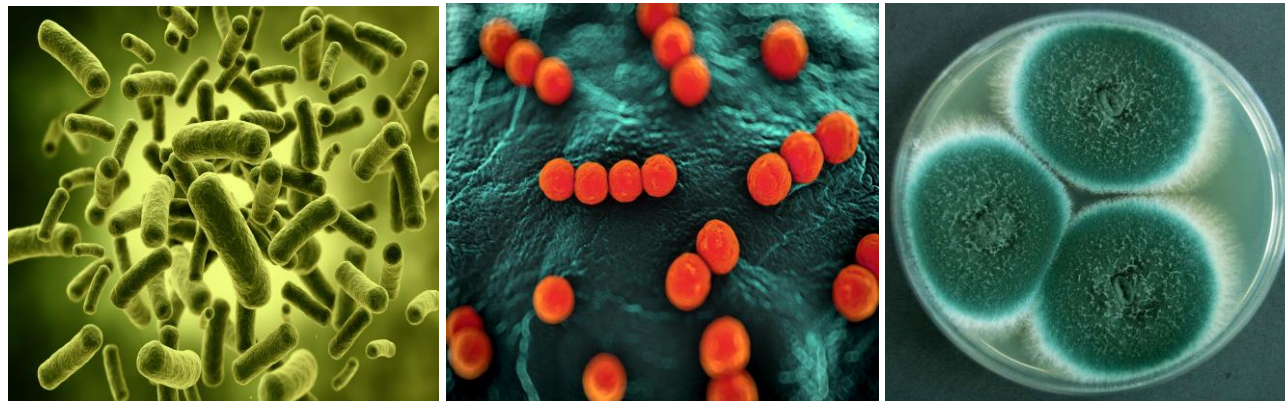


# Microbiology

## User Manual



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## About us

**The department of Microbiology, Virology and Infection Control provides a comprehensive, rapid and high-quality service for the diagnosis, management and prevention of infectious disease in patients at Great Ormond Street Hospital.**

**The Laboratory provides a wide range of both routine and specialised investigations in Bacteriology, Virology, Mycology and Parasitology. We provide environmental monitoring for Pharmacy, Cellular Therapy in addition to that required for prevention of infection, such as environmental cleanliness, air and water quality and for outbreak investigations.**

**Our expert team is on hand to provide expert clinical advice 24 hours a day all year round. In addition, our infection control team provide full service for the prevention, investigation and control of infection in patient and staff.**

**The department is highly active in research and development, specialising in molecular diagnostics, including cutting edge high throughput sequencing for diagnostics, epidemiological studies and novel pathogen detection methods.**

## Disclaimer

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## Location

Department of Microbiology, Virology and Infection Control  
Level 4  
Camelia Botnar Laboratories  
Great Ormond Street Hospital  
Great Ormond Street  
London  
WC1N 3JH



| Camelia Botnar Laboratories                         | Level | Room number |
|---|-------|-------------|
| Main Microbiology Laboratory and Specimen Reception | 4     | P4.042      |
| Virology Laboratory and Specimen Reception          | 4     | P4.040      |
| Virology Laboratory                                 | 4     | P4.036      |

## Contacts

| Microbiology and Virology Telephone Numbers   |  | Telephone  | Bleep / direct line                   |
|---|--|------------|---------------------------------------|
| <b>Laboratories</b>   |  |            |                                       |
| Microbiology Laboratory   |  | 5280/ 8661 | Bleep 0670/ direct line 0207 829 8661 |
| Virology Laboratory   |  | 8506/42401 | Direct line 0207 813 8506             |
| <b>Microbiology out of hours service: 20:00 - 08:00 Monday to Friday, all weekend and bank holidays</b> |  |            |                                       |
| Microbiology Laboratory   |  | 5280/ 8661 | Bleep 0670/ direct line 0207 829 8661 |
| <b>Virology out of hours service 08:00 – 12:00 Saturdays and bank holidays</b>                          |  |            |                                       |
| Virology Laboratory   |  | 8506/42401 | Direct line 0207 813 8506             |
| <b>Senior laboratory staff</b>  |  |            |                                       |
| Lead Laboratory Manager   | Christine Morris   | 8664       | Direct line 0207 829 8664             |
| Laboratory Manager  | Francis Yongblah   | 5658       | Direct line 0207 813 5658             |
| Principal Clinical Scientist  | Dr Julianne Brown  | 0437       | Direct line 0207 829 0437             |
| <b>Medical staff</b>  |  |            |                                       |
| Microbiology and Virology Specialist Registrars   |  | 5282       |                                       |
| Microbiology Consultants  | Dr. James Hatcher  | 4583       | Direct line 0207 829 4583             |
|   | Dr Garth Dixon   | 8594       | Direct line 0207 829 8594             |
|   | Dr Surjo De  | 7930       | Direct line 0207 829 7930             |
|   | Dr. James Soothill   | 5237       | Direct line 0207 829 5237             |
|   | Prof. J Breuer   |            |                                       |
| Infection Control   | Helen Dunn<br>Dr Elaine Cloutman-Green<br>Helen Saraqi<br>Barbara Brekle<br>Anna-Lena Waldner<br>Kate Harkus | 5284/8443  | Direct line 0207 813 8443             |

Note that any of the above staff can be contacted via email, using [forname.surname@gosh.nhs.uk](mailto:forname.surname@gosh.nhs.uk)

## Laboratory Service

| <b>Routine Working Hours</b>  |                  |
|---|------------------|
| <b>Microbiology</b>   |                  |
| 08:00 – 16:30   | Monday to Friday |
| 08:00 – 14:00   | Saturday         |
| <b>Clinical advice</b>  |                  |
| The laboratory specialist registrars and consultants are contactable for clinical advice from 09:00 – 17:30 Monday to Friday. See table above for contact numbers. At all other times a Specialist Registrar or Consultant are on call and contactable via the switchboard. |                  |
| <b>Virology</b>   |                  |
| 08:00 – 17:30   | Monday to Friday |
| 08:00 – 14:00   | Saturday         |
| <b>Clinical advice</b>  |                  |
| The laboratory specialist registrars and consultants are contactable for clinical advice from 09:00 – 17:30 Monday to Friday. See table above for contact numbers. At all other times a Specialist Registrar or Consultant are on call and contactable via the switchboard. |                  |

| <b>Out of Hours</b> |   |
|---------------------|---|
| <b>Microbiology</b> |   |
| 16:30 – 08:00       | Monday to Friday, plus all weekends and bank holidays |
| 14:00 – 08:00       | Saturday  |
| All day             | Sunday and bank holidays                              |

| Tests Available Out of Hours  |  |
|---|--|
| Routine tests   |  |
| Microbiology  | Virology – By arrangement with On-Call Microbiology staff                          |
| Antibiotic assays (Amikacin, Gentamicin, Tobramycin, Vancomycin).   | Needlestick injury testing of donor (HIV antibody and Hepatitis B surface antigen) |
| Blood cultures.   |  |
| Bronchoalveolar lavages – Microscopy, culture, mycobacterial microscopy.  |  |
| CSF – Microscopy and culture.   |  |
| Sterile body fluids and tissues - Microscopy and culture.   |  |
| Rapid antigen screening.  |  |
| Theatre samples.  |  |
| Urine microscopy (until 22:00).   |  |
|   |  |
|   |  |
| Other tests available by discussion with BMS on Bleep 0670 or by discussion with On Call Medical Microbiology cover (via switchboard) |  |
|   |  |
|   |  |
|   |  |
|   |  |
|   |  |



## Laboratory Advisory Services

### Clinical advice

The laboratory Specialist Registrars and Consultants are contactable for clinical advice including;

- clinical indications and choice of appropriate tests
- advice on individual clinical cases
- professional judgement on the interpretation of the results of examinations

Please refer to the above table for contact details.

### Scientific and Technical advice

Biomedical Scientists in the laboratory are available for scientific and technical advice. Please refer to the above table for contact details.

The laboratory calculates and monitors measurement uncertainty values for all assays that involve a quantitative element, applying these where deemed appropriate for result interpretation. Details of measurement uncertainty values and application can be obtained from the laboratory upon request.

## Test Requesting

### Internal

All test requests must be made through EPIC, following appropriate local protocols.

### External Test Requests

It is important that full contact details are provided on the request form, so that contact can be made if necessary and to allow the accurate and timely release of results and reports.

## Sample Labelling

Samples should be clearly labelled, using the labels generated by EPIC. Missing or inaccurate patient data will lead to delays in testing/ rejection of sample.

All samples must be taken and labelled in accordance with the Clinical Procedure Guidelines, which are available on the hospital intranet (GOS web).

Please place the label on the sample container so that it does not obscure the view of the sample.

In instances where a sample fails to meet laboratory acceptance criteria, the requesting ward or doctor will be contacted and a statement to that effect documented in the report. Please refer to the policy: Accepting unlabelled and mislabelled samples available in the GOS web document library

## Rejection of Samples

Although every effort is taken to avoid rejecting samples received in the lab, in some circumstances specimens cannot be accepted for testing. Reasons include, but are not limited to;

- Missing/ incomplete/ illegible patient identifiable information
- Incorrect or un-matching patient identifiable information
- Leaking specimens
- Incorrect sample type
- Insufficient sample
- Compromised sample integrity e.g. haemolysis of blood specimen, age of specimen, incorrect sample transport

## Sample Collection and Transport to the Laboratory

The pneumatic chute system should be the primary mode of transport for the delivery of pathology samples. In addition, the Site Services department provides a routine specimen transport service. The pneumatic chute system may be used out of hours for the transport of routine samples if there is a lack of available porter staff. Certain samples require hand delivery and **must not be placed in the chute i.e. BALs and NPA.**

Microbiology and Virology

Chute station : 041

### If the chute is unavailable

A porter from Site Services can be booked to deliver a specimen via EPIC.

Ward staff may bring specimens to the laboratories, which are located on level 4 Camelia Botnar Laboratories.

Samples for Microbiology and Virology should be placed in the sample reception box in the Microbiology main laboratory, including those which are urgent. Telephone the appropriate laboratory if the sample needs to be processed as a matter of urgency.

Please ensure that samples are sent to the laboratory as soon as they are taken. Please do not store a large batch and dispatch them together, as this causes delay to sample processing.

### Delivery of samples from external sources

Samples can be delivered to the Microbiology Department by Royal Mail, a trusted courier or Hays DX. (Please refer to General Information for the address)

Please ensure that all samples are packaged appropriately in suitable containers with enough absorbent material present to absorb any spillage that may occur in the event of a leak or damage to the packaging. Relevant request forms and paperwork should be included, outside of the sample containment as to avoid spoilage in the event of a leak.

**It is the responsibility of the sender to ensure that samples are sent in an appropriate manner to protect the health and safety of the chosen delivery service.**

The following link has links to appropriate guidance and legislation for the transport and handing of infectious material.

<http://www.dft.gov.uk/vca/dangerousgoods/useful-links.asp>

The following link provides guidance from the Royal Mail on using their services:

<http://www.royalmail.com/business/services/sending/parcels-uk/safebox>

## Accessing Results

We endeavour to produce and report all of our results in a timely manner, fitting in with turnaround times stated with our listed investigations.

Results will not be communicated directly to patients.

## Internal Computer Access to Results

Results are accessible via EPIC. Significant results are phoned or emailed by the Microbiology medical team.

Please refer to the tables on the following pages for turnaround times for each test.

## External results

For external requesting laboratories who have not signed up to the results portal, result reports are printed and posted to the address of the requesting laboratory or GP supplied on the request form.

If results are required urgently, copies of the report can be emailed using the NHS encrypted email system. Results can be released over the phone to Doctors, Nurses and other healthcare professionals in line with current Caldicott legislation.

For interpretation of results, clinical guidance can be given from the appropriate sources (see above for a list of contacts).

## Requesting additional investigations

If additional investigations are required after the specimen has been dispatched or processed by the laboratory, please telephone as soon as possible, contact details above. The new request will need to be ordered on EPIC.

There is a practical time limit for requesting additional investigations: the laboratory stores specimens for a variable time period (depending upon sample type) before disposal. Also note that some specimens deteriorate in storage or may be completely consumed during processing rendering them unsuitable for further investigation.

Please note that any specimen requiring culture becomes less viable as time progresses and so additional testing must be requested at the earliest possible opportunity. If too much time has elapsed the specimen may give a false negative result.

## Sample Retention Times

|                                   |                                      |
|-----------------------------------|--------------------------------------|
| Tissues and biopsies              | 1 month (minimum)                    |
| Fluids excluding Urine            | 2 weeks (minimum)                    |
| Urine                             | 7 days                               |
| Faeces and rectal swabs           | 7 days                               |
| MRSA, wound, skin and other swabs | 7 days                               |
| Blood samples (antibiotic assays) | 7days                                |
| Blood cultures                    | 2 days post completion of processing |
| Serum samples (serology)          | 6 months except for those referred   |

## Quality Assurance and Accreditation

The department operates a robust quality management system and maintains accreditation by UKAS to ISO 15189:2012. The schedule of accreditation can be found on the UKAS website [here](#).

The laboratory currently subscribes to external quality assurance panels provided by UK National External Quality Assessment Scheme (UKNEQAS), Quality Control for Molecular Diagnostics (QCMD) and Instand. Certification to confirm participation is available upon request.

The laboratory also carries out internal quality assurance in the form of anonymous resubmission of previously tested samples.

## Laboratory Complaints Procedure

The medical and senior management staff in the Department of Paediatric Laboratory Medicine work very closely with users both within the Hospital Trust and with external referring clinicians. In order to provide the best service to its users, the department encourages both positive and negative feedback. The laboratory manager can be contacted to discuss concerns.

The Trust also has a general complaints policy, which can be located on the GOS web document library

## Laboratory Policy on Protection of Personal Information

The laboratory adheres to the Trust's Policy on Information Governance to ensure compliance with the key principles of Information Governance. The Trust wishes to ensure all patients and service users to have confidence that their records will be maintained securely and will not be disclosed or shared inappropriately.

Details of the Trust's Information Governance Policy can be located on the GOS web

## Special Considerations for Microbiology Investigations

### Antibiotic Assays (Amikacin, Gentamicin, Tobramycin, Vancomycin) from Blood or CSF.

#### Timing of Levels:

**Trough Levels** – any regimen: should be taken immediately before a dose is given.

Trough and hold levels should be clearly recorded in the comments section on EPIC so that priority may be given.

**Peak levels** – should be taken 60 minutes after administration of a dose has finished. Where extra fluid infusion is given to flush the last traces of a dose the dose administration should be considered to have finished before the flush is started.

**Please note: BLOOD FOR ANTIBIOTIC ASSAY MUST NEVER BE TAKEN FROM A LINE WHICH HAS BEEN USED TO GIVE THAT ANTIBIOTIC AT ANY TIME.**  
Samples taken in this way have been shown to give unreliable results.

**Antibiotic Regime** - please state the dose, patient's weight, the frequency and timing of the dose and sampling on EPIC.

**Renal Function** - please state whether this is normal or not; if impaired give the urea and creatinine.

#### Results

Antibiotic assay results are available on patient chart once verified.

Ward staff will be notified of levels above the normal range, advice is available from a medical microbiologist or ID consultant regarding modification of dose regime and timing of further assays. Please discuss any results you are not familiar with interpreting, especially CSF levels.

#### Antibiotic Policy

Antibiotic regimens and normal ranges can be found in the [GOSH Antibiotic Policy](#) on GOS Web, which has been produced under the auspices of the antibiotic subcommittee of the Drugs and Therapeutics Committee after discussion with users.

Antibiotic Recommended Normal Ranges are [here](#)

## **Screening Policy**

Antibiotic resistance is an increasing problem. To limit the spread of antibiotic-resistant bacteria at GOSH we aim to screen all patients for carriage of MRSA (nose and throat swabs) and for antibiotic-resistant *Enterobacteriaceae* (faeces), please contact Infection control for details of screening policy and procedures.

Antibiotic sensitivity test results are issued on MRSA and resistant *Enterobacteriaceae*. However, when these bacteria are isolated on screening, antibiotic therapy is generally not required: the sensitivity results are supplied for infection control purposes only.

The full admission screening policy can be read [here](#).

## **Blood culture technique**

**Method** A continuous monitoring automated blood culture system is used in the department of Microbiology. The system detects the presence of aerobic and anaerobic bacteria, and fungi by measurement of CO<sub>2</sub> generated in a specially formulated culture medium.

Blood culture sets consist of two bottles - a paediatric aerobic bottle (pink label and silver cap) and an anaerobic bottle (purple label and purple cap) supplied by the Department of Microbiology.

Blood cultures are incubated for 5 days (21 days where endocarditis is suspected) all positives are notified to ward clinicians as soon as possible.

**Samples Volumes**

Up to 5ml of blood should be placed in the aerobic (pink label and silver cap) bottle and up to 10 ml in the anaerobic (purple label and cap) bottle.

**Number of Sets**

In acute bacterial sepsis – at least one set of cultures should be taken prior to starting antibiotic therapy.

In the investigation of Endocarditis three sets should be taken before starting antibiotics.

In patients with central venous and arterial lines, cultures should be taken from each lumen of each line and from a peripheral site if possible.

**Labelling** Bottles must be clearly labelled with EPIC generated barcode

**Procedure** See - [Blood tests, requesting, sampling & labelling requirements](#)



## Microscopy, Culture and Sensitivity

**Faeces** There are three reasons for sending faecal samples to microbiology: (1) to screen for the presence of antibiotic resistant bacteria, (2) for investigation of gastrointestinal disease (in most cases diarrhoea). **It is vital that if faeces are sent for investigation of disease that this is stated** and that detail are given. Otherwise (unless the specimen is liquid) the sample may be processed as a screening specimen only. (3) **Weekly** screening of stool samples from neutropenic patients as part of their monitoring process. Repeat samples received in the same week without significant clinical details will be discarded.

**Respiratory samples** Nose and Throat swabs: Please give clinical details as they are part of the routine admission screen and may not get processed for pharyngeal pathogens unless the patient's clinical condition is indicated.

Mouth swabs and Tongue swabs: Mainly for investigation of upper airway specimens and *Candida* sp

Sputum samples: For investigation of lower respiratory infections.

Where NPAs are sent for both Bacteriology and Virology please label container with the 2 separate numbers or send two specimens, one labelled for Bacteriology and one for virology.

Per nasal swabs should be sent for cases of suspected *B. pertussis*. This sample may also be sent for *Bordetella pertussis* PCR if an NPA is not received. These swabs should be sent as soon as possible and **not** be put into a charcoal swab container.

**Urine samples** Because of the high frequency of immunosuppression at GOSH, empirical antimicrobial therapy and the difficulty of collecting specimens from children, urine samples are followed up in more detail than in many other laboratories. Please repeat specimens when clinically indicated and remember that the provision of sensitivity data does not always imply that treatment is necessary.

**Skin swabs** Please remember to indicate if these are for the investigation of infection or for screening for MRSA.

**Soft tissue infections and abscesses**

For microbiological investigations of such infections tissue or pus are preferred to swabs. Tissue often also requires histopathological investigation and may be sent fresh (the histologists will then place it in formalin) or may be put in formalin by the clinician sending the sample. Formalin kills bacteria and thus makes the samples useless for bacteriological investigation by culture. Before you send a sample to Histopathology and especially **before you put a sample in formalin, consider whether infection is part of the differential diagnosis.**

If TB is a possible diagnosis this should be stated as it requires special culture techniques.

**Slow-growing organisms**

*Bordetella pertussis* (Whooping Cough) – cultures are maintained for 5 days

*Burkholderia* spp – may be slow growing and special plates are incubated for 5 days (used for all cystic fibrosis respiratory specimens)

*Legionella* spp – All Bronchoalveolar lavages are cultured for *Legionella* spp, plates are incubated for 10 days.

Fungi – selective plates are maintained for extended incubation up to 21 days depending on the clinical information

## Laboratory Investigations – Microbiology - Cultures

| Test  | Collection requirements   | Turnaround time              | Additional information  | Contact the laboratory to arrange the test in advance | External referrals  |
|---|---|------------------------------|---|---|---|
| <u>Microscopy:</u><br>- Gram stain<br>- AAFB stain<br>- Wet film<br>- Cell count and differential | As per sample requirements for culture.   | Same day                     |   | Yes, if urgent only.                                  |   |
| <u>Bacterial Culture and Sensitivity:</u><br>-Blood cultures                                      | Aerobic bottle (pink label with silver cap) requires up to 5ml blood.<br><br>Anaerobic bottle (purple label and cap) requires up to 10ml blood. | 5 days                       | Please state on EPIC if endocarditis or brucellosis is suspected.<br>Endocarditis requires extended incubation – 21 days.<br>Brucellosis requires extended incubation – 7 days. | Not required  |   |
| -Body fluids (other than urine)   | Sterile plastic universal   | 2- 5 days                    | Please state the type of body fluid.  | Yes, if urgent only.                                  |   |
| -Eye swabs  |   | 2- 5 days                    | Please state on EPIC “Left” or “Right” eye.   | Not required  |   |
| -Faeces and Rectal swabs  | Charcoal swab<br><br>Sterile plastic  | 2- 5 days<br><br>C.Difficile | Please state if requiring investigation for intestinal pathogens.   | Not required  | C.difficile isolates referred to: Clinical Microbiology & Public Health laboratory (CMPHL), |

|  |                            |                         |   |                      |  |
|--|----------------------------|-------------------------|---|----------------------|--|
|  | universal or charcoal swab | culture approx. 7 days. |   |                      | Level 6, Addenbrookes Hospital, Cambridge, CB2 0QW |
| -Legionella culture                                    | Sterile plastic universal  | 10 days                 |   | Not required         |  |
| -MRSA Screen   | Charcoal swab              | 2- 5 days               |   | Not required         |  |
| -Respiratory swabs                                     | Charcoal swab              | 2- 5 days               |   | Not required         |  |
| -Skin and site swabs                                   | Charcoal swab              | 2- 5 days               |   | Not required         |  |
| -Sputum, respiratory secretions, washings or aspirates | Sterile plastic universal  | 2- 5 days               | <i>Burkholderia spp.</i> culture for CF patients completed after 5 days.  | Not required         |  |
| -Tips  | Sterile plastic universal  | 2- 5 days               |   | Not required         |  |
| -Tissue, Biopsy, Pus                                   | Sterile plastic universal  | 2- 5 days               | Primary culture and subculture will be completed in 3 days if negative. All specimens will be given extended incubation which will be completed in 10 days. | Yes, if urgent only. |  |
| -Urine   | Sterile plastic universal  | 3 days                  | Minimum volume of 0.5ml   | Not required         |  |
| -Wound and umbilical swabs                             | Charcoal swab              | 2- 5 days               |   | Not required         |  |

|   |  |  |  |   |   |
|---|--|--|--|---|---|
| <p><u>Bacterial isolates</u></p> <ul style="list-style-type: none"> <li>- Toxin, typing</li> </ul>  | <p>Agar slope</p>  | <p>7 – 14 days</p>                           |  | <p>Not required</p>   | <p>Bacteriology Reference Department (AMRHAI)<br/>61 Colindale Avenue<br/>London NW9 5HT</p> <p>Phone +44 (0)20 8327 7887<br/>Website: <a href="http://www.gov.uk/phe">www.gov.uk/phe</a></p>   |
| <p><u>Fungal Culture and Sensitivity:</u></p> <ul style="list-style-type: none"> <li>- Skin scrapings (for Dermatophytes)</li> <li>- Hair, nails.</li> <li>- Other specimen types.</li> </ul> | <p>Scraping kit</p> <p>Scraping kit or sterile plastic univseral</p> <p>As per specimen type for Bacterial culture and sensitivity</p> | <p>21 days</p> <p>21 days</p> <p>21 days</p> |  | <p>Not required</p> <p>Not required</p> <p>Not required</p> |   |
| <p><u>Fungal isolate</u></p> <ul style="list-style-type: none"> <li>- Sensitivities</li> </ul>  | <p>Sab Agar Slope</p>  | <p>9 days</p>                                |  |   | <p>PHE Mycology Reference Laboratory<br/>National Infection Service,<br/>PHE South West Laboratory<br/>Science Quarter<br/>Southmead Hospital<br/>Westbury-on-Trym<br/>Bristol<br/>BS10 5NB</p> <p>General enquiries: 0117 414 6222</p> |

|  |   |  |  |   |  |
|--|---|--|--|---|--|
| <p><u>Mycobacterial Culture and Sensitivity:</u></p> <p>-Sputum, bronchoalveolar lavage, body fluids, gastric aspirates, urine</p> <p>- Tissues including lymph nodes and biopsies.</p> <p>- Blood and bone marrow</p> | <p>Sterile plastic universal</p> <p>Sterile plastic universal</p> <p>Lithium heparin vacutainer (sterile)<br/>Phone<br/>Microbiology to request for container to be sent/collected.</p> | <p>8 weeks</p> <p>12 weeks</p> <p>12 weeks</p>     | <p>AAFB microscopy will be performed and reported on day of receipt. AAFB microscopy is not performed on gastric aspirates and urine samples. Isolates requiring sensitivity testing are referred to PHE National Mycobacterial Reference Laboratory. Results may take up to 8 weeks to be completed.</p> <p>AAFB microscopy will be performed and reported on day of receipt.</p> <p>The Microbiology Department is unable to process blood or bone marrow samples for Mycobacterial culture on site.</p> <p>A minimum volume of 2ml is required collected into lithium heparin vacutainer. Samples should be sent to Microbiology at GOSH as soon as possible before being referred to the Mycobacterial Reference Laboratory for culture.</p> | <p>Not required</p> <p>Not required</p> <p>Not required</p> | <p>Positive isolates referred to:<br/>National Mycobacterium Reference Unit<br/>Colindale London NW9 5HT<br/>Tel. 0208 327 6957</p> <p>Scottish Mycobacterial Reference Laboratory<br/>Dept of Laboratory Medicine<br/>Royal Infirmary of `Edinburgh<br/>51 Little France Crescent<br/>Old Dalkeith Road<br/>Edinburgh<br/>EH16 4SS<br/>Tel 0131 242 6016<br/>Email<br/>LOTHIAN.SMRL@nhs.net</p> |
| <p><u>Screening Cultures:</u></p> <p>- MRSA screening</p> <p>-β-haemolytic Streptococcus screening (Nose and throat)</p> <p>- Resistant gram-negative screening</p>  | <p>Charcoal swab</p> <p>Charcoal swab</p> <p>Charcoal swab/<br/>Faeces or urine in sterile plastic</p>  | <p>2- 5 days</p> <p>2- 5 days</p> <p>2- 5 days</p> | <p>Please state screening site on swab.</p> <p>Please state screening site on swab.</p> <p>Please discuss with Microbiology/Infection Control clinicians before screening. Contact details above</p>   | <p>Not required</p> <p>Not required</p> <p>Not required</p> |  |

|  |   |             |  |              |  |
|--|---|-------------|--|--------------|--|
|  | universal                                 |             |  |              |  |
| <u>Referred Cultures:</u>                    |   |             |  |              |  |
| - Mycoplasma/Ureaplasma (Urine, CSF, sputum) | Sterile plastic universal                 | 7 days      |  | Not required | Bacteriology Reference Department (RVPBRU)<br>61 Colindale Avenue<br>London NW9 5HT<br><br>Phone +44 (0)20 8327 7887<br>Website: <a href="http://www.gov.uk/phe">www.gov.uk/phe</a>                                  |
| - <i>Francisella tularaemia</i>              | Sterile plastic universal / charcoal swab | 7 – 14 days | Please label with hazard stickers. <u>Category 3 organism.</u> | Not required | Rare and Imported Pathogens Laboratory (RIPL)<br>Public Health England<br>Porton Down<br>Salisbury<br>Wiltshire<br>SP4 0JG<br>Telephone: 01980 612348<br>Email: <a href="mailto:ripl@phe.gov.uk">ripl@phe.gov.uk</a> |

## Laboratory Investigations – Bacteriology – Antimicrobial Agent Assays Performed at GOSH

| Test               | Sample requirements                          | Turnaround time | Additional information  | Contact the laboratory to arrange the test in advance | Test Schedule   |
|--------------------|--|-----------------|---|---|---|
| <u>Amikacin:</u>   |  |                 |   |   |   |
| - Blood            | 0.5ml heparinised blood.<br>Orange bottle.   | 6 hours         | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given. | Yes, if urgent only.                                  | Non-urgent levels routinely performed at approximately:<br>10:30<br>15:30<br>20:30<br>00:00 |
| - CSF              | Sterile plastic universal.<br>Minimum 0.3ml. | 6 hours         |   | Yes, if urgent only.                                  |   |
| <u>Gentamicin:</u> |  |                 |   |   |   |
| - Blood            | 0.5ml heparinised blood.<br>Orange bottle.   | 6 hours         | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given. | Yes, if urgent only.                                  | Non-urgent levels routinely performed at approximately:<br>10:30<br>15:30<br>20:30<br>00:00 |
| - CSF              | Sterile plastic universal.<br>Minimum 0.3ml. | 6 hours         |   | Yes, if urgent only.                                  |   |
| <u>Tobramycin:</u> |  |                 |   |   |   |
| - Blood            | 0.5ml heparinised blood.<br>Orange bottle.   | 6 hours         | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given. | Yes, if urgent only.                                  | Non-urgent levels routinely performed at approximately:<br>10:30<br>15:30<br>20:30<br>00:00 |
| - CSF              | Sterile plastic universal.<br>Minimum 0.3ml. | 6 hours         |   | Yes, if urgent only.                                  |   |



| <u>Vancomycin:</u> |  |         |   |                      |   |
|--------------------|--|---------|---|----------------------|---|
| - Blood            | 0.5ml heparinised blood.<br>Orange bottle.   | 6 hours | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given. | Yes, if urgent only. | Non-urgent levels routinely performed at approximately:<br>10:30<br>15:30<br>20:30<br>00:00 |
| - CSF              | Sterile plastic universal.<br>Minimum 0.3ml. | 6 hours |   | Yes, if urgent only. |   |

## Laboratory Investigations – Bacteriology – Antimicrobial Agent Assays Sent to Reference Laboratories

There may be no weekend or Bank Holiday Reference Laboratory service, levels received after 16:00 Thursday may not be processed until the following Monday or Tuesday.

**Please note:** This list is not exhaustive. If an antimicrobial agent assay is required for an agent not present on this list, please contact Microbiology on the details provided above.

| Test            | Sample requirements                            | Turnaround time | Additional information   | Contact the laboratory to arrange the test in advance | External referrals  |
|-----------------|--|-----------------|--|---|---|
| Amphotericin    | 1ml clotted blood.<br>Brown, serum gel bottle. | 7 days          | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given.<br><u>-Any other antifungals previously administered.</u>                  | Not required  | Mycology Reference Centre<br>Leeds Teaching Hospital NHS Trust<br>The General Infirmary, Leeds, LS1 3EX<br><br>Telephone: 0113 392 6787<br>Dr Richard Hobson: 0113 392 2835<br>Dr Richard Barton: 0113 392 3390 |
| Ceftazidime     | 1ml clotted blood.<br>Brown, serum gel bottle. | <3 days         | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given.<br><br><b>24 hour notice must be given before sample sent for testing.</b> | Yes   | Antimicrobial Reference Laboratory<br>Level 2, Phase 1, Pathology Sciences Building<br>Southmead Hospital<br>Westbury-on-Trym<br>Bristol<br>BS10 5NB<br><br>General enquiries: 0117 414 6269<br>0117 414 6220   |
| Chloramphenicol | 1ml clotted blood.<br>Brown, serum gel bottle. | 7 days          | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given.  | Not required  | Antimicrobial Reference Laboratory<br>Dpt. of Medical Microbiology<br>Lime Walk Building<br>North Bristol NHS Trust<br>Southmead Hospital<br>Bristol, BS10 5NB  |

|               |  |         |   |              |   |
|---------------|--|---------|---|--------------|---|
|               |  |         |   |              | General enquiries:0117 323 5698/5654  |
| Ciprofloxacin | 1ml clotted blood.<br>Brown, serum gel bottle. | 7 days  | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given.   | Not required | Antimicrobial Reference Laboratory<br>Dpt. of Medical Microbiology<br>Lime Walk Building<br>North Bristol NHS Trust<br>Southmead Hospital<br>Bristol, BS10 5NB<br><br>General enquiries:0117 323 5698/5654    |
| Colistin      | 1ml clotted blood.<br>Brown, serum gel bottle. | <3 days | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given.   | Not required | Antimicrobial Reference Laboratory<br>Level 2, Phase 1, Pathology Sciences Building<br>Southmead Hospital<br>Westbury-on-Trym<br>Bristol<br>BS10 5NB<br><br>General enquiries: 0117 414 6269<br>0117 414 6220 |
| Cycloserine   | 1ml clotted blood.<br>Brown, serum gel bottle. | 7 days  | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given.   | Not required | Antimicrobial Reference Laboratory<br>Dpt. of Medical Microbiology<br>Lime Walk Building<br>North Bristol NHS Trust<br>Southmead Hospital<br>Bristol, BS10 5NB<br><br>General enquiries:0117 323 5698/5654    |
| Daptomycin    | 1ml clotted blood.<br>Brown, serum gel bottle. | <3 days | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given.<br><u>-Any other antifungals previously administered.</u> | Not required | Antimicrobial Reference Laboratory<br>Level 2, Phase 1, Pathology Sciences Building<br>Southmead Hospital<br>Westbury-on-Trym<br>Bristol<br>BS10 5NB  |

|               |  |          |   |              |   |
|---------------|--|----------|---|--------------|---|
|               |  |          |   |              | General enquiries: 0117 414 6269<br>0117 414 6220   |
| Fluconazole   | 1ml clotted blood.<br>Brown, serum gel bottle. | < 3 days | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given.<br><u>-Any other antifungals previously administered.</u> | Not required | Antimicrobial Reference Laboratory<br>Level 2, Phase 1, Pathology Sciences Building<br>Southmead Hospital<br>Westbury-on-Trym<br>Bristol<br>BS10 5NB<br><br>General enquiries: 0117 414 6269<br>0117 414 6220 |
| Flucytosine   | 1ml clotted blood.<br>Brown, serum gel bottle. | <3 days  | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given.<br><u>-Any other antifungals previously administered.</u> | Not required | Antimicrobial Reference Laboratory<br>Level 2, Phase 1, Pathology Sciences Building<br>Southmead Hospital<br>Westbury-on-Trym<br>Bristol<br>BS10 5NB<br><br>General enquiries: 0117 414 6269<br>0117 414 6220 |
| Isavuconazole | 1ml clotted blood.<br>Brown, serum gel bottle. | <3 days  | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given.<br><u>-Any other antifungals previously administered.</u> | Not required | Antimicrobial Reference Laboratory<br>Level 2, Phase 1, Pathology Sciences Building<br>Southmead Hospital<br>Westbury-on-Trym<br>Bristol<br>BS10 5NB<br><br>General enquiries: 0117 414 6269<br>0117 414 6220 |
| Itraconazole  | 1ml clotted blood.<br>Brown, serum gel bottle. | 72 hours | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given.<br><u>-Any other antifungals previously administered.</u> | Not required | HSL<br>The Halo Building<br>1 Mabledon Place<br>London WC1H 9AX<br><br>Tel: 020 7307 7373   |

|              |  |          |  |              |   |
|--------------|--|----------|--|--------------|---|
| Meropenem    | 1ml clotted blood.<br>Brown, serum gel bottle. | <3 days  | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given.<br><br><b>24 hour notice must be given before sample sent for testing.</b> | Yes          | Antimicrobial Reference Laboratory<br>Level 2, Phase 1, Pathology Sciences Building<br>Southmead Hospital<br>Westbury-on-Trym<br>Bristol<br>BS10 5NB<br><br>General enquiries: 0117 414 6269<br>0117 414 6220 |
| Posaconazole | 1ml clotted blood.<br>Brown, serum gel bottle. | 72 hours | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given.  | Not required | HSL<br>The Halo Building<br>1 Mabledon Place<br>London WC1H 9AX<br><br>Tel: 020 7307 7373   |
| Rifampicin   | 1ml clotted blood.<br>Brown, serum gel bottle. | <3 days  | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given.  | Not required | Antimicrobial Reference Laboratory<br>Level 2, Phase 1, Pathology Sciences Building<br>Southmead Hospital<br>Westbury-on-Trym<br>Bristol<br>BS10 5NB<br><br>General enquiries: 0117 414 6269<br>0117 414 6220 |
| Streptomycin | 1ml clotted blood.<br>Brown, serum gel bottle. | 7 days   | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given.  | Not required | Antimicrobial Reference Laboratory<br>Dpt. of Medical Microbiology<br>Lime Walk Building<br>North Bristol NHS Trust<br>Southmead Hospital<br>Bristol, BS10 5NB<br><br>General enquiries:0117 323 5698/5654    |

|              |  |          |   |              |   |
|--------------|--|----------|---|--------------|---|
| Teicoplanin  | 1ml clotted blood.<br>Brown, serum gel bottle. | <3 days  | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given.   | Not required | Antimicrobial Reference Laboratory<br>Level 2, Phase 1, Pathology Sciences Building<br>Southmead Hospital<br>Westbury-on-Trym<br>Bristol<br>BS10 5NB<br><br>General enquiries: 0117 414 6269<br>0117 414 6220 |
| Voriconazole | 1ml clotted blood.<br>Brown, serum gel bottle. | 72 hours | On EPIC please include:<br>-Date and time antimicrobial last given.<br>-Date and time sample taken.<br>-Dosage of antimicrobial last given.<br><u>-Any other antifungals previously administered.</u> | Not required | HSL<br>The Halo Building<br>1 Mabledon Place<br>London WC1H 9AX<br><br>Tel: 020 7307 7373   |

## Laboratory Investigations – Bacteriology – Serology (Antibody) Processed at GOSH

Serum concentrations of antibody to infective agents.

| Test                                | Sample requirements                            | Turnaround time | Additional information   | Contact the laboratory to arrange the test in advance | Test Schedule                                    |
|-------------------------------------|--|-----------------|--|---|--|
| Anti-Streptolysin O / DNAase B      | 1ml clotted blood.<br>Brown, serum gel bottle. | 7 days          |  | Not required  | Samples tested once weekly, usually Thursday PM. |
| Borrelia burgdorferi (Lyme disease) | 1ml clotted blood.<br>Brown, serum gel bottle. | 7 days          | This test is now provided by Virology. Please refer to their User Manual | Not required.   |  |
| Syphilis serology                   | Brown top serum tube                           | 2 days          | This test is provided by Virology. Please refer to their user manual     | Not required  |  |

## Laboratory Investigations – Bacteriology – Serology (Antibody) Sent to Reference Laboratories

Serum concentrations of antibody to infective agents

| Test                           | Sample requirements                            | Turnaround time | Additional information   | Contact the laboratory to arrange the test in advance | External Reference  |
|--------------------------------|--|-----------------|--|---|---|
| Anaplasma                      | 1ml clotted blood.<br>Brown, serum gel bottle. | 7 – 14 days     |  | Not required  | Rare and Imported Pathogens Laboratory (RIPL)<br>Public Health England<br>Porton Down<br>Salisbury, Wiltshire<br>SP4 0JG<br>Telephone: 01980 612348<br>Email: <a href="mailto:ripl@phe.gov.uk">ripl@phe.gov.uk</a>  |
| Bartonella (Cat Scratch Fever) |  |                 | This test is sent to France via HSL which makes the test expensive and has a long turnaround time. Please contact Microbiology consultant before requesting. |   | Referral bench. THE DOCTORS LABORATORY (HSL)<br>The Halo Building<br>1 Mabledon Place<br>London WC1H 9AX<br><br>Tel: 020 7307 7373  |
| Brucella                       | 1ml clotted blood.<br>Brown, serum gel bottle. | 7 days          |  | Not required  | Brucella Special Diagnostic Unit<br>Liverpool Clinical Laboratories<br>Virology Department<br>8th floor Duncan Building<br>Royal Liverpool & Broadgreen Hospital<br>Prescott Street,<br>Liverpool<br>L7 8XP<br>Phone: 44 (0)151 529 4900/ 44 (0)151 706 4404/4782 |



|                               |  |               |                                 |              |   |
|-------------------------------|--|---------------|---------------------------------|--------------|---|
| Campylobacter                 | 1ml clotted blood.<br>Brown, serum gel bottle. | Up to 14 days |                                 | Not required | Preston Microbiology Services, Royal Preston Hospital, PO Box 202, Sharoe Green Lane Fulwood, Preston, Lancs PR2 9HT<br><br>Email: <a href="mailto:LabFwePreston@phe.gov.uk">LabFwePreston@phe.gov.uk</a><br><br>Telephone 01772 523116 |
| <i>E. coli</i> 0157           | 1ml clotted blood.<br>Brown, serum gel bottle. | 7 – 14 days   |                                 | Not required | Bacteriology Reference Department GBRU<br>61 Colindale Avenue<br>London<br>NW9 5HT<br>Phone: +44 (0)20 8327 7887  |
| Helicobacter Antibody - serum | 1ml clotted blood.<br>Brown, serum gel bottle. | 7 -14 days    |                                 | Not required | Bacteriology Reference Department GBRU<br>61 Colindale Avenue<br>London<br>NW9 5HT<br>Phone: +44 (0)20 8327 7887  |
| Antigen - Faeces              | Faeces in sterile universal/stool pot          | 2-4 days      |                                 |              | Department of Microbiology, St Helier Hospital Epsom & St Helier University Hospitals NHS Trust Wrythe Lane Carshalton, Surrey SM5 1AA  |
| Antigen Biopsy                | Sterile universal container                    | 15 days       | Avoid sending samples on Friday |              | Bacteriology Reference Department GBRU<br>61 Colindale Avenue<br>London<br>NW9 5HT<br>Phone: +44 (0)20 8327 7887  |

|   |  |            |   |              |   |
|---|--|------------|---|--------------|---|
| Legionella  | See comment                                    | 7 -14 days | Serum test no longer available. Please send a urine sample for Legionella antigen.  | Not required | Bacteriology Reference Department (RVPBRU)<br>61 Colindale Avenue<br>London<br>NW9 5HT  |
| Leptospira  | 1ml clotted blood.<br>Brown, serum gel bottle. | 7 -14 days | It is necessary to examine at least 2 serum specimens taken at least 7 days apart.  | Not required | Rare and Imported Pathogens Laboratory (RIPL)<br>Public Health England<br>Porton Down<br>Salisbury<br>Wiltshire<br>SP4 0JG<br>Telephone: 01980 612348<br>Email: <a href="mailto:ripl@phe.gov.uk">ripl@phe.gov.uk</a>        |
| Neisseria meningitidis functional antibody to serogroups ACYW135 or B | 1ml clotted blood.<br>Brown, serum gel bottle. | 28 days    |   | Not required | PHE Meningococcal Reference Unit<br>Manchester Medical Microbiology Partnership (MMMP)<br>Clinical Sciences Building 2,<br>Manchester Royal Infirmary, Oxford Road,<br>Manchester, M13 9WL<br>Tel: +44 (0)161 276 8788/6757 |
| Streptococcus Antibody  | 1ml clotted blood.<br>Brown, serum gel bottle. | 7 -14 days |   | Not required | Bacteriology Reference Department (AMRHAI)<br>61 Colindale Avenue<br>London<br>NW9 5HT<br>Phone: +44 (0)20 8327 7887  |
| Yersinia enterocolitica and pseudo-tuberculosis                       |  |            | The reference laboratory no longer offers this service. Any specimens sent for this test will be saved for 6 months only. Please contact the Microbiology clinical staff (details above) for further information. |              |   |

## Laboratory Investigations – Bacteriology – Serology (Antigen Detection) Processed at GOSH

Rapid antigen screens can be performed as urgent investigations and results are available via the Pathology Results Browser as soon as the test is completed. Positive results will be telephoned to the requesting clinician.

| Test   | Sample requirements   | Turnaround time | Additional information | Contact the laboratory to arrange the test in advance | Test Schedule        |
|--|---|-----------------|------------------------|---|----------------------|
| <i>E. coli</i> Type K1   | 1ml clotted blood.<br>Brown, serum gel bottle.<br><br>1ml body fluid including CSF. | Same day.       |                        | Yes   | Urgent request only. |
| B-haemolytic Streptococci Group B<br><br>( <i>Streptococcus agalactiae</i> ) | 1ml clotted blood.<br>Brown, serum gel bottle.<br><br>1ml body fluid including CSF. | Same day.       |                        | Yes   | Urgent request only. |
| <i>Haemophilus influenzae</i> Type B   | 1ml clotted blood.<br>Brown, serum gel bottle.<br><br>1ml body fluid including CSF. | Same day.       |                        | Yes   | Urgent request only. |
| <i>Neisseria meningitidis</i><br>Groups A,B,C,W <sub>135</sub>               | 1ml clotted blood.<br>Brown, serum gel bottle.<br><br>1ml body fluid including CSF. | Same day.       |                        | Yes   | Urgent request only. |

|                                 |   |           |  |     |                      |
|---------------------------------|---|-----------|--|-----|----------------------|
| <i>Streptococcus pneumoniae</i> | 1ml clotted blood.<br>Brown, serum gel bottle.<br><br>1ml body fluid including CSF. | Same day. |  | Yes | Urgent request only. |
|---------------------------------|---|-----------|--|-----|----------------------|

## Laboratory Investigations – Mycology Serology

Please note that the stated times until results are available of antibody tests performed externally to GOSH are a guide only - serology testing is performed on a batch basis and results may be available sooner (or later) than stated.

| Test                                | Sample requirements   | Turnaround time | Additional information | Contact the laboratory to arrange the test in advance | External Reference   |
|-------------------------------------|---|-----------------|------------------------|---|--|
| Aspergillus Antibody                | 2ml clotted blood.<br>Brown, serum gel bottle.<br><br>(Minimum 1ml serum required). | 7 – 14 days     |                        | Not required  | Mycology Reference Laboratory<br>PHE South West Laboratory<br>Myrtle Road, Kingsdown<br>Bristol BS2 8EL<br><br>Phone +44 (0)117 342 5028<br><a href="http://www.gov.uk/phe">www.gov.uk/phe</a>                         |
| Aspergillus Antigen (Galactomannan) | Broncheolavage<br><br>CSF   | 2 days          |                        | Not required  | PHE Mycology Reference Laboratory<br>National Infection Service, PHE South West Laboratory<br>Science Quarter<br>Southmead Hospital<br>Westbury-on-Trym<br>Bristol<br>BS10 5NB<br><br>General enquiries: 0117 414 6222 |

|                                     |   |             |  |              |  |
|-------------------------------------|---|-------------|--|--------------|--|
| Aspergillus Antigen (Galactomannan) | 2ml clotted blood. Brown, serum gel 2ml clotted blood. bottle.<br><br>(Minimum 1ml serum required). | 72 hours    |  | Not required | HSL<br>The Halo Building<br>1 Mabledon Place<br>London WC1H 9AX<br><br>Tel: 020 7307 7373  |
| Beta-d Glucan                       | 2ml clotted blood. Brown, serum gel bottle.<br><br>(Minimum 1ml serum required).                    | 72 hours    |  | Not required | HSL<br>The Halo Building<br>1 Mabledon Place<br>London WC1H 9AX<br><br>Tel: 020 7307 7373  |
| Blastomyces Antibody                | 2ml clotted blood. Brown, serum gel bottle.<br><br>(Minimum 1ml serum required).                    | 7 – 14 days |  | Not required | Mycology Reference Laboratory<br>PHE South West Laboratory<br>Myrtle Road, Kingsdown<br>Bristol BS2 8EL<br><br>Phone +44 (0)117 342 5028<br><a href="http://www.gov.uk/phe">www.gov.uk/phe</a> |
| Candida Antibody                    | 2ml clotted blood. Brown, serum gel bottle.<br><br>(Minimum 1ml serum required).                    | 7 – 14 days |  | Not required | Mycology Reference Laboratory<br>PHE South West Laboratory<br>Myrtle Road, Kingsdown<br>Bristol BS2 8EL<br><br>Phone +44 (0)117 342 5028<br><a href="http://www.gov.uk/phe">www.gov.uk/phe</a> |
| Candida Antigen (Mannan)            | 2ml clotted blood. Brown, serum gel bottle.<br><br>(Minimum 1ml serum required).                    | 2 days      |  | Not required | PHE Mycology Reference Laboratory<br>National Infection Service, PHE South West Laboratory<br>Science Quarter<br>Southmead Hospital<br>Westbury-on-Trym<br>Bristol                             |

|                                 |   |        |   |              |  |
|---------------------------------|---|--------|---|--------------|--|
|                                 |   |        |   |              | BS10 5NB<br><br>General enquiries: 0117 414 6222<br><a href="http://www.gov.uk/phe">www.gov.uk/phe</a>   |
| Cryptococcus Antibody           | 2ml clotted blood.<br>Brown, serum gel bottle.<br><br>(Minimum 1ml serum required). | 2 days |   | Not required | Mycology Reference Laboratory<br>PHE South West Laboratory<br>Myrtle Road, Kingsdown<br>Bristol BS2 8EL<br><br>Phone +44 (0)117 342 5028<br><a href="http://www.gov.uk/phe">www.gov.uk/phe</a>   |
| Cryptococcus Antigen            | 2ml clotted blood.<br>Brown, serum gel bottle.<br><br>(Minimum 1ml serum required). | 2 days |   | Not required | PHE Mycology Reference Laboratory<br>National Infection Service, PHE South West Laboratory<br>Science Quarter<br>Southmead Hospital<br>Westbury-on-Trym<br>Bristol<br>BS10 5NB<br><br>General enquiries: 0117 414 6222<br><a href="http://www.gov.uk/phe">www.gov.uk/phe</a> |
| Histoplasma capsulatum Antibody | 2ml clotted blood.<br>Brown, serum gel bottle.<br><br>(Minimum 1ml serum required). | 2 days | Please refer to<br>Microbiology Consultant<br>before requesting | Not required | PHE Mycology Reference Laboratory<br>National Infection Service, PHE South West Laboratory<br>Science Quarter<br>Southmead Hospital<br>Westbury-on-Trym<br>Bristol<br>BS10 5NB<br><br>General enquiries: 0117 414 6222<br><a href="http://www.gov.uk/phe">www.gov.uk/phe</a> |

## Laboratory Investigations – Parasitology

Please note that the stated times until results are available of antibody tests performed externally to GOSH are a guide only - antibody testing is performed on a batch basis and results may be available sooner (or later) than stated.

| Test   | Sample requirements  | Turnaround time                                      | Additional information  | Contact the laboratory to arrange the test in advance      | External Reference   |
|--|--|--|---|--|--|
| <p><u>Ova, cysts and parasites:</u></p> <p>Microscopy for the detection of:</p> <ul style="list-style-type: none"> <li>- Giardia</li> <li>- Entamoeba</li> <li>- Ascaris</li> <li>- Capillaria</li> <li>- Clonorchis</li> <li>- Hookworm</li> <li>- Cryptosporidium</li> </ul> | Unfixed faeces sample.   | 2 days   | <p>Some ova, cysts and parasites cannot be excluded from a single sample and so sequential stool testing may be necessary. Please discuss with the Microbiology Clinicians (see details above) for guidance.</p> <p><b>Worms and worm segments</b><br/>Adult worms and tapeworm segments should be sent without preservative in a sterile universal container. If there is likely to be a delay of more than 24 hours, then 10% formol water should be added to the specimen.</p> | Not required   |  |
| <p><u>Acanthamoeba:</u></p> <p>-Microscopy and culture</p>   | <p>contact lens and/or wash fluids</p> <p>corneal scrapes, biopsies,</p> | 5-7 days, all positive results telephoned in interim |   | Yes. Special transport media requirement. Needs discussion | <p>Diagnostic Parasitology Laboratory<br/>Faculty of Infectious and Tropical Diseases<br/>London School of Hygiene &amp; Tropical Medicine<br/>Keppel Street<br/>London WC1E 7HT</p> |

|                       |  |             |  |  |   |
|-----------------------|--|-------------|--|--|---|
| - PCR                 | swabs<br><br>CSF, biopsy material  | 7 – 14 days |  | with Microbiology medical staff.<br><br>Not required | Tel: +44 (0)20 7927 2427<br><br>National parasitology reference laboratory (NPRL)<br>Department of Clinical Parasitology, Hospital for Tropical Diseases<br>3rd floor Mortimer Market Centre<br>Mortimer Market<br>London<br>WC1E 6JB<br>Telephone: 020 344 75418 |
| Ameobic Serology / ID | 1ml clotted blood.<br>Brown, serum gel bottle.<br><br>(0.5ml serum required) | 7 – 14 days |  | Not required   | National parasitology reference laboratory (NPRL)<br>Department of Clinical Parasitology, Hospital for Tropical Diseases<br>3rd floor Mortimer Market Centre<br>Mortimer Market<br>London<br>WC1E 6JB<br>Telephone: 020 344 75418                                 |
| Angiostrongyloides    | 1ml clotted blood.<br>Brown, serum gel bottle.<br><br>(0.5ml serum required) | 7 – 14 days |  | Not required   | National parasitology reference laboratory (NPRL)<br>Department of Clinical Parasitology, Hospital for Tropical Diseases<br>3rd floor Mortimer Market Centre<br>Mortimer Market<br>London<br>WC1E 6JB<br>Telephone: 020 344 75418                                 |



|  |  |             |  |   |   |
|--|--|-------------|--|---|---|
| Babesia                                | 1ml clotted blood.<br>Brown, serum gel bottle.<br><br>(0.5ml serum required) | 7 – 14 days |  | Needs to be discussed<br>HTD only test after discussion | National parasitology reference laboratory (NPRL)<br>Department of Clinical Parasitology, Hospital for Tropical Diseases<br>3rd floor Mortimer Market Centre<br>Mortimer Market<br>London<br>WC1E 6JB<br>Telephone: 020 344 75418 |
| Cysticercosis                          | 1ml clotted blood.<br>Brown, serum gel bottle.<br><br>(0.5ml serum required) | 7 – 14 days | <b>Please note:</b> Intestinal infections with <i>Taenia solium</i> or <i>saginata</i> will usually give negative results by Serology. Please contact the Microbiology clinical staff (details above) for further information. | Not required  | National parasitology reference laboratory (NPRL)<br>Department of Clinical Parasitology, Hospital for Tropical Diseases<br>3rd floor Mortimer Market Centre<br>Mortimer Market<br>London<br>WC1E 6JB<br>Telephone: 020 344 75418 |
| <u>Cryptosporidium:</u><br>-Microscopy | Unfixed stool sample   | 2 days      |  | Not required  | Cryptosporidium Reference Unit (CRU)<br>Public Health Wales Microbiology ABM<br>Singleton Hospital<br>Sketty<br>Swansea<br>SA2 8QA  |
| -PCR                                   | Unfixed stool sample   | 7 – 14 days |  | Not required  |   |
| Fasciola                               | 1ml clotted blood.<br>Brown, serum gel bottle.<br><br>(0.5ml serum required) | 7 – 14 days |  | Not required  | National parasitology reference laboratory (NPRL)<br>Department of Clinical Parasitology, Hospital for Tropical Diseases<br>3rd floor Mortimer Market Centre<br>Mortimer Market<br>London<br>WC1E 6JB<br>Telephone: 020 344 75418 |

|                       |  |               |  |   |   |
|-----------------------|--|---------------|--|---|---|
| Filaria               | 1ml clotted blood.<br>Brown, serum gel bottle.<br><br>(0.5ml serum required) | 7 – 14 days   |  | Needs to be discussed<br>HTD only test after discussion | National parasitology reference laboratory (NPRL)<br>Department of Clinical Parasitology, Hospital for Tropical Diseases<br>3rd floor Mortimer Market Centre<br>Mortimer Market<br>London<br>WC1E 6JB<br>Telephone: 020 344 75418 |
| Hydatid               | 1ml clotted blood.<br>Brown, serum gel bottle.<br><br>(0.5ml serum required) | 7 – 14 days   |  | Not required  | National parasitology reference laboratory (NPRL)<br>Department of Clinical Parasitology, Hospital for Tropical Diseases<br>3rd floor Mortimer Market Centre<br>Mortimer Market<br>London<br>WC1E 6JB<br>Telephone: 020 344 75418 |
| Leishmania – Serology | 1ml clotted blood.<br>Brown, serum gel bottle.<br><br>(0.5ml serum required) | 7 – 14 days   | Note: negative serology does not exclude the diagnosis of visceral leishmaniasis, particularly in sera from HIV positive patients.<br><br>Serology is not helpful in the diagnosis of cutaneous infections. In mucocutaneous leishmaniasis serology is usually seropositive except in early cases. | Not required  | National parasitology reference laboratory (NPRL)<br>Department of Clinical Parasitology, Hospital for Tropical Diseases<br>3rd floor Mortimer Market Centre<br>Mortimer Market<br>London<br>WC1E 6JB<br>Telephone: 020 344 75418 |
| Culture/PCR           | 1ml Bone marrow should be collected into EDTA tube                           | Up to 20 days |  |   |   |

|               |  |             |  |              |   |
|---------------|--|-------------|--|--------------|---|
| Schistosoma   | 1ml clotted blood.<br>Brown, serum gel bottle.<br><br>(0.5ml serum required) | 7 – 14 days |  | Not required | National parasitology reference laboratory (NPRL)<br>Department of Clinical Parasitology, Hospital for Tropical Diseases<br>3rd floor Mortimer Market Centre<br>Mortimer Market<br>London<br>WC1E 6JB<br>Telephone: 020 344 75418 |
| Strongyloides | 1ml clotted blood.<br>Brown, serum gel bottle.<br><br>(0.5ml serum required) | 7 – 14 days | Note: There is known to be cross reaction between filaria and strongyloides in ELISA tests.                                      | Not required | National parasitology reference laboratory (NPRL)<br>Department of Clinical Parasitology, Hospital for Tropical Diseases<br>3rd floor Mortimer Market Centre<br>Mortimer Market<br>London<br>WC1E 6JB<br>Telephone: 020 344 75418 |
| Toxocara      | 1ml clotted blood.<br>Brown, serum gel bottle.<br><br>(0.5ml serum required) | 7 – 14 days | A negative serum result does not exclude ocular toxocariasis. Vitreous sampling may be necessary to exclude ocular toxocariasis. | Not required | National parasitology reference laboratory (NPRL)<br>Department of Clinical Parasitology, Hospital for Tropical Diseases<br>3rd floor Mortimer Market Centre<br>Mortimer Market<br>London<br>WC1E 6JB<br>Telephone: 020 344 75418 |
| Trichinella   | 1ml clotted blood.<br>Brown, serum gel bottle.<br><br>(0.5ml serum required) | 7 – 14 days |  | Not required | National parasitology reference laboratory (NPRL)<br>Department of Clinical Parasitology, Hospital for Tropical Diseases<br>3rd floor Mortimer Market Centre<br>Mortimer Market<br>London<br>WC1E 6JB<br>Telephone: 020 344 75418 |

|             |   |             |   |                          |   |
|-------------|---|-------------|---|--------------------------|---|
| Trypanosoma | A <b>minimum</b> of 2ml of EDTA anti-coagulated blood( Red EDTA bottle) <b>and a minimum</b> of 0.5ml of serum (Brown serum gel) is required. | 7 – 14 days | Trypanosomes disintegrate rapidly on removal from the body, therefore it is vital that EDTA whole blood must be examined within 24 hrs. | Yes, for urgent referral | National parasitology reference laboratory (NPRL)<br>Department of Clinical Parasitology, Hospital for Tropical Diseases<br>3rd floor Mortimer Market Centre<br>Mortimer Market<br>London<br>WC1E 6JB<br>Telephone: 020 344 75418 |
|-------------|---|-------------|---|--------------------------|---|

## Molecular Microbiology

### **Broad-range bacterial 16S rDNA PCR**

Some bacterial species are difficult to isolate, or grow slowly in the laboratory due to stringent growth requirements, while others may not grow due to prior empirical treatment of patients with anti-microbial agents.

Molecular diagnostic techniques, such as PCR, aid in the diagnosis of bacterial infection by detecting bacterial genetic material.

Broad range assays are based on ribosomal genes (rDNA). Bacterial rDNA consists of highly conserved nucleotide sequences that are shared by all bacterial species, interspersed with variable regions that are genus or species specific.

By using PCR primers that are targeted at conserved regions of rDNA it is possible to design broad-range PCRs capable of detecting DNA from almost any bacterial species. The identity of the bacterium captured is revealed by nucleotide sequencing of the PCR product followed by comparison of this sequence with known sequences located in Genbank or other databases.

#### Suitable specimens:

Broad range 16S PCR may be performed on specimens from any normally sterile site e.g. empyema, pericardial fluid, joint aspirate, CSF, tissue and pus. Please discuss any requests with a Consultant Microbiologist or Clinical Scientist. Positive results will be telephoned to discuss significance.

### **Broad-range PCR and sequencing for identification of bacterial and fungal isolates**

PCR and sequencing of 16S rDNA (bacteria) and Internal Transcribed Spacer Region – 1 (ITS-1) (fungi) may be used to confirm the identity of isolates which would previously have been referred to a reference laboratory. This provides a more rapid accurate service. Certain strains may be reported as 'identity to follow' pending the 16S rDNA and ITS-1 sequencing results.

Particular strains, for instance *Burkholderia*, are always confirmed by PCR.

## ***Bordetella pertussis* (Whooping Cough)**

Rapid diagnosis of *B. pertussis* infection is essential for patient management and especially infection control. This bacterium has fastidious growth requirements and laboratory culture is slow (up to 5 days). Detection of *B. pertussis* genomic DNA by PCR is rapid and the preferred method of detection for this organism.

Suitable specimens: Pernasal swabs or NPAs. Please discuss this request with a Microbiologist first.

## ***Tropheryma whippelii* (Whipple's Disease)**

*T. whippelii* is a recently characterised bacterium that is the aetiological agent of Whipple's disease. First characterised by its 16S rDNA sequence, it has recently been propagated in continuous cell-culture and the entire genome sequenced. Detection of *T. whippelii* by cell-culture is not a practical diagnostic test and routine serological assays are not yet available. Amplification of nucleic acid by PCR remains the preferred detection method for this organism.

Suitable specimens: Preferred specimens are CSF, blood, duodenal biopsy. Please discuss this investigation with a Microbiologist first.

## ***Streptococcus pneumoniae***

Our laboratory has shown that diagnosis of *S. pneumoniae* infection can be improved by utilising molecular methods in addition to culture.

A real-time PCR to detect *S. pneumoniae* has been developed in our laboratory which offers greater sensitivity than the broad-range 16S rDNA PCR and can deduce susceptibility to penicillin via sequence polymorphisms in the *S. pneumoniae* penicillin binding protein (PBP)- 2b.

Suitable specimens: Preferred specimens are CSF, blood, pleural fluid, joint fluid and tissue. However, other specimens may also be suitable, please discuss request with a Microbiologist.

## ***Neisseria meningitidis***

*Neisseria meningitidis* is the major cause of bacterial meningitis in the UK, in both adults and children. It is also a cause of septicaemia. Rapid diagnosis is critical for patient management and also for implementation of public health measures. This real-time PCR assay targets the meningococcal *ctrA* gene to detect *Neisseria meningitidis* DNA in clinical material more rapidly than culture-based methods. PCR is also frequently positive in culture-negative samples. This real-time PCR assay can detect *N. meningitidis* is most commonly applied to blood and CSF samples but can be used on any sterile site sample.

## ***Streptococcus agalactiae* (Group B Streptococcus)**

*Streptococcus agalactiae* (Group B Strep, GBS) is the leading cause of septicaemia and meningitis in the newborn infant, and can result in serious morbidity and mortality. Empirical antibiotic treatment may result in failure to culture this organism and real-time PCR can then be used to obtain a diagnosis. This real-time PCR assay targets the *sip* gene which codes for a surface antigen protein in *Streptococcus agalactiae*. The assay is most commonly applied to blood and CSF samples but can be used on any sterile site sample.

## ***Kingella kingae***

Primary osteoarticular infections (OAI) in children must be diagnosed and treated urgently because of the risk of prolonged morbidity and crippling long-term sequelae. Isolation of the causative organism is the traditional way to confirm diagnosis. *K. kingae*, a member of the HACEK group of organisms, is now considered to be the leading cause of OAI in young children and can also be the cause of other infections, most notable infective endocarditis. However, its prevalence is underestimated as it frequently fails to culture due to its fastidious nature. PCR based methods are essential for the diagnosis of *K. kingae* OAI and other infections. This real-time PCR assay that can detect *K. kingae* from a range of clinical samples, in particular joint fluids and tissue from young children.

## ***Staphylococcus aureus***

*Staphylococcus aureus* is a catalase-positive, gram-positive coccus that may form part of the normal flora of the skin and other sites such as the upper respiratory tract. *S. aureus* causes a wide range of major and minor infections, including wound infections, abscesses, bacteraemia, osteomyelitis, pneumonia and endocarditis. Production of the enzyme *coagulase* is its main distinctive diagnostic feature. Molecular methods of detection are used to diagnose *S. aureus* infection when cultures are negative and a range of different target genes have been utilised. The identification of methicillin-resistant *S. aureus* (MRSA) is based on detection of the *mecA* gene target.

The assay targets the gene coding for the coagulase enzyme (*coa*) and can be applied to any sterile site sample. A second assay can also detect methicillin resistance by simultaneously detecting a *mecA* gene target and another *S. aureus* specific gene target (Sa442). This assay is primarily used on pure cultures of *S. aureus* to confirm methicillin resistance. Simultaneous detection of the *mecA* Sa442 targets at similar CT values directly from clinical samples implies (but does not confirm) infection with a methicillin-resistant *S. aureus* (MRSA).

## ***Streptococcus pyogenes* (Group A Streptococcus)**

*Streptococcus pyogenes* (Group A Strep, GAS) can produce a spectrum of clinical syndromes in humans that range from superficial infection of the pharyngeal mucosa to invasive infection of deep tissues or the blood stream. Empirical antibiotic treatment may result in failure to culture this organism and real-time PCR can then be used to obtain a diagnosis.

This real-time PCR assay targets the gene coding for the CsrR protein, which is part of a regulatory system that controls expression of several virulence determinants in *Streptococcus pyogenes*. The assay can be applied to any sterile site sample.

## ***Mycobacterium tuberculosis* and Atypical Mycobacteria**

Bacterial culture is the gold-standard method for diagnosis of Mycobacterial infection. Molecular methods can be used to detect Mycobacterial DNA directly from clinical specimens. They can also be used to identify cultured organisms, in particular from liquid culture media from positive flagging bottles, providing accurate identification of acid-fast organisms several days before traditional methods. Several different regions in the Mycobacterial genome are targeted in two multiplexed real-time PCR assays that can detect all clinically relevant *Mycobacteria species*, quickly differentiating *M. tuberculosis* complex from NTM and also RGM from the slow-growing NTM. Sequencing of



amplicon can further identify organisms to species level. We have implemented this assay to allow us to do the following:

- Rapidly confirm (same day) whether liquid cultures that flag positive contain *M. tuberculosis* complex.
- Differentiate BCG strains from other members of the *M. tb* complex using an *ESAT-6* target (Present in all *M.tb* complex strains but absent in BCG strains).
- Rapidly and accurately identify Mycobacteria to species level when they are isolated by liquid culture or on solid media.
- Primary detection of *Mycobacterium spp.* from a range of clinical samples, in particular CSF, tissue and respiratory samples. (This is always in addition to culture).

## Enterobacteriaceae

The Enterobacteriaceae are a large family of gram negative rods that include a number of pathogenic species e.g. *E. coli*, *Shigella sp.*, *Klebsiella sp.*, *Enterobacter sp.* and *Salmonella sp.* Many members of the family are part of the normal human gut flora but can also cause a range of significant infections ranging from sepsis to joint infections. They are of particular interest in our patient population as they are a common cause of neonatal sepsis and meningitis.

Molecular methods can be used to detect Enterobacteriaceae DNA directly from clinical specimens. This assay is primarily for us on culture negative samples for diagnosing infection with bacteria in this family. Additionally the assay can be used to further identify Enterobacteriaceae detected by the broad-range 16S rDNA PCR as sequencing of the *dnaK* target provides better discrimination and can identify many members of this family to genus level.

## Tests, sample volumes, containers and turnaround times - Molecular Microbiology

Please note that the stated times until results are available are a guide only.

| Investigation  | Container   | Min. volume  | Turnaround Time |
|--|---|--|-----------------|
| <b>Broad-range bacterial 16S rDNA PCR &amp; sequence – sterile site fluids and Blood culture fluids (If they are positive)</b> | Any sterile, dry container (no added fluids or transport media).                  | 0.5ml (Sterile Body Fluids)<br><br>1ml for Positive blood cultures | <7 days         |
| <b>Broad-range bacterial 16S rDNA PCR &amp; sequence - tissue</b>  | Any sterile, dry container (no added fluids or transport media)                   | 50 mg  | <7 days         |
| <b><i>Bordetella pertussis</i> (whooping cough) PCR</b>  | NPA or pernasal swab  |  | 24 hours        |
| <b>Specific bacterial real-time PCR</b>  | Any sterile, dry container (no added fluids or transport media)<br><br>EDTA blood |  | <7 days         |

Department of Microbiology location and contact details are [here](#).

The range of specific diagnostic PCRs offered by ourselves and other reference laboratories is increasing, we are happy to discuss the availability of diagnostic molecular tests whenever appropriate.

Please note the 24 hour turnaround at GOS and Reference Laboratories is not available at weekends. Specimens received after 16:00 Thursday may not have results available until the following Monday or Tuesday.

## References

Forms and documents are available on the hospital intranet (GOSweb) and Qpulse, the Trust's Quality Management System  
Clinical guidelines are also available on the hospital website <http://www.gosh.nhs.uk/health-professionals/clinical-guidelines/>

## Forms

|  |   |
|--|---|
| Antibiotic Assay Request Form<br>(External users only) | <a href="http://www.labs.gosh.nhs.uk/media/760961/RequestFormAntimicrobialAssays.pdf">http://www.labs.gosh.nhs.uk/media/760961/RequestFormAntimicrobialAssays.pdf</a>   |
| PCR Request Form                                       | <a href="http://www.labs.gosh.nhs.uk/media/760967/RequestFormPCR.pdf">http://www.labs.gosh.nhs.uk/media/760967/RequestFormPCR.pdf</a>   |
| PIMS downtime form                                     | <a href="http://goshweb.pangosh.nhs.uk/corporate/ict/Getting_help/PIMS_Information/PIMS_downtime_procedures/Documents/Forms/AllItems.aspx">http://goshweb.pangosh.nhs.uk/corporate/ict/Getting_help/PIMS_Information/PIMS_downtime_procedures/Documents/Forms/AllItems.aspx</a> |

## Documents

|   |   |
|---|---|
| Patient Identification Policy                                 | <a href="http://goshweb.pangosh.nhs.uk/search/Pages/results.aspx?k=patient%20identification%20policy&amp;s=All%20Sites">http://goshweb.pangosh.nhs.uk/search/Pages/results.aspx?k=patient%20identification%20policy&amp;s=All%20Sites</a>   |
| Accepting Unlabelled and Mislabeled Samples Policy            | <a href="http://goshweb.pangosh.nhs.uk/document_library/_layouts/OSSSearchResults.aspx?k=unlabelled&amp;cs=This%20Site&amp;u=http%3A%2F%2Fgoshweb.pangosh.nhs.uk%2Fdocument_library">http://goshweb.pangosh.nhs.uk/document_library/_layouts/OSSSearchResults.aspx?k=unlabelled&amp;cs=This%20Site&amp;u=http%3A%2F%2Fgoshweb.pangosh.nhs.uk%2Fdocument_library</a>   |
| AQU 013 Laboratory User Satisfaction and Complaints Procedure | Available on Qpulse   |
| Trust Complaints Policy                                       | <a href="http://goshweb.pangosh.nhs.uk/document_library/_layouts/OSSSearchResults.aspx?k=complaints%20policy&amp;cs=This%20Site&amp;u=http%3A%2F%2Fgoshweb.pangosh.nhs.uk%2Fdocument_library">http://goshweb.pangosh.nhs.uk/document_library/_layouts/OSSSearchResults.aspx?k=complaints%20policy&amp;cs=This%20Site&amp;u=http%3A%2F%2Fgoshweb.pangosh.nhs.uk%2Fdocument_library</a>   |
| Information Governance Policy                                 | <a href="http://goshweb.pangosh.nhs.uk/document_library/_layouts/OSSSearchResults.aspx?sq=1&amp;k=information%20governance%20policy&amp;cs=This%20Site&amp;u=http%3A%2F%2Fgoshweb.pangosh.nhs.uk%2Fdocument_library">http://goshweb.pangosh.nhs.uk/document_library/_layouts/OSSSearchResults.aspx?sq=1&amp;k=information%20governance%20policy&amp;cs=This%20Site&amp;u=http%3A%2F%2Fgoshweb.pangosh.nhs.uk%2Fdocument_library</a> |
| PHE User Manual   | <a href="https://www.gov.uk/government/publications/bacteriology-reference-department-brd-user-manual">https://www.gov.uk/government/publications/bacteriology-reference-department-brd-user-manual</a>   |

## Clinical Procedure Guidelines

|  |   |
|--|---|
| Blood Tests: requesting, labelling and sampling requirements | <a href="http://goshweb.pangosh.nhs.uk/search/Pages/results.aspx?k=sampling%20requirements&amp;cs=This%20Site&amp;u=http%3A%2F%2Fgoshweb.pangosh.nhs.uk">http://goshweb.pangosh.nhs.uk/search/Pages/results.aspx?k=sampling%20requirements&amp;cs=This%20Site&amp;u=http%3A%2F%2Fgoshweb.pangosh.nhs.uk</a>   |
| Blood Sampling, Neonatal Capillary                           | <a href="http://goshweb.pangosh.nhs.uk/clinical_and_research/clinical_resources/clinical_guidelines/Documents/Blood%20Sampling%20Neonatal%20Capillary.pdf">http://goshweb.pangosh.nhs.uk/clinical_and_research/clinical_resources/clinical_guidelines/Documents/Blood%20Sampling%20Neonatal%20Capillary.pdf</a>   |
| Blood sampling from central venous access devices (CVADs)    | <a href="http://goshweb.pangosh.nhs.uk/clinical_and_research/clinical_resources/clinical_guidelines/Documents/Blood%20sampling%20from%20central%20venous%20access%20devices.pdf">http://goshweb.pangosh.nhs.uk/clinical_and_research/clinical_resources/clinical_guidelines/Documents/Blood%20sampling%20from%20central%20venous%20access%20devices.pdf</a> |