

NATIONAL STANDARD METHOD

INVESTIGATION OF TISSUES AND BIOPSIES

BSOP 17

Issued by Standards Unit, Department for Evaluations, Standards and Training
Centre for Infections



Scottish Microbiology Forum

Association of Medical Microbiologists
Association of Medical Microbiologists
Association of Medical Microbiologists

INVESTIGATION OF TISSUES AND BIOPSIES

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AMENDMENT PROCEDURE

Controlled document reference	BSOP 17
Controlled document title	Investigation of tissues and biopsies

Each National Standard Method has an individual record of amendments. The current amendments are listed on this page. The amendment history is available from standards@hpa.org.uk.

On issue of revised or new pages each controlled document should be updated by the copyholder in the laboratory.

Amendment Number/ Date	Issue no. Discarded	Insert Issue no.	Page	Section(s) involved	Amendment
7/ 03.12.09	5	5.1	1 8	Front page Technical Information/Limitations 1.2 Specimen transport and storage	SMF logo added The term "CE marked leak proof container" replaces "sterile leak proof container"; endnote ^a added to clarify the change and referenced to IVD Directive 98/79/EC

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Types of specimens: Tissue
Biopsy

SCOPE OF DOCUMENT

This National Standard Methods (NSMs) describes the processing and bacteriological investigation of tissues and biopsies.

INTRODUCTION

A biopsy may be defined as a portion of tissue removed from the living body for further examination. With the increasing sophistication of clinical imaging and sampling devices there are few organs in the human body that cannot be biopsied. Tissue obtained at operation is particularly precious as the sampling procedure may not be repeatable. Ideally these specimens should be discussed with the laboratory prior to sampling to ensure that transport and processing are timely and appropriate tests are performed.

Biopsies and other tissue samples are obtained in three main ways:

- 1) As a closed procedure usually through the skin (eg needle biopsy). Percutaneous biopsy samples are associated with particular problems. They are often very small, may miss the infected lesion and may be contaminated with skin flora
- 2) As an open procedure at operation (eg during debridement of devitalised or infected tissue). Tissue obtained at operation is generally more rewarding to deal with, particularly when the purpose of surgery is to remove infected tissue
- 3) At post mortem (eg tissue from the lungs of a patient with pneumonia). In many cases the primary purpose of sampling is to obtain tissue for histological examination. The microbiological yield from such samples is often low and they are commonly contaminated with enteric flora. Careful clinical interpretation of such isolates is required because they are often not significant

Biopsies may be taken from chronically infected tissues and so require investigation for fungi, mycobacteria ([BSOP 40 - Investigation of specimens for *Mycobacterium* species](#)) or parasites ([BSOP 31 - Investigation of specimens other than blood for parasites](#)). Histological investigation will often inform the decision to investigate for particular classes of infection. For instance, the presence of caseating granulomata should raise the suspicion of tuberculous infection; similar appearances may be caused by deep fungal infection on occasion.

Specific tissues

Heart valves

Heart valves are submitted from patients with infective endocarditis undergoing valve replacement or at post mortem. Infected prosthetic valves may also be sent for culture. Where possible the results of these cultures should be correlated with blood cultures or serology.

Donor heart valves or cornea rims

Donor heart valves or cornea rims need to be screened for bacterial infection prior to implantation.

Corneas

Corneas should be examined in cases where deep seated eye infection is suspected.

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Aortic aneurysm contents

Aortic aneurysm contents may be sent for the exclusion of an infective cause².

Tissue adjacent to prosthetic joints

Tissue adjacent to prosthetic joints is often cultured at the time of revision to exclude infection. By collecting multiple operative samples and by the use of an agreed protocol it is possible to predict which joints are genuinely infected and advise on treatment ([BSOP 44 - Investigation of prosthetic joint infection samples](#)).

Bone samples

Bone samples may be submitted from cases of osteomyelitis (for more information see [BSOP 42 - Investigation of bone and soft tissue associated with osteomyelitis](#)). This is a progressive infective process involving the various components of bone. It may be acute or chronic. Diagnosis can be made by isolation of the causative organism from a biopsy of the bone involved. Blood cultures may aid diagnosis (see [BSOP 37 - Investigation of blood cultures \(for organisms other than *Mycobacterium* species\)](#)).

Artificial materials

Artificial materials may also be sent to the laboratory for investigation. Such materials include prosthetic cardiac valves, pacemakers, grafts, artificial joints and tissue implants.

Gastric biopsies

Gastric biopsies are investigated for the presence of *Helicobacter pylori* ([BSOP 55 - Investigation of gastric biopsies for *Helicobacter pylori*](#)).

Rectal biopsies

Rectal biopsies may be submitted for detection of parasites such as *Entamoeba histolytica*, *Schistosoma mansoni* and *Schistosoma japonicum*. Small bowel (usually jejunal) biopsies may detect *Giardia lamblia* and microsporidia ([BSOP 31 - Investigation of specimens other than blood for parasites](#)).

Skin biopsies

Skin biopsies may be submitted for the investigation of tissue parasites such as *Onchocerca volvulus*, *Mansonella streptocerca* and *Leishmania* species ([BSOP 31 - Investigation of specimens other than blood for parasites](#)). They are also used to confirm cases of swimming pool or fish tank granuloma, a chronic skin infection which results from infection with *Mycobacterium marinum*, and is associated with injury and contact with water in swimmers and keepers of tropical fish³ ([BSOP 40 - Investigation of specimens for *Mycobacterium* species](#)).

Lung biopsies (percutaneous, bronchoscopic, surgical or post mortem)

Lung biopsies may be useful for infections caused by *Legionella* species ([BSOP 47 - Investigation of specimens for *Legionella* species](#)), *Mycobacterium* species (see [BSOP 40 - Investigation of specimens for *Mycobacterium* species](#)), fungi, especially *Aspergillus* species, *Nocardia* species and *Pneumocystis jiroveci*. Pneumocystis pneumonia (PCP) occurs almost exclusively in patients who are immunocompromised. PCP may be diagnosed less invasively, but usually with reduced sensitivity, by processing induced sputum or bronchoalveolar lavage specimens.

Excised lymph nodes

Excised lymph nodes are submitted for investigation of lymphadenitis, particularly suspected mycobacterial lymphadenitis. The most common cause in children under 15 years old is mycobacteria other than *Mycobacterium tuberculosis* (MOTT), notably *Mycobacterium avium-intracellulare*⁴. However, *Mycobacterium tuberculosis* may also be isolated^{4,5} from these and older patients (see [BSOP 40 - Investigation of specimens for *Mycobacterium* species](#)). Other important causes of lymphadenitis are toxoplasmosis; cat scratch disease which is caused by *Bartonella henselae*, a Gram-negative organism endemic among domestic cats; and lymphogranuloma venereum - a

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sexually transmitted chlamydial infection of the tropics. All of these conditions are perhaps best diagnosed by a combination of histological and serological investigations, coupled with molecular diagnostic testing where available (eg PCR for Toxoplasma genome, offered by the Toxoplasma Reference Laboratory http://www.hpa.org.uk/cfi/other_ref_labs/tru.htm).

Products of conception and placental specimens

Products of conception and placental specimens are submitted for the investigation of septic abortion and listeriosis. *Listeria monocytogenes* may cause serious infection in pregnant women, neonatal infants and patients who are immunocompromised^{6,7}. In pregnant women septicaemia caused by *L. monocytogenes* presents as an acute febrile illness that may affect the fetus⁷. This may lead to systemic infection (granulomatosis infantisepticum), stillbirth and neonatal meningitis. Products of conception, placenta and neonatal screening swabs should be examined for this organism (processing neonatal screening swabs is described in [BSOP 23 - Investigation of gastric aspirates and infection screen swabs from neonates](#)). Routine culture of vaginal swabs for *L. monocytogenes* is not usually performed although it may be useful in suspected cases⁸. Blood cultures are indicated. Serological investigations have no place in the diagnosis of listeriosis⁶ (see [BSOP 28 - Investigation of genital tract and associated specimens](#)).

Septic abortion

Septic abortion may result in serious maternal morbidity and may be fatal⁷. Uterine perforation, presence of necrotic debris, and retained placental products can lead to infection. Most infections are polymicrobial and involve anaerobes. Clostridial sepsis complicating abortion is potentially lethal. *Clostridium* species are part of the normal vaginal flora in some women.

Types of infection

Soft tissue infections

Soft tissue infections are common, but detecting the causative organisms is difficult. The surfaces of ulcers usually become colonised with a polymicrobial flora of uncertain pathogenicity. Wound disinfection or the use of topical agents to remove colonising organisms can give false-negative culture results or select for organisms such as *Pseudomonas aeruginosa*. Deep tissue sampling may be needed to isolate organisms responsible for these infections, particularly in the case of infected burns⁹.

Necrotising soft tissue infections

The terminology for necrotising soft tissue infections is confused. Terms are not applied consistently and may relate to the kind of pathogen, the tissues involved, or the presence or absence of gas in the tissues^{10,11}.

It is clinically important to recognise these conditions as surgical intervention as well as antimicrobial therapy is essential. Appropriate specimens are blood, fluid from bullae, and tissue biopsies. Growth from swabs taken from the surface of a lesion tends to be misleading, often yielding mixed cultures of colonising organisms. Mortality rates are high, about 30%-60%¹¹.

Necrotising fasciitis¹²

Necrotising fasciitis is a serious, infrequently occurring infection primarily affecting the subcutaneous fat and superficial fascia of muscles and often the overlying soft tissues. It is limited by the deep fascia. The infection spreads widely and rapidly due to the absence of internal barriers in the fascia. The infection can be fatal in a very short time. Some cases occur post-operatively or in patients with underlying clinical conditions such as malignancy. Some authorities consider that it exists as two types. Type I is due to infection by a polymicrobial mixture with aerobic and anaerobic organisms (group A streptococci, anaerobes, *S. aureus* and members of the Enterobacteriaceae). Type II (haemolytic streptococcal gangrene) is due to infection with group A streptococci¹³.

Necrotising myositis

Necrotising myositis is an infection of the muscles. It rapidly involves the entire muscle bed and may spread to adjacent tissues. Both polymicrobial and unimicrobial forms may be seen.

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Pyomyositis

Pyomyositis is a purulent infection of skeletal muscle and occurs more commonly in tropical countries. It usually presents as a single abscess but multiple abscesses do occur. Most patients have no underlying predisposing condition, previous trauma accounting for only 25% of cases. The majority of cases are due to *S. aureus*. More rarely, fungi and viruses may cause infection in patients who are immunocompromised¹⁴.

Actinomycosis

Actinomycosis is a chronic suppurative infection characterised by abscess formation with the production of "sulphur granules" which mainly consist of micro-colonies of *Actinomyces* species¹⁵. Usual sites of infection are around the jaw, chest or abdomen. Material should be drained from these abscesses (see [BSOP 14 - Investigation of abscesses and post-operative wound and deep-seated wound infections](#)) and biopsies taken. Biopsies may reveal the presence of organisms¹⁶. Most infections are due to *Actinomyces israelii*¹⁷, Actinomycete-like-organisms and actinomycetes from IUCDs are commonly seen in cervical smears where the clinical significance is doubtful.

Gangrene

There are four main types:

- 1) Meleney's progressive synergistic gangrene presents as a burrowing lesion or chronic gangrene of the skin following abdominal operations, and results from mixed infections by organisms such as *S. aureus*, streptococci, Enterobacteriaceae, pseudomonads and anaerobic Gram-negative bacilli^{18,19}.
- 2) Gas gangrene is a necrotising process associated with systemic signs of toxæmia and gas is present in the tissues. It often follows traumatic injuries such as penetrating wounds or crush injuries. Gas gangrene is caused by clostridia, in particular *Clostridium perfringens*. However, these organisms may colonise a wound without causing disease. Alternatively, they may cause a spreading cellulitis, or extend into the muscle causing myonecrosis²⁰. Classical gas gangrene is associated with clinical shock, leakage of serosanguinous fluid, tissue necrosis and presence of gas in the tissues.
- 3) Fournier's gangrene applies to the non-sporing anaerobes. These are particularly important causes of infection in the pelvic and scrotal areas, and are common causes of gangrene in ischaemic and diabetic limbs. They often occur in infections mixed with Enterobacteriaceae, streptococci and *Clostridium* species.²¹
- 4) Spontaneous gangrene occurs either with no apparent relation to trauma or following mild, non-penetrating trauma. It is most commonly seen in patients with colonic carcinoma, leukaemia or neutropaenia. The main causative organisms are *C. perfringens* and *Clostridium septicum*¹⁵.

Traumatic inoculation

Traumatic inoculation from soil or plant sources can lead to infection with *Nocardia* species or fungi such as *Sporothrix schenckii*. *Nocardia* species will grow on simple media at 25-37°C but can take as long as 2-4 weeks to appear^{22,23}. Accordingly, it is reasonable to prolong incubation of cultures when investigating material from such cases.

Mycetoma^{24,25}

Mycetoma occurs in people living in tropical and sub-tropical climates, usually following a puncture wound. The condition results from a chronic destructive process involving the skin, subcutaneous tissue, muscle and bone. Granulation tissue develops with chronic inflammation and fibrosis and is characterised by a draining sinus and the presence of granules. A mycetoma can form anywhere in the body. Formation in the foot is called "Madura foot".

Mycetomata are divided into 2 categories based on the aetiological agents involved.

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There are at least twenty moulds that may cause this condition. Ninety five percent of the cases are caused by:

Eumycetoma:	<i>Acremonium</i> species <i>Leptosphaeria senegalensis</i> <i>Madurella grisea</i> <i>Scedosporium (Pseudallescheria) apiospermum</i>
Actinomycetoma:	<i>Actinomadura</i> species <i>Nocardia</i> species <i>Streptomyces</i> species

Organisms are found in tissue sinuses as aggregates of filaments. These are called granules but differ from the sulphur granules of actinomycosis in that they do not have the characteristic clubbed peripheral fringe. Granules obtained directly from tissue will ensure the best cultural recovery of the causative organism because granules found in sinus discharge contain only dead organisms. Surgical biopsy to obtain material for culture is important for diagnosis, especially if sinus discharge is culture-negative for aerobic actinomycetes or is contaminated by other bacteria.

Deep or disseminated fungal infections

Deep or disseminated fungal infection diagnosis may be assisted by examination of tissue biopsies (eg of the lung, liver, skin and bone marrow, as indicated). Conditions such as coccidioidomycosis, histoplasmosis, blastomycosis, and disseminated filamentous fungal infections of the immunocompromised (eg invasive aspergillosis) may be diagnosed by this means.

Parasitic myositis

Parasitic myositis is generally an indolent infection of muscles by parasites, such as trichinosis.

Organisms

Any organism isolated from tissue and biopsy specimens can be significant.

TECHNICAL INFORMATION/LIMITATIONS

In National Standard Methods, the term "CE marked leak proof container" is used to describe containers bearing the CE marking and which are used for the collection and transport of clinical specimens. The requirements of the EU *in vitro* Diagnostic Medical Devices Directive (98/79/EC Annex 1 B 2.1)²⁶ state that such devices must "reduce as far as possible contamination of, and leakage from, the device during use and, in the case of specimen receptacles, the risk of contamination of the specimen. The manufacturing processes must be appropriate for these purposes".

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1 SAFETY CONSIDERATIONS²⁷⁻³⁴

1.1 SPECIMEN COLLECTION

Care should be taken to avoid accidental injury when "sharps" are used

1.2 SPECIMEN TRANSPORT AND STORAGE

CE Marked leak proof container^a in a sealed plastic bag

1.3 SPECIMEN PROCESSING

Containment Level 2 unless infection with a Hazard Group 3 organism is suspected on clinical grounds, or where the specimen is from a brain abscess or from any site in a patient with a travel history to Africa, Asia, America or the Middle east (to cover *R. mackenziei*), in which case all work must be undertaken in a microbiological safety cabinet at Containment Level 3. Relevant Containment Level 3 organisms include: *M. tuberculosis*, *Brucella abortus*, *Histoplasma capsulatum*, *Coccidioides* species, *Blastomyces dermatitidis*, *Paracoccidioides brasiliensis*, *Penicillium marneffei*, *Cladophialophora* species, *Fonsecea* species and *Ramichloridium mackenziei*

Laboratory procedures that give rise to infectious aerosols must be conducted in a microbiological safety cabinet.

Grinding and homogenisation of all specimens must be undertaken in a microbiological safety cabinet.

Wherever possible, the use of sterile scissors is recommended in preference to a scalpel blade.

Refer to current guidance on the safe handling of all organisms documented in this NSM.

The above guidance should be supplemented with local COSSH and risk assessments.

Compliance with postal and transport regulations is essential.

2 SPECIMEN COLLECTION

2.1 OPTIMAL TIME FOR SPECIMEN COLLECTION

Before antimicrobial therapy where possible.

2.2 CORRECT SPECIMEN TYPE AND METHOD OF COLLECTION

A medical practitioner will collect the specimen.

2.3 ADEQUATE QUANTITY AND APPROPRIATE NUMBER OF SPECIMENS

The specimen should, ideally, be large enough to carry out all microscopical preparations and cultures.

Minimum specimen size will depend on the number of investigations requested.

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3 SPECIMEN TRANSPORT AND STORAGE

3.1 TIME BETWEEN SPECIMEN COLLECTION AND PROCESSING

Specimens should be transported and processed as soon as possible.

The volume of the specimen influences the transport time that is acceptable. Larger pieces of tissue maintain the viability of anaerobes for longer³⁵.

Tissue or biopsy material in a microbiologically CE marked leak proof container²⁶ has an optimal time for transport.

3.2 SPECIAL CONSIDERATIONS TO MINIMISE DETERIORATION

If specimen is small, place it in sterile water to prevent desiccation³⁶.

Note 1: Specimens received in formol-saline are not suitable for culture. If processing is delayed, refrigeration is preferable to storage at ambient temperature. Delays of over 48 h are undesirable.

Note 2: Ensure that the retention and disposal of tissues complies with the Human Tissue Act.

4 SPECIMEN PROCESSING

4.1 TEST SELECTION

Select a representative portion of specimen for appropriate procedures such as culture for fungi, *Legionella* ([BSOP 47 - Investigation of specimens for *Legionella* species](#)) and *Mycobacterium* species ([BSOP 40 - Investigation of specimens for *Mycobacterium* species](#)), and examination for parasites ([BSOP 31 - Investigation of specimens other than blood for parasites](#)) depending on clinical details.

If there is insufficient specimen for all investigations, they should be prioritised according to clinical indications after consultation with a medical microbiologist.

4.2 APPEARANCE

N/A

4.3 MICROSCOPY

([BSOPTP 39 - STAINING PROCEDURES](#))

4.3.1 STANDARD

N/A

4.3.2 SUPPLEMENTARY

For all specimens except gastric biopsies for *H. pylori*: [BSOP 55 – Investigation of gastric biopsies for *Helicobacter pylori*](#)

Homogenised specimens

(see Section 4.4.1 for method of homogenisation)

Place one drop of specimen on to a clean microscope slide with a sterile pipette

Spread this with a sterile loop to make a thin smear for Gram staining

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Non-homogenised specimens

Prepare a touch preparation - use sterile forceps to grasp pieces of specimen, touch the sides of one or more pieces of the specimen to a clean microscope slide for Gram staining. Group the touch preparations together for easier examination. This sample should not be used for culture.

Other

Microscopy for fungi, *Legionella* ([BSOP 47 - Investigation of specimens for *Legionella* species](#)) and *Mycobacterium* species ([BSOP 40 - Investigation of Specimens for *Mycobacterium* species](#)), *H. pylori* ([BSOP 55 - Investigation of gastric biopsies for *Helicobacter pylori*](#)) and parasites.

4.4 CULTURE AND INVESTIGATION

4.4.1 PRE-TREATMENT

Standard

Grind or homogenise specimen with, as appropriate, a sterile tissue grinder (Ballotini beads), a sterile scalpel or (preferably) sterile scissors and petri dish. The addition of a small volume (approximately 0.5 mL) of sterile, filtered water, saline, peptone or broth will aid the homogenisation process.

All grinding or homogenisation must be performed in a Class 1 exhaust protective cabinet

Supplementary

Fungi, *Legionella* ([BSOP 47 - Investigation of specimens for *Legionella* species](#)) and *Mycobacterium* species ([BSOP 40 - Investigation of specimens for *Mycobacterium* species](#)), and parasites

4.4.2 SPECIMEN PROCESSING

Homogenised specimens

Inoculate each agar plate and enrichment broth with homogenised or ground specimen (see [QSOP 52 – Inoculation of culture media](#)).

For the isolation of individual colonies, spread inoculum with a sterile loop.

NB: Homogenised samples should not be used for fungal cultures only cut pieces of tissue.

Non-homogenised specimens

Inoculate each agar plate with the cut pieces of tissue (see [QSOP 52 – Inoculation of culture media](#)).

For the isolation of individual colonies, spread inoculum with a sterile loop.

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4.4.3 CULTURE MEDIA, CONDITIONS AND ORGANISMS FOR ALL SPECIMENS:

Clinical details/ conditions	Standard media	Incubation			Cultures read	Target organism(s)
		Temp °C	Atmos	Time		
All samples	Blood agar	35-37	5-10% CO ₂	40-48 h	daily	Any organism
	CLED/ MacConkey agar	35-37	air	16-24 h	≥16 h	
	Fastidious anaerobe agar and fastidious anaerobe agar with neomycin	35-37	anaerobic	5 d	≥40 h and at 5 d	
	Fastidious anaerobe broth then subcultured at ≥40 h to above media (excluding MacConkey agar)	35-37 35-37	air as above	5 days 40-48 h	N/A ≥40 h	
For these situations, add the following:						
Clinical details/ conditions	Supplementary media	Incubation			Cultures read	Target organism(s)
		Temp °C	Atmos	Time		
If microscopy suggestive of mixed infection	Neomycin fastidious anaerobe agar with metronidazole disc 5 µg	35-37	anaerobic	5 d	≥40 h and at 5 d	Anaerobes
Actinomycosis	Blood agar supplemented with metronidazole and nalidixic acid	35-37	anaerobic	10 d	≥40 h, at 7 d and 10 d	<i>Actinomyces</i> species
Immunocompromised, or suspected fungal infection	Sabouraud agar	35-37 and 25-30	air	40-48 h*	≥40 h: up to 8 weeks	Fungi

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4.4.3 CULTURE MEDIA, CONDITIONS AND ORGANISMS FOR ALL SPECIMENS (CONTINUED):

Clinical details/ conditions	Supplementary media	Incubation			Cultures read	Target organism(s)
		Temp °C	Atmos	Time		
For these situations, add the following:						
Mycetoma Nocardiosis	Lowenstein- Jensen slope / Blood agar	35-37	air	up to 28d	every 3-4 days	Aerobic actinomycetes
Optional media		Incubation			Cultures read	Target organism(s)
		Temp °C	Atmos	Time		
When clinical details or when microscopy suggestive of mixed infection	Staph/strep selective agar	35-37	air	40-48 h*	daily	<i>S. aureus</i> Streptococci
Other organisms for consideration - Fungi, <i>H. pylori</i> (BSOP 55 - Investigation of gastric biopsies for <i>Helicobacter pylori</i>), <i>Legionella</i> species (BSOP 47 - Investigation of specimens for <i>Legionella</i> species), <i>Listeria</i> species, <i>Mycobacterium</i> species (BSOP 40 - Investigation of specimens for <i>Mycobacterium</i> species) and parasites						
<p>*incubation may be extended to 5 days. In such cases plates should be read at ≥40 h and left in the incubator/cabinet until day 5.</p> <p>Agents of exotic imported mycoses eg <i>Histoplasma capsulatum</i> may take up to 8 weeks to grow; adequate humidification of incubators will be necessary³⁷.</p>						

4.5 IDENTIFICATION

4.5.1 MINIMUM LEVEL IN THE LABORATORY

Actinomycetes	genus level BSOPID 10 – Identification of aerobic Actinomycetes species BSOPID 15 – Identification of anaerobic Actinomycetes species
Anaerobes	"anaerobes" level BSOPID 8 - Identification of Clostridium species
β-haemolytic streptococci	Lancefield group level
Coagulase-negative staphylococci	"coagulase-negative" level
Enterobacteriaceae	"coliforms" level
Pseudomonads	"pseudomonads" level
S. aureus	species level
S. anginosus group	<i>S. anginosus</i> group level
Yeasts	species level
Fungi	species level

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[Legionella species](#)

species level see [BSOP 47 - Investigation of specimens for Legionella species](#)

[Mycobacterium species](#)

species level see [BSOP 40 - Investigation of specimens for Mycobacterium species](#)

[Parasites](#)

species level see [BSOP 31 - Investigation of specimens other than blood for parasites](#)

4.5.2 REFERRAL TO REFERENCE LABORATORIES

For information on the tests offered, turn around times, transport procedure and the other requirements of the reference laboratory [click here for user manuals and request forms](#).

Isolates associated with outbreaks, where epidemiologically indicated, and organisms with unusual or unexpected resistance and whenever there is a laboratory or clinical problem or anomaly that requires elucidation should be sent to the appropriate reference laboratory.

Legionella species, see [BSOP 47 - Investigation of specimens for Legionella species](#)

Mycobacterium species, see [BSOP 40 - Investigation of specimens for Mycobacterium species](#)

4.6 ANTIMICROBIAL SUSCEPTIBILITY TESTING

Refer to NSM on Susceptibility Testing ([BSOP 45 - Susceptibility Testing](#))

5 REPORTING PROCEDURE

5.1 MICROSCOPY

Gram stain

Report on WBCs and organisms detected

Microscopy for fungi, *Legionella* ([BSOP 47 - Investigation of specimens for Legionella species](#)), *Mycobacterium* species ([BSOP 40 - Investigation of specimens for Mycobacterium species](#)), *H. pylori* ([BSOP 55 - Investigation of gastric biopsies for Helicobacter pylori](#)) and parasites ([BSOP 31 - Investigation of specimens other than blood for parasites](#))

5.1.1 MICROSCOPY REPORTING TIME

Urgent microscopy results to be telephoned or sent electronically

Written report, 16 – 72 h

5.2 CULTURE

Report clinically significant organisms isolated, **or**

Report other growth with appropriate comment, eg No significant growth, **or**

Report absence of growth

Also, report results of supplementary investigations

5.2.1 CULTURE REPORTING TIME

Clinically urgent culture results to be telephoned or sent electronically

Written report, 16 – 72 h stating, if appropriate, that a further report will be issued

Supplementary investigations:

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Fungi ([BSOP 39 - Investigation of dermatological specimens for superficial mycoses](#)), *Legionella* ([BSOP 47 - Investigation of specimens for *Legionella* species](#)), *Mycobacterium* species ([BSOP 40 - Investigation of specimens for *Mycobacterium* species](#)) and parasites ([BSOP 31 - Investigation of specimens other than blood for parasites](#))

5.3 ANTIMICROBIAL SUSCEPTIBILITY TESTING

Report susceptibilities as clinically indicated

6 REPORTING TO THE HPA (LOCAL AND REGIONAL SERVICES AND CENTRE FOR INFECTIONS)³⁸

Refer to the following:

Individual NSMs on organism identification

Health Protection Agency publications:

“Laboratory reporting to the HPA: A guide for diagnostic laboratories”

"Hospital infection control: Guidance on the control of infection in hospitals"

Local guidelines

Report all isolates of *Mycobacterium* species

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7 ACKNOWLEDGEMENTS AND CONTACTS

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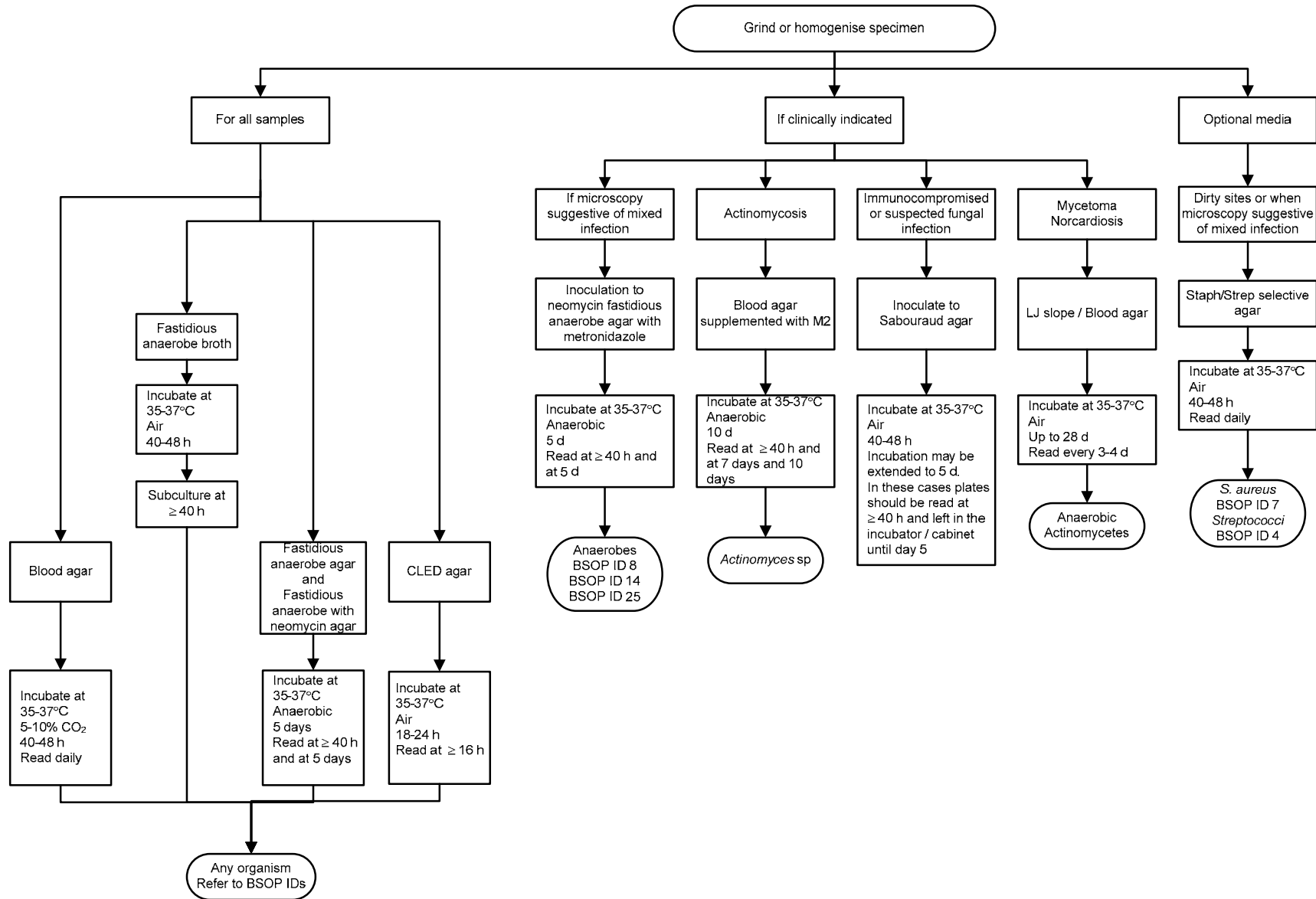
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APPENDIX



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