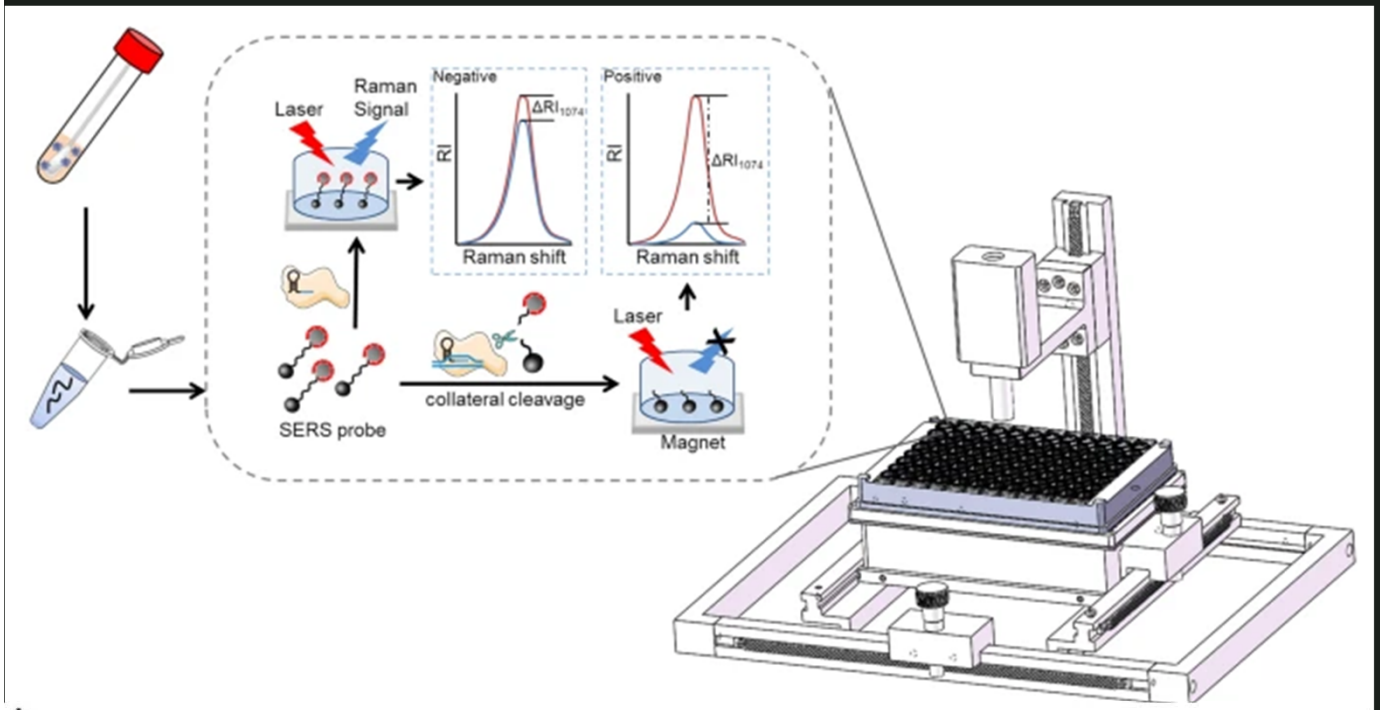
The Third People's Hospital of Shenzhen

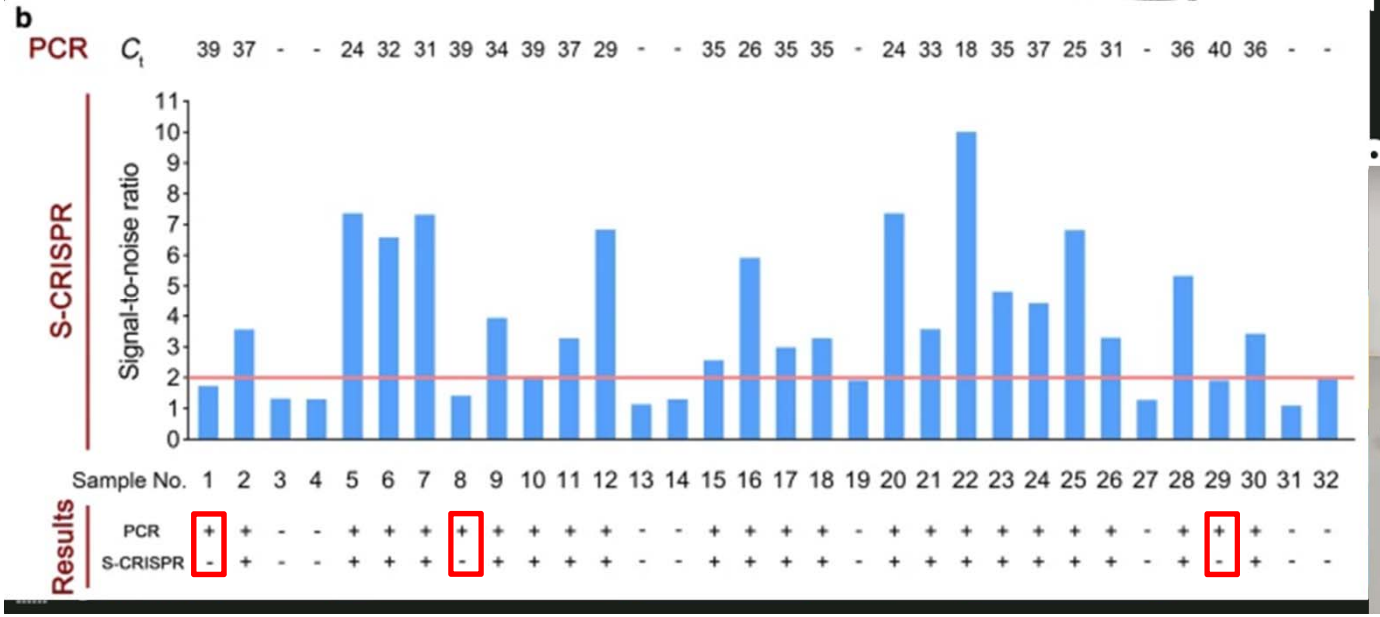
- Self-collection of respiratory specimens and full automation
- Multiplex PCR against 8 pathogens, including SARS-CoV2, *Mycoplasma pneumoniae*, influenza
- 30 minutes analytical time
- LOD 100 copies/mL

Emergency care for disasters/epidemics

- **Gram stain and culture of blood and sterile body fluid**
- **CSF cell count and protein**
- **Procalcitonin and C reactive protein**
- ***HIV, syphilis serology, IL-6, bacterial antigen, Influenza A/B, rotavirus antigen/antibody, Influenza A, B, SARS-CoV2, Vibrio chlorae PCR***
- Loop-Mediated Isothermal Amplification (LAMP) <20 min
  TB, DenV1-4, H7N9, *Legionella pneumophilia*, *Salmonella*

Amplification-free SERS-based CRISPR/Cas12a platform





- metallic nanoscopic surfaces generate Raman enhancement effect: surface-enhanced Raman scattering (SERS)
- Sensitivity 87.5% Specificity 100%
- 30-40 min
- <2 weeks to develop the probe

Liang et al. J Nanobiotechnol (2021) 19:273

Cutting edge technology

A multiplex PCR-dipstick

LOD 10 CFU/mL,

Sensitivity >95% Specificity 100%

>0.97 kappa correlation with DNA sequencing

<2 hours

Canadian Journal of Infectious Diseases and Medical Microbiology
Volume 2023, Article ID 6654504, 7 pages

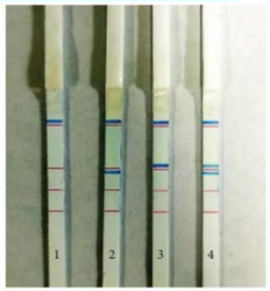


FIGURE 2: Specificity of multiplex PCR-dipstick chromatography. 1: negative control; 2: *M. pneumoniae*; 3: *C. pneumoniae*; 4: joint detection of *M. pneumoniae* and *C. pneumoniae*.

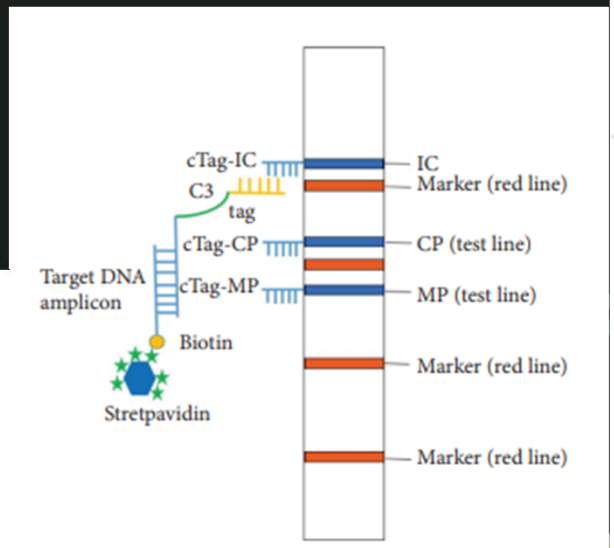
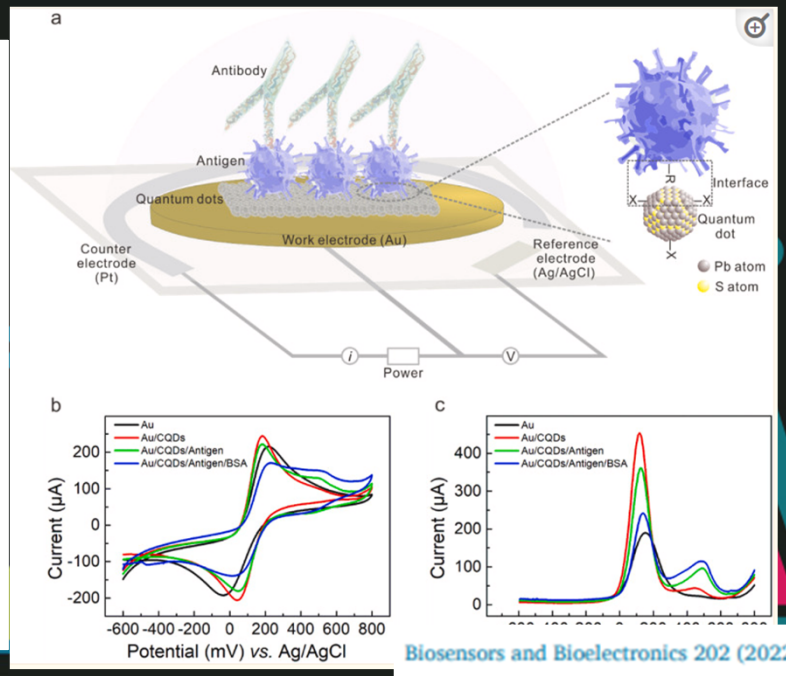


FIGURE 1: The schematic diagram of multiplex PCR-dipstick DNA chromatography.

Protein biosensor employing colloidal quantum dots-modified electrode

- recognize the specific binding reaction between antigen and antibody and then transduce it into significant electrical current.
- correlation coefficient of 93.8% compared to enzyme-linked immunosorbent assay (ELISA)
- Accuracy >90%
- < 1 min by handheld testing system prototype



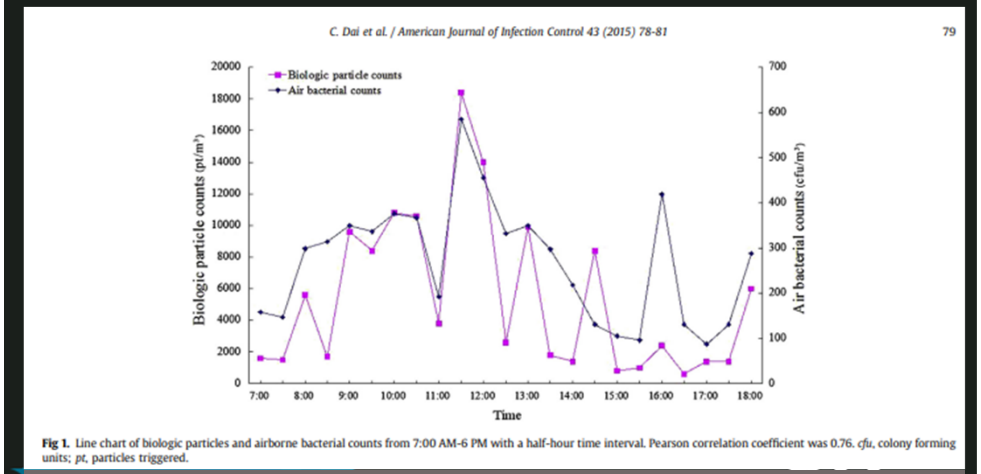
Biosensors and Bioelectronics 202 (2022) 113974

Real time monitoring of POCT samples, critical results handling, quality control


空气智慧感控系统
广东省第二人民医院&森林医院智慧感控系统
Real time monitor of air quality
2023-04-18 09:41:31
全院综合概括
良
57
智慧森林科室
15%
24个
738338次
247263
KW·h
553
良
未检出
2463
Man (people)
Machine
Method
Material
Measurement
Mother Nature (environment)
CFU/m3
SARS-CoV2
E coli
C诊区 ——空气质量监测数据
PM2.5指数
37.84
ug/m³
PM10指数
40.74
标准值
150ug/m³
实际温度
21.4
标准值
26℃
二氧化碳浓度
803.79
标准值
800ppm
设备开启状态监测
设备开启时长统计
区域
A区
B区
C区
D区
VIP区
大厅
一次候诊区
紫外线消毒模块
光等离子杀菌模块
静电除尘模块
91%
88%
83%
95%
60%
100%
100%
消杀效果监测报告

Real time monitor microbial aerosols

Fluorescent biologic particle



- Laser-induced fluorescence to biologic particle (NADH, NADPH and flavins)
- Pearson correlation coefficient 0.76

American Journal of Infection Control 43 (2015) 78-81

SARS-CoV2

Nature Communications | (2023)14:3692

At 0.65V, tyrosine in S protein oxidized & detected by MIE as peak oxidation current

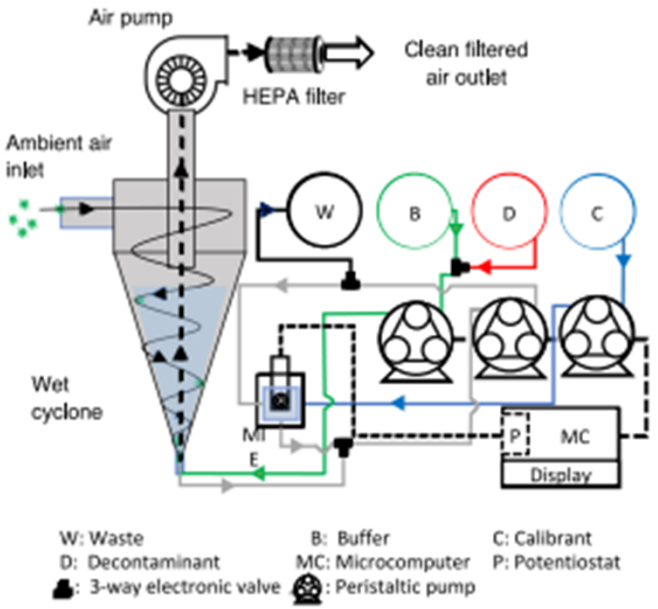
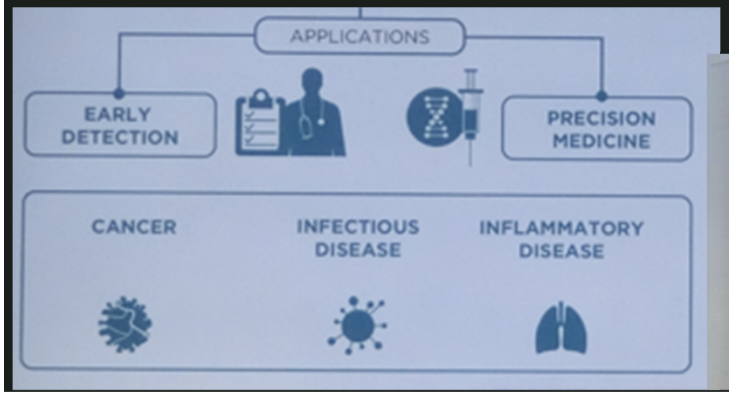


Fig. 1 | The layout of the pAQ monitor. a pAQ monitor schematic showing the wet cyclone PILS coupled with the MIE detection unit comprising a submerged MIE

- 5 min time resolution
- Nanobody (against spike protein)-based ultrasensitive micro-immunoelectrode (MIE) biosensor
- Sensitivity 77-83%, LOD 7-35 RNA copies/m^3

Volatile Organic compounds



- Reflect metabolites of the infecting pathogen or pathogen-induced host responses or a combination of
- exhaled-breath samples are easy to collect
- gas-chromatography and mass-spectrometry (GCMS): analyzing individual compounds vs
- electronic nose (eNose) with pattern-recognition of chemical compounds using multivariate analysis (metal-oxide sensors with changes in conductivity)
- for noninvasive detection and monitoring of infectious diseases.

TABLE 4 Summary of published studies regarding the diagnostic performance of VOC profiles in detecting infectious diseases

Pathogen and disease	Sample source	VOC biomarker (no. of VOCs)[a]	No. of patients[d] DPG	ODG	HCG	Sensitivity/ specificity (%)
Mycobacterium tuberculosis						
TB	Breath	Profile (14)	23[b]	19	59	96/79
Active TB	Breath	Profile (10)	226[c]			84/65
Active TB	Breath	Profile (8)	130		121	72/72
TB	Breath	Profile (7)	50[b]		50	72/86
			21[b]	50		62/84
Pseudomonas aeruginosa						
Lung infection in patients	Breath	Profile (21)	24		29	89/77
with CF	Breath	Profile (14)	48		57	100/100
CF and non-CF brochiectasis	Sputum	Profile (17)	32	28	12	91/88

[a] Numbers in parentheses indicate the number of discriminatory VOCs.
[b] TB culture positive.
[c] Suspected TB.
[d] DPG, disease patient group; ODG, other diseases group; HCG, healthy control group.

Clinical Microbiology Reviews p. 462–475 July 2013 Volume 26 Number 3

COVID-19 FDA approved May 2022

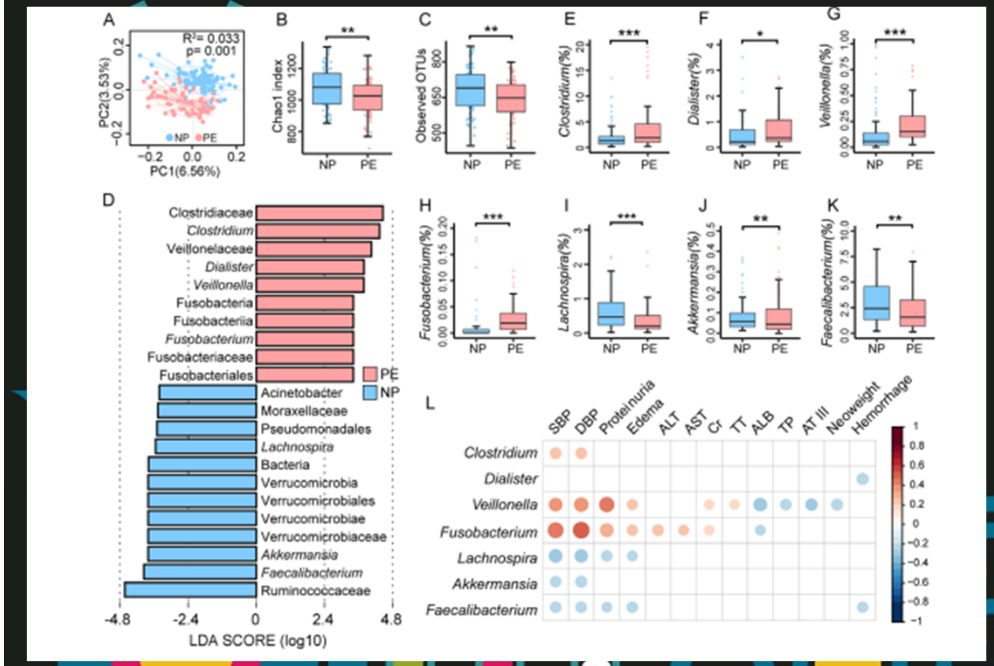
Studies, y	Annotation	True Positive (TP)	False Negative (FN)	False Positive (FP)	True Negative (TN)	Total Sample	Sensitivity (Sn; %)	Specificity (Sp; %)
Wintjens *et al.* 2020	N/A	49	8	75	87	219	86	53.7
Berna *et al* 2020	N/A	10	0	5	10	25	100	66.6
Grassin-Delyle *et al* 2020	N/A	25	3	1	11	40	90	94
Vries *et al* 2020	Validation Set	871	0	7	26	904	100	78.8
	Replication Set	1711	7	46	184	1948	99.6	80
	Asymptomatic Set	689	15	11	39	754	97.9	78
Ruszkiewicz *et al* 2020	Edinburgh Set	17	4	3	9	33	81	75
	Dortmund Set	9	1	11	44	65	90	80
Shan *et al* 2020	COVID-19 vs Control Testing Set	11	0	7	11	29	100	61.1
	COVID-19 vs Lung Infection Testing Set	12	0	1	9	22	100	90

Diagnostic Microbiology and Infectious Disease 102 (2022) 115589

Gut Microbiome research – the paradigm shift

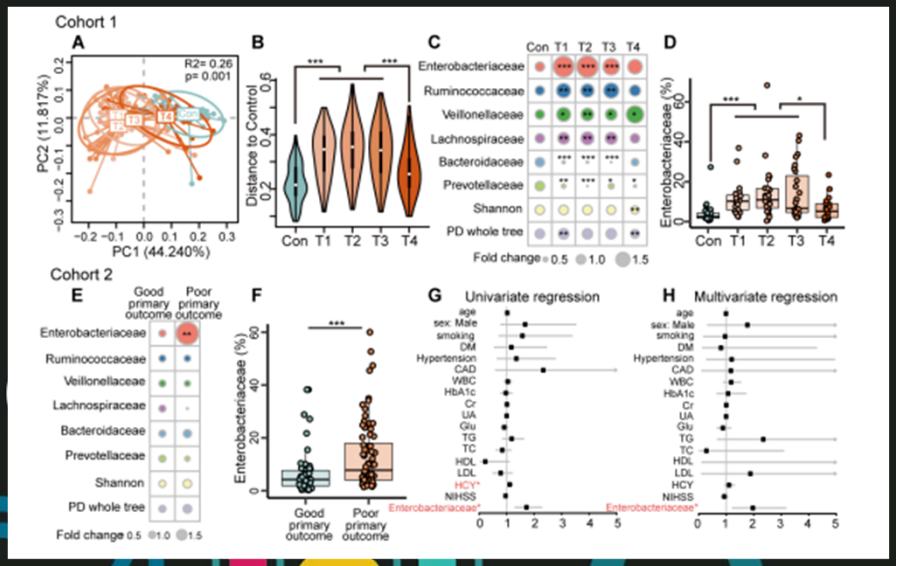
Gut dysbiosis induces the development of pre-eclampsia through bacterial translocation

Chen X, *et al. Gut* 2020;**69**:513–522. doi:10.1136/gutjnl-2019-319101

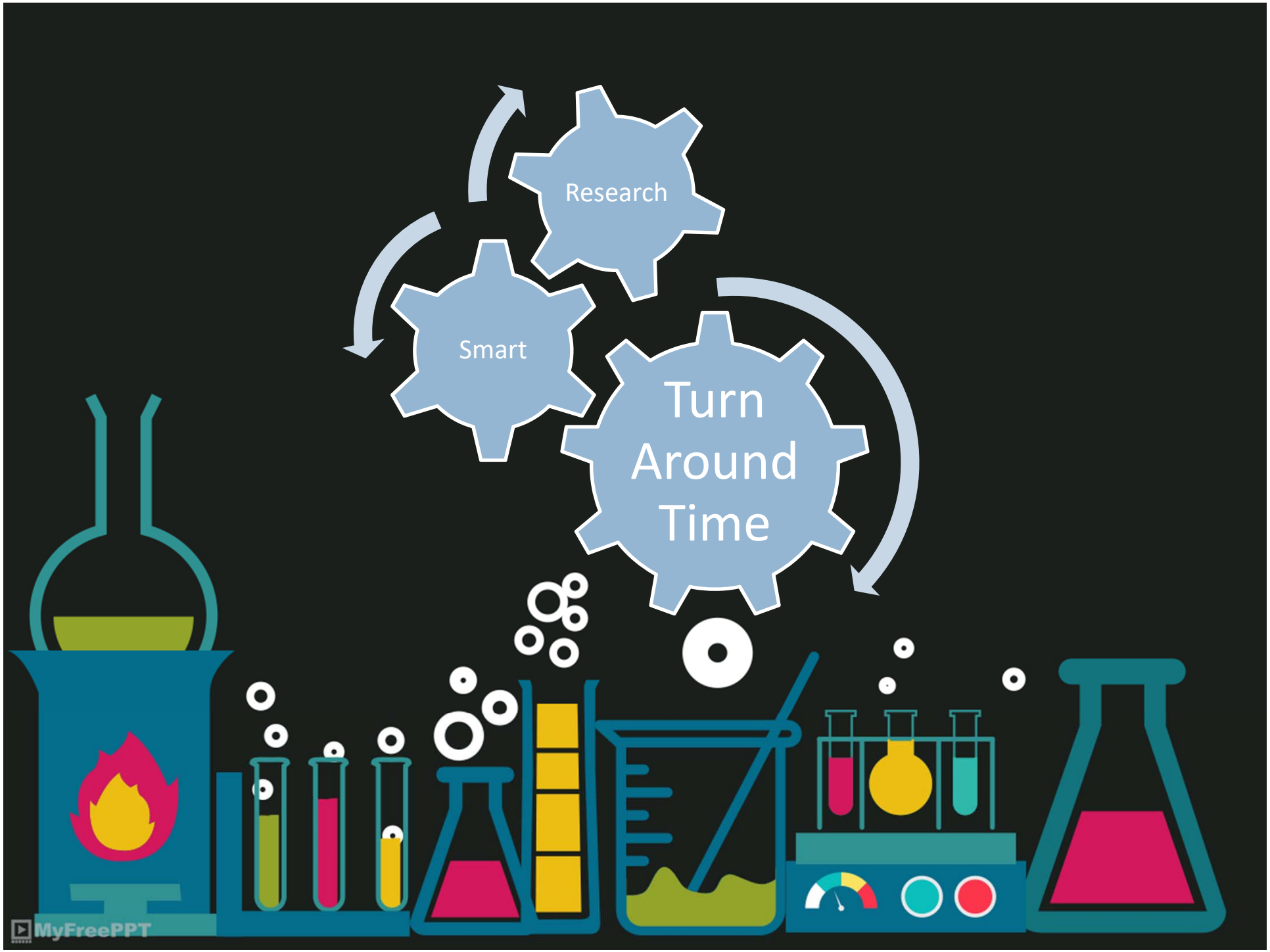


Rapid gut dysbiosis induced by stroke exacerbates brain infarction in turn

Xu K, *et al. Gut* 2021;**0**:1–9. doi:10.1136/gutjnl-2020-323263



Replicate the same result in mice models by FMT


Research
Smart
Turn Around Time
MyFreePPT