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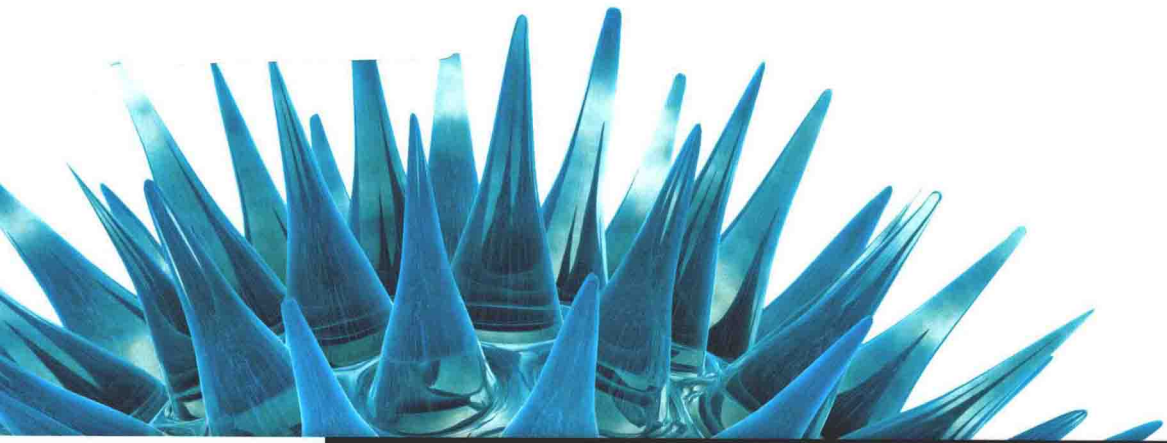
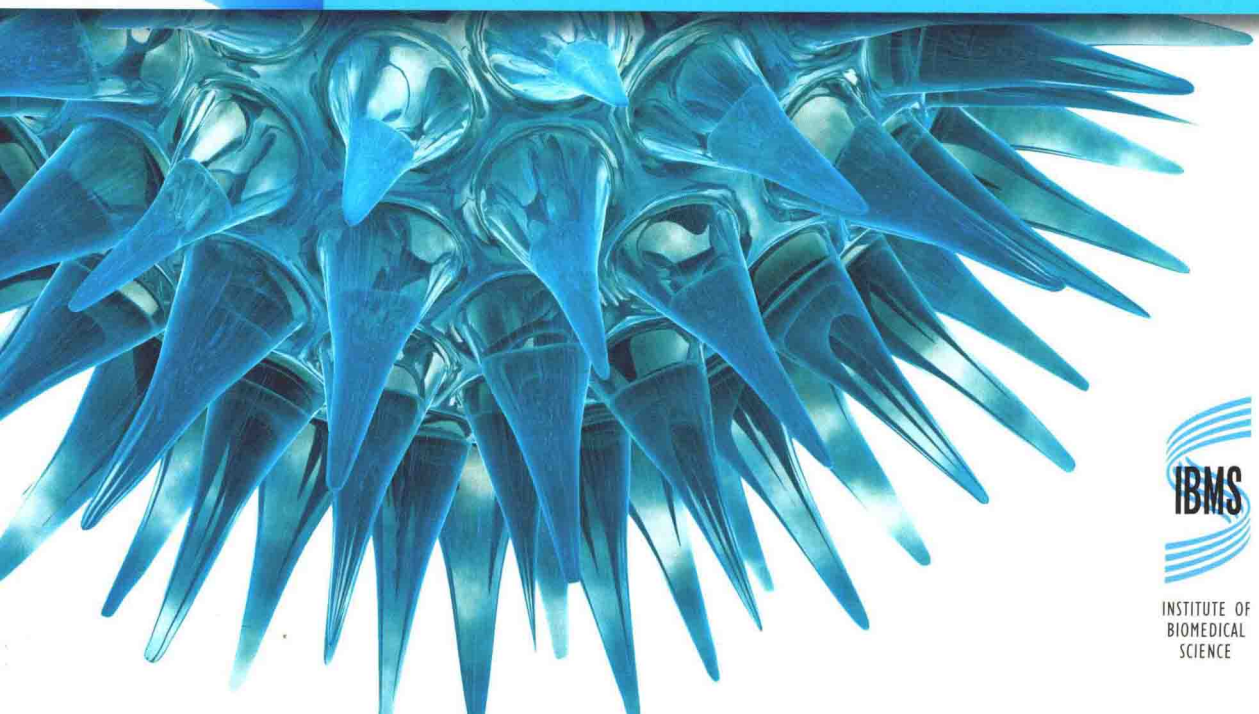


MEDICAL MICROBIOLOGY

EDITED BY Michael Ford

SECOND EDITION



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Medical Microbiology

Second edition

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Edited by

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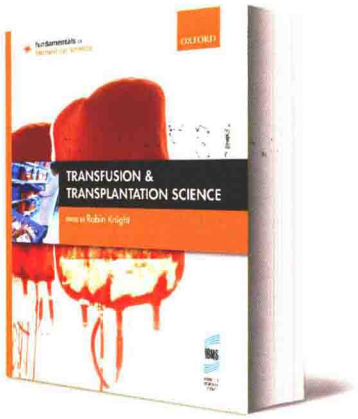

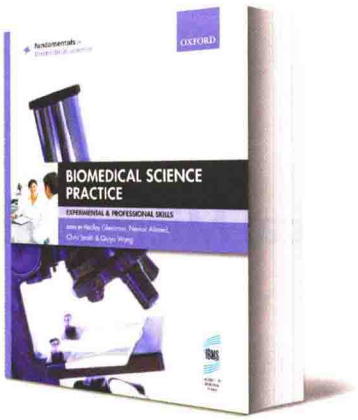

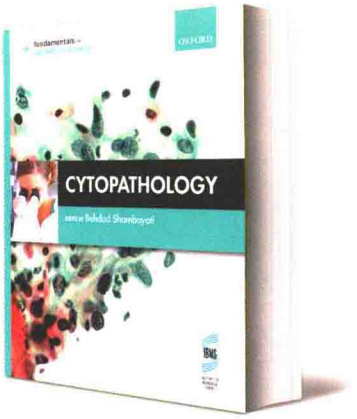

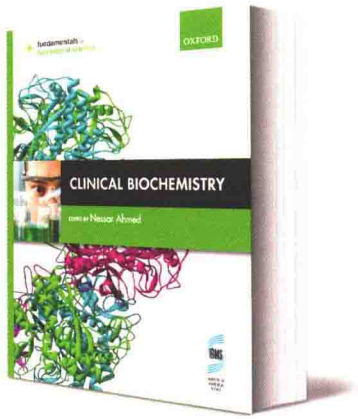

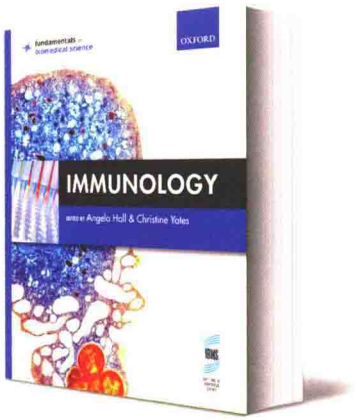

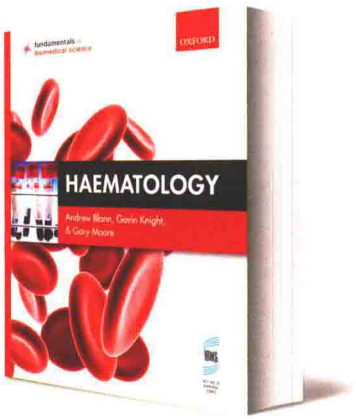

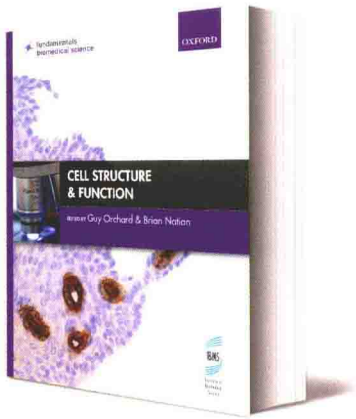

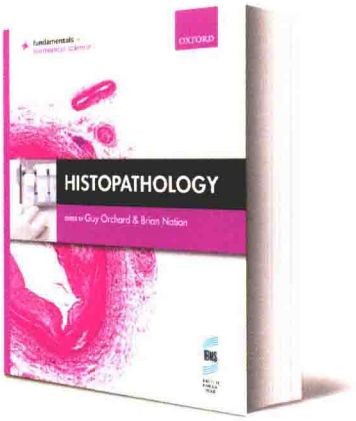

fundamentals OF
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An introduction to the Fundamentals of Biomedical Science series

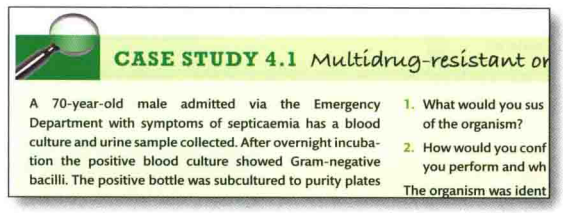
Biomedical scientists form the foundation of modern healthcare, from cancer screening to diagnosing HIV, from blood transfusion for surgery to infection control. Without biomedical scientists, the diagnosis of disease, the evaluation of the effectiveness of treatment, and research into the causes and cures of disease would not be possible. However, the path to becoming a biomedical scientist is a challenging one: trainees must not only assimilate knowledge from a range of disciplines, but must understand–and demonstrate–how to apply this knowledge in a practical, hands-on environment.

The *Fundamentals of Biomedical Science* series is written to reflect the challenges of biomedical science education and training today. It blends essential basic science with insights into laboratory practice to show how an understanding of the biology of disease is coupled to the analytical approaches that lead to diagnosis. Produced in collaboration with the Institute of Biomedical Science, the series provides coverage of the full range of disciplines to which a biomedical scientist may be exposed.

Learning from this series

The *Fundamentals of Biomedical Science* series draws on a range of learning features to help readers master both biomedical science theory, and biomedical science practice.

Case Studies illustrate how the biomedical science theory and practice presented throughout the series relate to situations that are likely to be encountered routinely in the biomedical science laboratory.

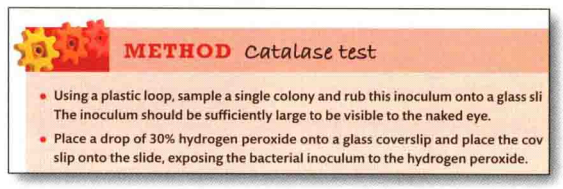

CASE STUDY 4.1 Multidrug-resistant or

A 70-year-old male admitted via the Emergency Department with symptoms of septicaemia has a blood culture and urine sample collected. After overnight incubation the positive blood culture showed Gram-negative bacilli. The positive bottle was subcultured to purity plates

1. What would you sus of the organism?
2. How would you conf you perform and wh

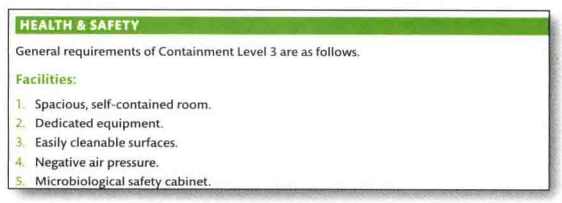
The organism was ident

Method boxes walk through the key protocols that the reader is likely to come across in the laboratory.


METHOD Catalase test

- Using a plastic loop, sample a single colony and rub this inoculum onto a glass sli The inoculum should be sufficiently large to be visible to the naked eye.
- Place a drop of 30% hydrogen peroxide onto a glass coverslip and place the cov slip onto the slide, exposing the bacterial inoculum to the hydrogen peroxide.

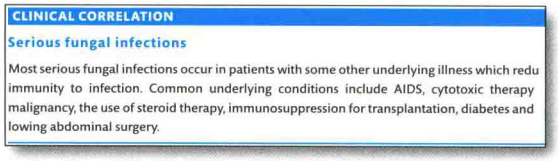
Health and Safety boxes raise awareness of key health and safety issues related to topics being discussed with which the reader should be familiar.


HEALTH & SAFETY

General requirements of Containment Level 3 are as follows.

Facilities:

1. Spacious, self-contained room.
2. Dedicated equipment.
3. Easily cleanable surfaces.
4. Negative air pressure.
5. Microbiological safety cabinet.

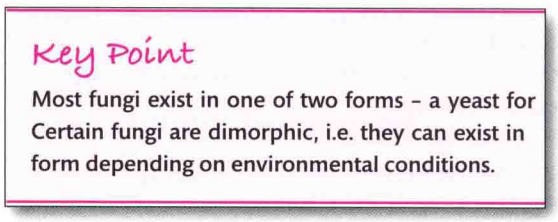

CLINICAL CORRELATION

Serious fungal infections

Most serious fungal infections occur in patients with some other underlying illness which redu immunity to infection. Common underlying conditions include AIDS, cytotoxic therapy malignancy, the use of steroid therapy, immunosuppression for transplantation, diabetes and lowing abdominal surgery.

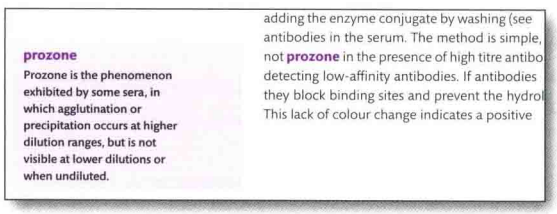
Clinical Correlation boxes emphasize at a glance how the material sits in a clinical context.

Further features are used to help consolidate and extend students' understanding of the subject


Key Point

Most fungi exist in one of two forms – a yeast for Certain fungi are dimorphic, i.e. they can exist in form depending on environmental conditions.

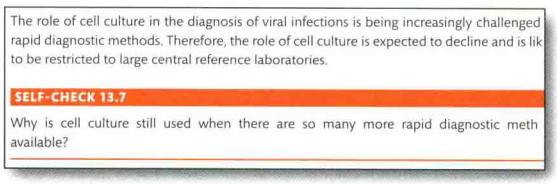
Key points reinforce the key concepts that the reader should master as they work through each chapter, while **Summary** points act as an end-of-chapter checklist for readers to verify that they have remembered the principal themes and ideas presented within the chapter.


prozone

Prozone is the phenomenon exhibited by some sera, in which agglutination or precipitation occurs at higher dilution ranges, but is not visible at lower dilutions or when undiluted.

adding the enzyme conjugate by washing (see antibodies in the serum. The method is simple, not **prozone** in the presence of high titre antibo detecting low-affinity antibodies. If antibodies they block binding sites and prevent the hydrol This lack of colour change indicates a positive

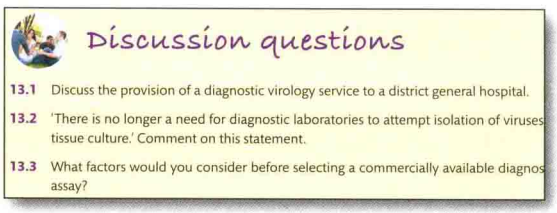
Key terms in the margins provide instant definitions of terms with which the reader may not be familiar; in addition, each title in the series features a **glossary**, in which the key terms featured in that title are collated.


The role of cell culture in the diagnosis of viral infections is being increasingly challenged rapid diagnostic methods. Therefore, the role of cell culture is expected to decline and is lik to be restricted to large central reference laboratories.

SELF-CHECK 13.7

Why is cell culture still used when there are so many more rapid diagnostic meth available?

Self-check questions throughout each chapter provide the reader with a ready means of checking that they have understood the material they have just encountered; answers to self-check questions are presented at the end of each volume.

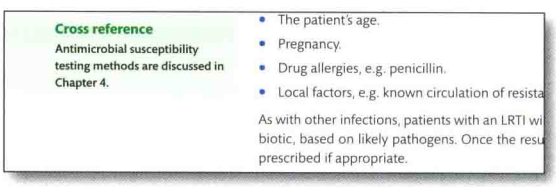

Discussion questions

13.1 Discuss the provision of a diagnostic virology service to a district general hospital.

13.2 'There is no longer a need for diagnostic laboratories to attempt isolation of viruses tissue culture.' Comment on this statement.

13.3 What factors would you consider before selecting a commercially available diagnos assay?

Discussion questions are provided at the end of each chapter, to encourage the reader to analyse and reflect on the material they have just read. Hints and tips for answering the discussion questions are provided at the end of each book.


Cross reference

Antimicrobial susceptibility testing methods are discussed in Chapter 4.

- The patient's age.
- Pregnancy.
- Drug allergies, e.g. penicillin.
- Local factors, e.g. known circulation of resista

As with other infections, patients with an LRTI wi biotic, based on likely pathogens. Once the resu prescribed if appropriate.

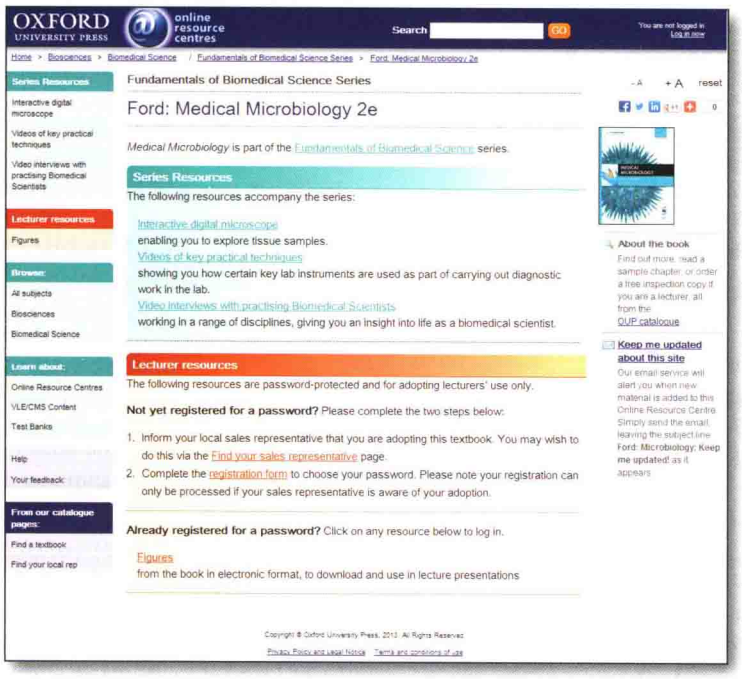
Cross references help the reader to see biomedical science as a unified discipline, making connections between topics presented within each volume, and across all volumes in the series.

Online learning materials

Each title in the *Fundamentals of Biomedical Science* series is supported by an Online Resource Centre, which features additional materials for students, trainees, and lecturers.

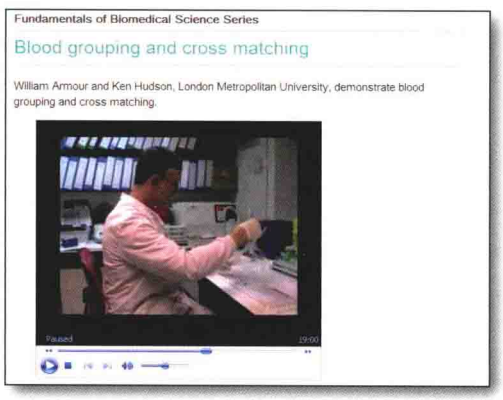
www.oxfordtextbooks.co.uk/orc/fbs

online resource centre



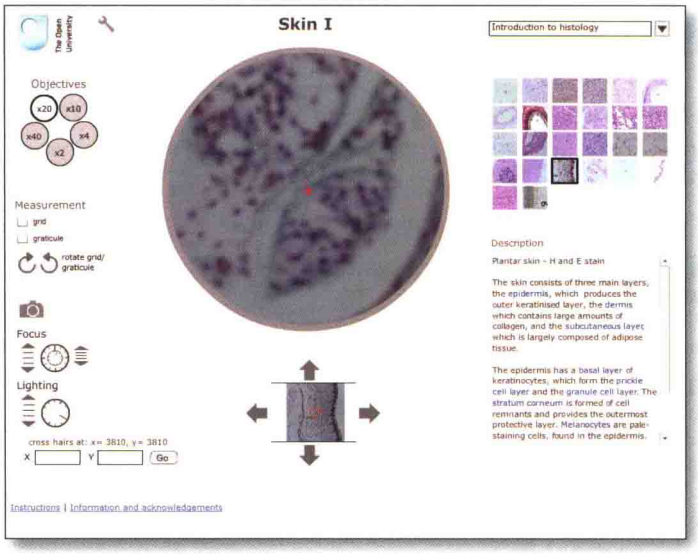
Guides to key experimental skills and methods

Video walk-throughs of key experimental skills are provided to help you master the essential skills that are the foundation of biomedical science practice.



Biomedical science in practice

Interviews with practicing biomedical scientists working in a range of disciplines give a valuable insight into the reality of work in a biomedical science laboratory.



Virtual microscope

Visit the library of microscopic images and investigate them with the powerful online microscope, to help gain a deeper appreciation of cell and tissue morphology.

Lecturer support materials

The Online Resource Centre for each title in the series also features figures from the book in electronic format, for registered adopters to download for use in lecture presentations, and other educational resources.

To register as an adopter visit **www.oxfordtextbooks.co.uk/orc/fbs** and follow the on-screen instructions.

Any comments?

We welcome comments and feedback about any aspect of this series. Just visit www.oxfordtextbooks.co.uk/orc/fbs and share your views.

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Abbreviations

4-MeU	4-methylumbelliferone
7-AMC	7-amido-4-methylcoumarin
AAFB	acid–alcohol-fast bacilli
ABHG	alcohol-based hand gels
ABPA	allergic bronchopulmonary aspergillosis
ACDP	Advisory Committee on Dangerous Pathogens
ACV	acyclovir
ADH	arginine dihydrolyase
ADPR	adenosine diphosphate
ADPR	ADP-ribose
A/E	attaching and effacing
AFB	acid-fast bacilli
AIDS	acquired immune deficiency syndrome
API	analytical profile index
ASO	antistreptolysin O
ATCC	American Type Culture Collection
ATP	adenosine triphosphate
AUC	area under curve
AZT	azidothymidine
β-HS	β-haemolytic streptococci
BAL	bronchoalveolar lavage
Bcc	*Burkholderia cepacia* complex
BCG	Bacille Calmette–Guérin
BCR	B-cell receptor
BCYE	buffered charcoal yeast extract
bDNA	branched DNA
BEAV	bile esculin azide vancomycin
BEB	bile esculin broth
BHI	brain heart infusion
BSAC	British Society for Antimicrobial Chemotherapy
BV	bacterial vaginosis
C390	9-chloro-9-(4-diethylaminophenyl)-10-phenylacridan
cAMP	cyclic adenosine monophosphate
CAPD	continuous ambulatory peritoneal dialysis
CAT	chloramphenicol acetyltransferase
cCTP	deoxycytidine triphosphate
CDC	Centers for Disease Control
CDC	cholesterol-dependent cytolysin
CF	cystic fibrosis
CFT	complement fixation test
CFTR	cystic fibrosis transmembrane conductance regulator
CFU	colony forming units
cGMP	cyclic guanosine monophosphate
CLED	cysteine lactose electrolyte deficient
CLSI	Clinical Laboratory Standards Institute
CMV	cytomegalovirus
CNS	coagulase-negative *Staphylococcus*
COSHH	Control of Substances Hazardous to Health
CPE	cytopathic effect
CRP	C-reactive protein
CSF	cerebrospinal fluid
CSU	catheter stream urine
CT	computed tomography
CV	coefficient of variation
CVA	cerebrovascular accident
DAEC	diffusely adherent *E. coli*
DAG	diacylglycerol
dATP	deoxyadenosine triphosphate
DCA	deoxycholate citrate agar
DFA	direct fluorescent antibody
DGI	disseminated gonococcal infection
dGTP	deoxyguanosine triphosphate
DNA	deoxyribonucleic acid
DNase	deoxyribonuclease
dNTP	deoxyribonucleotide triphosphate
DTT	dithiothreitol
dTTP	deoxythymidine triphosphate
EAEC	enteroaggregative *E. coli*
EBV	Epstein–Barr virus
ECM	extracellular matrix
EDTA	ethylenediaminetetraacetic acid
EF-2	elongation factor 2
EHEC	enterohaemorrhagic *E. coli*
EHO	Environmental Health Officer
EIA	enzyme immunoassay
EIEC	enteroinvasive *E. coli*

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ELISA	enzyme-linked immunosorbent assay
EM	electron microscopy
EPEC	enteropathogenic *E. coli*
EPS	exopolysaccharide
EPU	eyepiece units
ESBL	extended spectrum β-lactamase
ETEC	enterotoxigenic *E. coli*
E-Test	epsilometer test
EUCAST	European Committee on Antimicrobial Susceptibility Testing
FEC	formalin–ether concentration
FIC	fractional inhibitory concentration
FPIA	fluorescence polarization immunoassay
GAP	GTPase activating protein
GC	guanylate cyclase
GDI	guanine nucleotide dissociation inhibitor
GDP	guanosine diphosphate
GEF	guanine nucleotide exchange factor
GI	gastrointestinal
G6PD	glucose-6-phosphate dehydrogenase
GP	General Practitioner
GTP	guanosine triphosphate
GU	genitourinary
GUM	genitourinary medicine
HA	haemagglutination
HACEK	group of CO_2-dependent organisms – *Haemophilus* spp., *Aggregatibacter actinomycetemcomitans* (previously named *Actinobacillus*), *Cardiobacterium hominis*, *Eikenella corrodens*, and *Kingella* spp.
HAI	health-care-acquired infection
HAV	hepatitis A virus
HBV	hepatitis B virus
HCAI	health-care-acquired infection
HCV	hepatitis C virus
HEPA	high efficiency particulate absorption
Hib	*Haemophilus influenzae* type b
HIV	human immunodeficiency virus
HPLC	high-performance liquid chromatography
HPU	Health Protection Unit
HSV	herpes simplex virus
HVS	high vaginal swab
IA	invasive aspergillosis
IATA	International Air Transport Authority
ICU	Intensive Care Unit
IE	infective endocarditis
IFAT	indirect fluorescent antibody test
IgA	immunoglobulin A
IgG	immunoglobulin G
IgM	immunoglobulin M
I3P	inositol trisphosphate
INF	interferon
IL	interleukin
ISTB	Iso-Sensitest broth
IUCD	intrauterine contraceptive device
KES	*Klebsiella–Enterobacter–Serratia*
KOH	potassium hydroxide
LAP	leucyl aminopeptidase
LCR	ligase chain reaction
LD50	median lethal dose
LD50	median time to death
LEE	locus of enterocyte effacement
LJ	Löwenstein–Jensen
LOS	lipooligosaccharide
LRTI	lower respiratory tract infection
LV-PVA	low viscosity polyvinyl alcohol
MAC	*Mycobacterium avium* complex
MAC	membrane attack complex
MAMP	microbial associated molecular pattern
MAPK	mitogen-activated protein kinase
MBC	minimum bactericidal concentration
MDR	multidrug resistant
MHB	Mueller–Hinton broth
MHC	major histocompatibility complex
MIC	minimum inhibitory concentration
MICE	minimum inhibitory concentration evaluation
MIRU-VNTR	mycobacterial interspersed repetitive units variable number tandem repeats
MRSA	methicillin-resistant *Staphylococcus aureus*
MSA	mannitol salt agar
MSCRAMM	microbial surface components recognizing adhesive matrix molecules
MSU	midstream urine
MSM	men who have sex with men
MTB	*Mycobacterium tuberculosis*
NAAT	nucleic acid amplification test
NAC	*N*-acetyl-L-cysteine
NAD	nicotinamide adenine dinucleotide
NCTC	National Collection of Type Cultures

NEQAS	National External Quality Assurance Schemes
NHS	National Health Service
NNT	number needed to treat
NOD	nucleotide oligomerization domain
NPA	nasopharyngeal aspirate
NSU	non-specific urethritis
O129	2,4-diamino-6,7-diisopropylpteridine phosphate
ONPG	*o*-nitrophenyl-β-d-galactopyranoside
PABA	*para*-aminobenzoic acid
PBP	penicillin-binding protein
PCP	*Pneumocystis jirovecii* pneumonia
PCR	polymerase chain reaction
PID	pelvic inflammatory disease
PIP2	phosphatidylinositol-4,5-biphosphate
PK	protein kinase
PMC	pseudomembranous colitis
p-NA	*para*-nitroaniline
POC	products of conception
PPE	personal protective equipment
PRR	pattern recognition receptor
PUO	pyrexia of unknown origin
PVC	polyvinyl chloride
PVE	prosthetic valve endocarditis
PVL	Panton–Valentine leukocidin
RAPD	random amplified polymorphic DNA
RBC	red blood cell
RCA	regulators of complement activation
RFLP	amplified fragment length polymorphism
RNA	ribonucleic acid
RPR	rapid plasma reagin
RSV	respiratory syncytial virus
RT-PCR	real-time PCR
SAF	sodium acetate–acetic acid–formalin
SAH	subarachnoid haemorrhage
SCBU	Special Care Baby Unit
SDA	strand displacement amplification
SIC	streptococcal inhibitor of complement
SM-ID	*Salmonella* identification
SPA	suprapubic aspirate
SPS	sodium polyethanol sulphonate
STI	sexually transmitted infection
SU	stage unit
TAA	trimeric autotransporter adhesin
TB	tuberculosis
TCBS	thiosulphate citrate bile salt sucrose agar
TCR	T-cell receptor
TLR	Toll-like receptor
TPHA	*Treponema pallidum* haemagglutination
TPPA	*Treponema pallidum* particle agglutination
T3SS	type III secretion system
TSS	toxic shock syndrome
TSST	toxic shock syndrome toxin
TST	tuberculin skin test
TV	*Trichomonas vaginalis*
UBA	urine bacterial analysis
UCP	urine collection pad
UPEC	uropathogenic *E. coli*
UTI	urinary tract infection
UV	ultraviolet
VDRL	Venereal Disease Reference Laboratory
VHF	viral haemorrhagic fever
VP	Voges–Proskauer
VRE	vancomycin-resistant *Enterococcus*
VTEC	verocytotoxin-producing *E. coli*
VZV	varicella zoster virus
WBC	white blood cell
WHO	World Health Organization
WD	washer disinfector
XLD	xylose lysine deoxycholate
ZN	Ziehl–Neelsen

Contents

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