Scottish Microbiology Reference Laboratories, Glasgow.

Contents

Introduction

The Scottish Microbiology Reference Laboratories (SMiRL), Glasgow are part of the Acute Service Division of NHS Greater Glasgow and Clyde. Commissioning is through Health Protection Scotland (HPS) which is part of the NHS National Services Scotland. The services are combined on one site at Level 5 of the New Lister Building, Glasgow Royal Infirmary. The SMiRL, Glasgow work closely with stakeholders to deliver key public health functions for epidemiology and surveillance, as well as outbreak and incident investigations. Expert advice and specialist diagnostic testing are offered for a broad range of pathogens and the diseases they cause. Investigations include serology, microscopy, and state-of-the-art molecular profiling to permit in-depth examination of respiratory bacteria, gastrointestinal bacterial and parasites, ocular and blood parasites, ecto-parasites and multiple-drug resistant bacteria. Active collaborations are encouraged to undertake relevant research projects with a focus on public health through networking with a variety of academic institutes. The SMiRL, Glasgow participates in local, national and international surveillance programmes and operates a comprehensive quality management system. Services are subjected to regular external inspection by the United Kingdom Accreditation Service (UKAS) to ISO 15189:2012 standards. Our full scope (8514) is available to view on the UKAS website.

Postal Address

Scottish Microbiology Reference Laboratories (SMiRL)

Level 5

New Lister Building

Glasgow Royal Infirmary

10-16 Alexandra Parade

Glasgow

G21 3ER

DX Number: DX 6490200

DX Exchange: BISHOPBRIGGS 90GX

Normal laboratory working hours

Monday to Friday 08:45 to 17:00

Saturday mornings and Public holidays: Specimen reception only

Out of hours requests

SMiRL does not operate an out of hours service. Only under exceptional circumstances and with approval from the laboratory director will tests be performed outside the normal laboratory hours.

Services to the public

SMiRL does not offer diagnostic services to members of the public except via a registered medical practitioner. Results can only be issued to the requesting physician or medical unit and will not be given to patients directly under any circumstances. We reserve the right to check the authenticity of callers in order to protect the confidentiality of patients' personal data.

There are no clinical facilities at SMiRL and we are unable to see patients or give telephone medical advice directly to members of the public.

Contact details and key personnel

General enquiries

Internal: 38663

External: 0141 201 8663

Email

gg-uhb.glasgowsmrl@nhs.net

Please note the generic email address should not be used for urgent, clinical, or non-routine enquiries.

Key personnel

Alistair Leanord (Director)	0141 201 8633
Andrew Smith (SHLMPRL)	0141 201 8536
Stephen Hughes (Technical Services Manager)	0141 201 8744
Pamela Saunders (Laboratory Manager)	0141 201 8669
Jane McOwan (Integrated Systems Manager)	0141 201 8739
Diane Lindsay (Principal Clinical Scientist, SHLMPRL)	0141 201 8657
Alistair Brown (Technical Manager, SHLMPRL)	0141 201 8658
Claire Alexander (Consultant Clinical Scientist, SPDRL)	0141 201 8637
Michael Coyne (Technical Manager, SPDRL)	0141 201 8667
Derek Brown (Principal Clinical Scientist, SSSCDRL)	0141 201 8668
Fiona Shaw (Technical Manager, SSSCDRL)	0141 201 8670
Loraine Graham (Technical Manager, SMRSARL)	0141 201 8671
Andrew Robb (Principal Clinical Scientist, SMRSARL)	0141 201 8761

Consultant Medical Microbiologists are available to offer advice on diagnosis, clinical interpretation of results and management of infections. For emergency enquiries out with normal working hours please contact the duty microbiologist via switchboard on 0141 211 4000.

Test Repertoire

Below is a list of our current tests and the sample types required. Turnaround times (TAT) represent the number of working days from the time that we receive the sample until the result is authorised.

SERVICES	TEST(S) PERFORMED	SAMPLE REQUIRED	TRTs	REQUEST FORM
Acanthamoeba	PCR assay [a]	Corneal scrape (optimal sample type), contact lens, contact lens fluid tears	3 days	RF-3
Amoebiasis (see also *Entamoeba histolytica*)	Serology – LATEX agglutination	Clotted blood/serum [b]	10 days	RF-3
Anisakiasis	No test available within the UK	-	-	-
Bordetella pertussis	*B.pertussis* toxin antibody (IgG) detection	Serum	9 days	RF-4
Clostridium difficile	*C. difficile* PCR ribotyping	Pure culture in Robertson's Cooked Meat broth	7 days	RF-5
	C. difficile antibiotic susceptibility testing	Pure culture in Robertson's Cooked Meat broth	7 days	RF-5
Cryptosporidium Outbreak Service	Molecular assays	Faeces [c] Environmental samples (on request by HPS for outbreaks)	10 days	RF-3
Cysticercosis	Serology - ELISA	Clotted blood/serum [b]	10 days	RF-3
Echinococcus granulosus (see also Hydatid Disease)	Microscopy	Cyst fluid	3 days	RF-3
Ecto-parasites	Identification	Larvae, insects, worms	10 days	RF-3
Enteric parasites (see Intestinal Helminths and Intestinal Protozoa)	-	-	-	-
Carbapenemase producing organisms	Carbapenemase gene detection (RT-PCR)	Pure culture on Nutrient Agar Slope	1 day	RF-6
Entamoeba histolytica/ dispar (see also amoebiasis)	PCR assay	Faeces [c]	3 days	RF-3
Enterobius vermicularis	Microscopy [d]	Sellotape smear or perianal swab	10 days	RF-3
Fascioliasis	Microscopy [d]	Faeces	10 days	RF-3
	Serology - ELISA	Clotted blood / serum [b]	10 days	RF-3
Filariasis (main species *Wuchereria bancrofti, Onchocerca volvulus*, *Brugia malayi* and *Loa loa)*	Serology - ELISA	Clotted blood / serum [b]	10 days	RF-3
	Microscopy	Peripheral whole blood collected between 1000h-1400h (day blood) or 2200h-0200h (night blood) *Onchocerca volvulus* is diagnosed by skin snip microscopy – please contact the laboratory prior to sampling on 0141 201 8637.	3 days	RF-3

SERVICES	TEST(S) PERFORMED	SAMPLE REQUIRED	TRTs	REQUEST FORM
Giardiasis (see also Intestinal protozoa)	Antigen testing	Faeces [c]	10 days	RF-3
Hydatid Disease (see also *Echinococcus granulosus*)	Serology - ELISA	Clotted blood/serum [b]	10 days	RF-3
Haemophilus influenzae	Antimicrobial susceptibility testing	Pure culture on an agar slope OR swab in transport medium	4 days	RF-4
	Identification and serotyping	Pure culture on an agar slope OR swab in transport medium	4 days	RF-4
	MLST	Pure culture on an agar slope OR swab in transport medium	10 days	RF-4
	Multiplex PCR for meningococcal, pneumococcal and *H. influenzae* DNA	CSF, serum, EDTA blood, Blood culture fluid	3 days	RF-4
Insects (see Ectoparasites)	Identification		10 days	RF-3
Intestinal Helminths	Microscopy [d]	Faeces	10 days	RF-3
Intestinal Protozoa (see also *Entamoeba histolytica, Giardia* & *Cryptosporidium outbreak service)*	Microscopy [d]	Faeces Duodenal/jejunal juices for *Giardia duodenalis* (examined within 4 hours)	10 days	RF-3
Legionella spp.	*L. pneumophila* urinary antigen	Urine	2 days	RF-4
	Legionella RT-PCR on respiratory samples	Sputum, tracheal aspirates, bronchalveolar lavage, PM lung	5 days	RF-4
	Legionella sequence based typing on PCR positive samples and culture	DNA extracts, Pure culture on BCYE agar	12 days	RF-4
	Legionella culture	Sputum, tracheal aspirates, bronchalveolar lavage, PM lung	10 days	RF-4
	Legionella ID, mip genotyping and SBT	Pure culture on BCYE agar	12 days	RF-4
Leishmaniasis (visceral and cutaneous)	Microscopy (for visceral leishmaniasis only)	Bone marrow or EDTA whole blood	10 days	RF-3
	Serology – immunodiffusion assay (for visceral leishmaniasis only)	Clotted blood/serum [b]	10 days	RF-3
	Molecular assays (for visceral or cutaneous leishmaniasis)	a) Bone marrow, EDTA whole blood (for visceral leishmaniasis) b) Skin biopsy, skin swab (for cutaneous leishmaniasis)	3 days	RF-3
Malaria (see *Plasmodium* species)	----	----	----	----
Microsporidia species	Samples will be referred by the SMiRL, Glasgow to the Hospital for Tropical Diseases, London for molecular testing.	Faeces [c]	-	RF-3

SERVICES	TEST(S) PERFORMED	SAMPLE REQUIRED	TRTs	REQUEST FORM
Neisseria meningitidis (Meningococcus)	Antimicrobial susceptibility testing	Pure culture on an agar slope OR swab in transport medium	4 days	RF-4
	Identification and capsular serogrouping	Pure culture on an agar slope OR swab in transport medium	4 days	RF-4
	WGS (for determination of ST & vaccine antigen sequencing)	Pure culture on an agar slope OR swab in transport medium	10 days	RF-4
	Multiplex PCR for meningococcal, pneumococcal and *H. influenzae* DNA	CSF, serum, EDTA blood, Blood culture fluid	3 days	RF-4
	Capsular serogrouping, MLST and PorA typing from PCR positive samples and fast tracking outbreak isolates	DNA extracts Pure culture on an agar slope OR swab in transport medium	10 days	RF-4
Plasmodium species	Microscopy [e]	Microscope slide	2 days	RF-3
	Speciation PCR assays [e]	EDTA whole blood	3 days	RF-3
Salmonella species	Identification of genus and species by whole genome sequencing	Pure culture on Nutrient Agar Slope	14 days	RF-2
	Serological confirmation of Hazard Group 3 pathogens	Pure culture on Nutrient Agar Slope	4 days	RF-2
Schistosomiasis	Serology - ELISA	Clotted blood / serum taken at least 8 weeks after exposure [b]	10 days	RF-3
	Microscopy	Stools / urine [d]	10 days	RF-3
Shigella species	Identification of genus and species by whole genome sequencing	Pure culture on Nutrient Agar Slope	14 days	RF-2
Staphylococcus spp.	PCR confirmation of MRSA status	Pure culture on an agar slope OR swab in transport medium	5 days	RF-1
	PCR detection of mupirocin resistance gene	Pure culture on an agar slope OR swab in transport medium	7-8 days	RF-1
	Toxin testing (PVL, TSST, eta/b and enterotoxin genes by PCR)	Pure culture on an agar slope OR swab in transport medium	7-8 days	RF-1
	Epidemiological typing: Spa-typing – MSSA and MRSA PFGE – S.aureus, CNS	Pure culture on an agar slope OR swab in transport medium	7-8 days	RF-1
Streptococcus pneumoniae (Pneumococcus)	Antimicrobial susceptibility testing	Pure culture on an agar slope OR swab in transport medium	4 days	RF-4
	Identification and serotyping	Pure culture on an agar slope OR swab in transport medium	4 days	RF-4

SERVICES	TEST(S) PERFORMED	SAMPLE REQUIRED	TRTs	REQUEST FORM
Streptococcus pneumoniae (Pneumococcus) (continued)	MLST	Pure culture on an agar slope OR swab in transport medium	10 days	RF-4
	Multiplex PCR for meningococcal, pneumococcal and *H. influenzae* DNA	CSF, serum, EDTA blood, Blood culture fluid	3 days	RF-4
	MLST on PCR positive samples	DNA extracts	10 days	RF-4
Streptococcus pyogenes (Group A streptococcus)	Antimicrobial susceptibility testing	Pure culture on an agar slope OR swab in transport medium	4 days	RF-4
	emm (M) typing and selective MLST	Pure culture on an agar slope OR swab in transport medium		RF-4
Strongyloidiasis	Serology - ELISA	Clotted blood/serum [b]	10 days	RF-3
	Microscopy and culture	Faeces, duodenal / jejunal aspirates	10 days	RF-3
Toxocariasis	Serology - ELISA	Clotted blood/serum [b]	10 days	RF-3
Toxoplasmosis	User are requested to send samples **directly** to the Scottish Toxoplasma Reference Laboratory, Microbiology Department Zone 3, Raigmore Hospital Old Perth Road, Inverness, IV2 3UJ	Seek advice on sample types from the Scottish Toxoplasma Reference Laboratory Tel 01463 705882		
Trichinellosis	Samples will be referred by the SMiRL, Glasgow to the Hospital for Tropical Diseases, London.	Clotted blood/serum [b]	-	RF-3
Trypanosomiasis	Samples will be referred by the SMiRL, Glasgow to the Hospital for Tropical Diseases, London.	Clotted blood/serum [b]	-	RF-3
Vancomycin-Resistant Enterococci (VRE)	Epidemiological typing - PFGE	Pure culture on an agar slope OR swab in transport medium	No TRT defined	RF-1

[a] Corneal scrapes should be sent in sample tubes containing specialised transportation buffer that are provided by the SMiRL, Glasgow. Please phone 0141 201 8667 at least one week in advance of sampling if you require these tubes.
[b] For serology testing, 5-10mls clotted blood is required (minimum 1ml clotted blood).
[c] For molecular or antigen testing of faeces, approximately 5ml liquid faeces or 5g semi-solid / solid faecal material should be forwarded **WITHOUT** any additives / fixatives.
[d] Only if confirmatory testing is required as the SMiRL, Glasgow are not funded for first-line diagnostic parasite microscopy (excluding Filaria and Strongyloides).
[e] For confirmatory testing only – first line diagnostic testing for malaria is performed by the local haematology laboratory.

Sample submission and transport

Sample labelling

Samples should be labelled with the following information:

Essential Information	Desirable Information
1. Patient's full name or unique coded identifier 2. DOB or CHI/Hospital unit number 3. Sender's Laboratory number (if appropriate)	1. Date & Time of sampling

Request form completion

SMiRL request forms are available to download from our website. A separate request form must be completed for EACH sample. Please complete the forms in black or blue ink with the following information:

Essential Information	Desirable Information
1. Patient's full name or unique coded identifier 2. DOB 3. CHI/Hospital unit number 4. Investigation(s) required 5. Sender's address 6. Sender's laboratory number (if appropriate) 7. Clinical details including (where relevant) travel history, vaccination history and current antibiotic therapy 8. ACDP hazard group if known or suspected HG3	1. Date & Time of sampling 2. Patient's address 3. Practitioner's contact number especially if expecting an urgent result

It is the responsibility of the requester to ensure that samples are correctly labelled and forms completed to the standards detailed above. Failure to provide essential information may result in the specimen being discarded or a delay in receiving results.

Taking specimens in clinical areas

These are generic instructions for all samples:

- Confirm the identity of the patient
- Explain the procedure to the patient and obtain consent (as appropriate)

- Consent to treatment is the principal that a person must give permission before they receive any type of medical treatment, test or examination. The principle of consent is an important part of medical ethics and the international human right law. For full details refer to the NHS consent to Treatment webpage.
- Check that the specimen container is appropriate for the test
- Perform hand hygiene
- Take all required equipment to the patient
- After taking the sample ensure the sample container is sealed/secure
- Complete documentation near the patient
- Ensure the outside of the container is not contaminated (If so, either repeat the sample or clean the container with an alcohol wipe)
- Place the specimen in a sealed specimen bag for transport to the lab

Patient collected samples

Where patients are required to take their own samples they can be referred to the NHS website that answers common health questions regarding infections.

Transport of Specimens

All samples must be appropriately packaged and transported in accordance with UN 3373 postal regulations

Hazard Group 3 pathogens

To comply with UN 3373 regulations, the SMiRL must be NOTIFIED IN ADVANCE by telephone prior to the dispatch of any Hazard Group 3 (confirmed or suspected) organisms. To ensure the safety of our staff request forms for work on isolates that presumptively fall into ACDP (Advisory Committee on Dangerous Pathogens) Hazard Group 3 must be clearly marked to show the findings of the sending laboratory

Urgent samples & outbreak investigations

Please contact the laboratory by telephone in advance with regards to urgent samples or samples that are part of an outbreak investigation.

Specimen Acceptance and Rejection Criteria

In order for the laboratory to deliver accurate and reliable results we require good quality samples. Upon receipt of each sample, the laboratory will assess its suitability with regards to the requested test. Samples will be discarded in all but exceptional circumstances if any of the following criteria are not met:

- The sample/form lacks essential information as detailed in the sample submission guidelines
- They have been stored or transported incorrectly
- An inappropriate sample type, sample container or preservative has been used
- They have leaked or become damaged or cross contaminated in transit
- An insufficient quantity has been supplied
- Mixed cultures detected upon subculture

Exceptions may be made for clinically critical or irreplaceable samples i.e. those which are difficult to repeat or produce e.g. CSF, BAL, Aspirates, Parasite/Worm samples, Theatre samples and Post Mortem samples. However, in this instance the requesting laboratory will assume full responsibility for any data derived from such specimens.

Laboratory Expectations and Requirements of Service Users

Service users are responsible for ensuring that all of the following points are met and they must:

- Provide a specimen/sample that is valid and of acceptable quality for testing
- The sample must be fully and correctly labelled before sending this to the laboratory.
- The sample container must be sealed in order to prevent spillage. Failure to do so may result in loss of sample.
- Use the correct containers. Specimens may be discarded if the wrong container is used, or if the specimen is leaking.
- Specimens/samples must be taken into the correct containers and be filled to the correct levels. The laboratory must be contacted if this cannot be done and they will advise as to whether alternatives would be acceptable.
- Specimens must be correctly packaged, preserved and transported in a timely manner to the laboratory for testing.
- Request forms must be completed correctly and include both patient and clinical details and any other information that will ensure that the correct tests are performed as required.
- If a specimen is urgent please telephone us in advance and arrange what tests are required, where and to whom the results have to be telephoned and to find out when to expect the results.
- Users should ensure the purity of isolates prior to sending.

Communication of Results

All results are reported through the Telepath system, with paper reports posted to the sending laboratories. Reports are printed and dispatched every working day, Monday to Friday.

Results of urgent samples or samples with diagnostic or epidemiological significance will also be telephoned as soon as they are verified.

Data Protection

The laboratory adheres to Data Protection Law and holds all patient information in a secure manner. Staff complete Learnpro modules that cover all statutory and mandatory requirements relating to data protection. For further details refer to the NHS GG&C Health Records Policies and Procedures.

Problems, Complaints and Service Improvements

If any problems are encountered with the service or any matter for complaint arises, please contact a member of the laboratory management team by phone or by using the generic email provided. All complaints will be recorded in Q-pulse and a full investigation carried out.

We encourage all forms of feedback, positive and negative, and use it to continuously improve our services.

Appendix 1

Scottish *Haemophilus, Legionella,* Meningococcus and Pneumococcus Reference Laboratory (SHLMPRL)

Vaccine Preventable Diseases

Enhanced surveillance

All *H.influenzae*, pneumococcal and meningococcal isolates from sterile sites should be submitted to SHLMRPL for typing and antibiotic MIC determination. This data is important with regards to enhanced surveillance schemes such as MIDAS (Meningococcal Invasive Disease Augmented Surveillance) and SPIDER (Scottish Pneumococcal Invasive Disease Enhanced Reporting). Data from these schemes is used in epidemiological surveillance, vaccine policy development and evaluation of policy implementation.

Detection of meningococcal DNA

A multiplex RT-PCR is available for the detection of *N. meningitidis*, *S. pneumoniae* and *H. influenzae DNA* from CSF, serum or whole blood (EDTA or other un-clotted sample). It is therefore very important that whole blood samples are sent to the SHLMPRL for PCR testing as such testing can provide diagnostic and additional typing information in the absence of a culture isolate.

***Legionella* referrals**

Isolates of *Legionella spp.*

The laboratory welcomes submission of all suspected *Legionella* isolates from clinical and environmental sources for confirmation and surveillance purposes.

Detection of *Legionella* Urinary Antigen

This test detects the presence of *Legionella pneumophila* Sg 1 antigen in the acute phase of Legionnaires' disease. This is a useful test as usually antigen excretion is detectable before sero-conversion. Specimens should be collected as soon as possible after onset of symptoms. Excretion of antigen usually continues for up to 2 weeks after onset. It should be noted that a negative result does not exclude infection with a *Legionella sp*. other than *L. pneumophila* serogroup 1.

Detection of legionellae in Clinical Material

A RT- PCR assay screens for *Legionella* species and *Legionella pneumophila* in respiratory samples and has been adopted as defintive of a LD case in the UK.

Enhanced surveillance of travel associated Legionnaires' Disease

SHLMPRL is a collaborator in association with HPS and committee member of the European Legionnaires' disease Surveillance Scheme for Travel Associated Legionnaires' Disease (ELDSnet)

***Streptococcus pyogenes* (Group A strep)**

All group A streptococcal isolates from sterile sites should be submitted to SHLMPRL for emm typing and MLST. Isolates from non-sterile sites may also be submitted if they are associated with a severe clinical presentation, such as streptococcal toxic shock syndrome (STSS) or necrotising fasciitis. In addition, the laboratory should be contacted with regards to all suspected or confirmed GAS outbreaks in acute health care or maternity settings and the isolates submitted for typing.

***Bordetella pertussis* referrals**

As of June 2015, SHLMPRL became the referring lab in Scotland for IgG pertussis toxin antibody detection in human serum by ELISA. A clotted blood or serum sample is preferred. Vaccination history should be known when interpreting results as the test cannot discriminate between antibodies produced by disease and those produced post vaccination. Guidelines suggest that only patient samples from the age of 14 and over should be tested in this assay so as not confuse the results with those antibodies produced post childhood vaccination.

Appendix 2

Scottish MRSA Reference Laboratory (SMRSARL)

Gene Detection (qRT-PCR)

Confirmation of methicillin and mupirocin resistance and detection of the *PVL* gene is performed using quadraplex real-time PCR (qRT-PCR). The genes detected are:

- *mecA*
- *mupA*
- Panton Valentine Leucocidin (*PVL*)
- *S. aureus* species specific *nuc*

Strain typing

1. **Spa typing** (***S****. aureus* **P**rotein **A**) is a single-locus sequence typing method, sequencing the polymorphic region X, used in the characterisation of *Staphylococcus aureus*. Isolates typed by this method include all European Antimicrobial Resistance Surveillance Survey (EARSS) blood isolates and those from suspected outbreaks or transmission events.

Key factors affecting test performance

- <1% of isolates are non-typable, using the standard primer set, due to deletion of the entire protein A gene or genetic rearrangements with its IgG binding domain.

2. **Pulsed Field Gel Electrophoresis (PFGE)**

   PFGE analysis is available for the inter-strain comparison of, *S. aureus*, coagulase negative staphylococci (CNS) and enterococci, from suspected transmission events or outbreak situations. The laboratory must be consulted prior to sending isolates.

Key factors affecting test performance

- Strains belonging to CC398 (Livestock associated lineage) are non-typable using *smaI* endonuclease due to DNA-methylation
- Single isolate with no suitable comparator
- DNA degredation
- Presence of autolytic enzymes

Additional tests on request

- ***mecC*** **PCR** for the detection of the *mecC* gene is available if suspected. This gene is closely linked to the Livestock associated lineage CC130 which

accounts for 0.2% of annual submissions

- **BORSA** can be confirmed on isolates that are negative for the *mecA/C* genes and a raised oxacillin MIC.
- **Exfoliative toxins a and b** (eta/etb). Only tested if clinically suspected.
- **Toxic Shock Syndrome Toxin gene-1** (*tsst*). Only tested if clinically suspected
- **Enterotoxins** - *S. aureus* isolates from suspected cases of food poisoning can be screened for nine enterotoxin genes (A-E and G-J)
- ***Staphylococcus intermedius* group (SIG)** – Differentiation to species level by PCR

Appendix 3

Scottish *Salmonella, Shigella and Clostridium difficile* Reference Laboratory (SSSCDRL)

***Clostridium difficile* Reference Service - Services Available**

DNA-based typing

All *C. difficile* isolates will be tested by PCR Ribotyping according to the methods developed by Dr. Jon Brazier at the Anaerobic Reference Laboratory in Cardiff.

Antibiotic susceptibility testing

All isolates are screened for resistance to a wide range of clinically relevant and epidemiologically important antimicrobials by E-Test. The results of metronidazole and vancomycin sensitivities will be included in the final report to the sending laboratory.

Isolate submission criteria

Isolates of *C. difficile* should be submitted to the Scottish *Clostridium difficile* Reference Service in the case of the following: -

1) Severe cases

- Admission to a healthcare facility for treatment of community associated CDI.
- Admission to ITU for treatment of CDI or its complications.
- Endoscopic diagnosis of pseudomembranous colitis (with or without toxin confirmation).
- Surgery for the complications of CDI (toxic megacolon, perforation or refractory colitis).
- Death within 30 days following a diagnosis of CDI where it is either the primary or a major contributory factor.
- Persisting CDI where the patient has remained symptomatic and toxin positive despite 2 courses of appropriate therapy.

2) Suspected outbreaks

When an outbreak is suspected and stools are positive for *Clostridium difficile* toxin. An outbreak of CDAD occurs when more cases of CDAD than would normally be expected occur in a clinical unit, ward or hospital.

3) Representative Surveillance – "*Clostridium difficile*Snapshot Programme"

The "*Clostridium difficile* Snapshot Programme" looks at less severe hospital cases and isolates that are possibly community acquired. The protocol for the programme is available at:
http://www.hps.scot.nhs.uk/haiic/sshaip/resourcedetail.aspx?id=676

Salmonella* & *Shigella

Whole Genome Sequencing

Serotype and MLST are now derived using WGS data. Detailed strain comparison and cluster analysis is performed using core genome multilocus sequence typing (cgMLST) and single nucleotide polymorphism (SNP) analysis which is communicated with epidemiologists at Health Protection Scotland and can be readily compared with other national and international centres for the purposes of outbreak inverstigation.

Antibiotic resistance testing.

All isolates are screened for resistance to a wide range of antimicrobials for epidemiological purposes.

Appendix 4

Scottish Parasite Diagnostic & Reference Laboratory (SPDRL)

Acanthamoeba

Corneal scrapings should be placed in the transport buffer supplied on request by the SMiRL, Glasgow. There is no requirement to place contact lens or the contact lens solution into buffer prior to transportation – only corneal scrapes should be placed into buffer. For the safety of laboratory staff, please refrain from sending needles or scalpel blades.

Amoebiasis (see also Entamoeba histolytica / Entamoeba dispar)

Amoebic serology should be performed when invasive disease is suspected.

Cryptosporidium Outbreak Service

Only faeces from cases suspected to be part of an outbreak should be forwarded for molecular investigations. If an outbreak is suspected, please notify the laboratory in advance of sending a sample(s) (Tel 0141 201 8667). Speciation and sub-typing (if requested by Health Protection Scotland) will be performed.

Enteric Helminths and Protozoa (see also Intestinal Helminths and Protozoa)

A minimum of three separate samples should be examined before a diagnosis is excluded (taken on day 1, 3 and 5 preferably).

Entamoeba histolytica / Entamoeba dispar

The molecular assays are performed on faeces found to be microscopy-positive for *Entamoeba histolytica / Entamoeba dispar*. The cysts are identical in morphology therefore the molecular assay is required to differentiate *Entamoeba histolytica* (pathogenic) from *Entamoeba dispar* (non-pathogenic).

Enterobiasis

A sellotape smear taken in the morning from the perianal skin and attached with the adhesive side facing downwards on a microscope slide is the optimum specimen for detecting *Enterobius vermicularis* ova. The tape must be clear, and the slide should be sent to the laboratory in a suitable container. Alternatively, a swab may be taken from the

perianal region, preferably before the individual showers in the morning, using a dry swab, or a swab in clear transport media (not charcoal).

Filariasis

A negative serology result does not exclude the diagnosis, particularly with onchocerciasis.

Giardiasis

A minimum of three stools for antigen testing is preferable (taken day 1, 3 and 5 if possible). As the antigen test is more sensitive than microscopy, it is performed where there is a high index of suspicion of giardiasis despite negative microscopy.

Antibody detection for giardiasis is not deemed to be suitable and is therefore not available at the SMiRL, Glasgow.

Hydatid Disease

Positive serology results should be confirmed by non-serological means *e.g*. radiology, ultrasound, microscopy.

Intestinal Helminths and Protozoa (excluding *Enterobius* infections)

A minimum of three separate samples should be examined before a diagnosis is excluded (taken on day 1, 3 and 5 preferably).

Leishmaniasis

Please inform the laboratory on 0141 201 8667 in advance if testing for leishmaniasis is required.

In suspected cutaneous leishmaniasis, please avoid the use of iodine when taking a skin biopsy as this can inhibit downstream PCR reactions.

Malaria (*Plasmodium* species)

If referring samples to the SMiRL, Glasgow for confirmatory testing, please ensure a completed enhanced surveillance form is sent with the sample.

Schistosomiasis

Definitive diagnosis is by demonstrating the characteristic ova in clinical material. Only where a patient's serum is **positive** for schistosome antibodies will three stools (taken day 1, 3 and 5) and the terminal portion of the first morning urine (approximately 20mls) be requested by the local infectious diseases specialists. Microscopy detection of ova in stool and urine samples should be performed by the local microbiology laboratory whilst serology (antibody) testing will be performed by the SMiRL, Glasgow. The detection of ova from biopsy material (unfixed) *e.g*. rectum, sigmoid or bladder is also possible.