

NATIONAL STANDARD METHOD

# MOTILITY TEST

BSOP TP 21

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







## MOTILITY TEST

Issue no: 2 Issue date: 26.04.10 Issued by: Standards Unit, Department for Evaluations, Standards and Training Page no: 1 of 10  
BSOP TP 21i2

This NSM should be used in conjunction with the series of other NSMs from the Health Protection Agency

[www.evaluations-standards.org.uk](http://www.evaluations-standards.org.uk)

Email: [standards@hpa.org.uk](mailto:standards@hpa.org.uk)

# STATUS OF NATIONAL STANDARD METHODS

National Standard Methods, which include standard operating procedures (SOPs), algorithms and guidance notes, promote high quality practices and help to assure the comparability of diagnostic information obtained in different laboratories. This in turn facilitates standardisation of surveillance underpinned by research, development and audit and promotes public health and patient confidence in their healthcare services. The methods are well referenced and represent a good minimum standard for clinical and public health microbiology. However, in using National Standard Methods, laboratories should take account of local requirements and may need to undertake additional investigations. The methods also provide a reference point for method development.

National Standard Methods are developed, reviewed and updated through an open and wide consultation process where the views of all participants are considered and the resulting documents reflect the majority agreement of contributors.

Representatives of several professional organisations, including those whose logos appear on the front cover, are members of the working groups which develop National Standard Methods. Inclusion of an organisation's logo on the front cover implies support for the objectives and process of preparing standard methods. The representatives participate in the development of the National Standard Methods but their views are not necessarily those of the entire organisation of which they are a member. The current list of participating organisations can be obtained by emailing [standards@hpa.org.uk](mailto:standards@hpa.org.uk).

The performance of standard methods depends on the quality of reagents, equipment, commercial and in-house test procedures. Laboratories should ensure that these have been validated and shown to be fit for purpose. Internal and external quality assurance procedures should also be in place.

Whereas every care has been taken in the preparation of this publication, the Health Protection Agency or any supporting organisation cannot be responsible for the accuracy of any statement or representation made or the consequences arising from the use of or alteration to any information contained in it. These procedures are intended solely as a general resource for practising professionals in the field, operating in the UK, and specialist advice should be obtained where necessary. If you make any changes to this publication, it must be made clear where changes have been made to the original document. The Health Protection Agency (HPA) should at all times be acknowledged.

The HPA is an independent organisation dedicated to protecting people's health. It brings together the expertise formerly in a number of official organisations. More information about the HPA can be found at [www.hpa.org.uk](http://www.hpa.org.uk).

The HPA aims to be a fully Caldicott compliant organisation. It seeks to take every possible precaution to prevent unauthorised disclosure of patient details and to ensure that patient-related records are kept under secure conditions<sup>1</sup>.

More details can be found on the website at [www.evaluations-standards.org.uk](http://www.evaluations-standards.org.uk). Contributions to the development of the documents can be made by contacting [standards@hpa.org.uk](mailto:standards@hpa.org.uk).

The reader is informed that all taxonomy in this document was correct at time of issue.

*Please note the references are now formatted using Reference Manager software. If you alter or delete text without Reference Manager installed on your computer, the references will not be updated automatically.*

## **Suggested citation for this document:**

Health Protection Agency (2010). *Motility Test*. National Standard Method BSOP TP 21 Issue 2. [http://www.hpa-standardmethods.org.uk/pdf\\_sops.asp](http://www.hpa-standardmethods.org.uk/pdf_sops.asp).

## **MOTILITY TEST**

Issue no: 2 Issue date: 26.04.10 Issued by: Standards Unit, Department for Evaluations, Standards and Training Page no: 2 of 10  
BSOP TP 21i2

This NSM should be used in conjunction with the series of other NSMs from the Health Protection Agency

[www.evaluations-standards.org.uk](http://www.evaluations-standards.org.uk)

Email: [standards@hpa.org.uk](mailto:standards@hpa.org.uk)

# INDEX

**STATUS OF NATIONAL STANDARD METHODS..... 2**

**INDEX..... 3**

**AMENDMENT PROCEDURE ..... 4**

**SCOPE OF DOCUMENT ..... 5**

**INTRODUCTION ..... 5**

**TECHNICAL INFORMATION/LIMITATIONS ..... 5**

**1 SAFETY CONSIDERATIONS ..... 6**

**2 REAGENTS AND EQUIPMENT ..... 6**

**3 QUALITY CONTROL ORGANISMS ..... 6**

**4 PROCEDURE AND RESULTS..... 7**

    4.1 HANGING DROP METHOD..... 7

    4.2 SEMI SOLID AGAR (CRAIGIE)..... 7

    4.3 THREE COVER SLIP METHOD..... 7

**5 ACKNOWLEDGEMENTS AND CONTACTS..... 8**

**APPENDIX: MOTILITY TEST FLOWCHART ..... 9**

**REFERENCES..... 10**

**MOTILITY TEST**

Issue no: 2 Issue date: 26.04.10 Issued by: Standards Unit, Department for Evaluations, Standards and Training Page no: 3 of 10  
BSOP TP 21i2

This NSM should be used in conjunction with the series of other NSMs from the Health Protection Agency

[www.evaluations-standards.org.uk](http://www.evaluations-standards.org.uk)

Email: [standards@hpa.org.uk](mailto:standards@hpa.org.uk)

# AMENDMENT PROCEDURE

<b>Controlled document reference</b>	<b>BSOP TP 21</b>
<b>Controlled document title</b>	<b>Motility Test</b>

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

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

Amendment Number/ Date	Issue no. Discarded	Insert Issue no.	Page	Section(s) involved	Amendment
2 23.04.10	1.1	2	All	<b>Whole document</b>	Document reviewed, no updates required

## MOTILITY TEST

Issue no: 2 Issue date: 26.04.10 Issued by: Standards Unit, Department for Evaluations, Standards and Training Page no: 4 of 10  
BSOP TP 21i2

This NSM should be used in conjunction with the series of other NSMs from the Health Protection Agency

[www.evaluations-standards.org.uk](http://www.evaluations-standards.org.uk)

Email: [standards@hpa.org.uk](mailto:standards@hpa.org.uk)

# MOTILITY TEST

## SCOPE OF DOCUMENT

This test is used to determine if an organism is motile or non-motile. Motile organisms are generally bacilli although a few motile cocci do exist.

## INTRODUCTION

This test is used to determine if organisms are motile by means of flagella. The location of the flagella is determined by the bacterial species. Non-motile bacteria do not possess flagella. The production of flagella is also subject to culture conditions; for example, some bacteria are motile at different temperatures from those at which they are normally incubated eg *Yersinia enterocolitica* is motile at 20-25°C but not at 30°C<sup>2</sup>. Some bacteria such as *Capnocytophaga* species exhibit a gliding motility.

Occasionally bacteria such as *Campylobacter* species produce non-motile variants; these rarely revert to motile forms.

## TECHNICAL INFORMATION/LIMITATIONS

Bacterial motility must be distinguished from Brownian motion. Weakly motile bacteria may require prolonged observation of individual cells.

Some bacteria on first isolation from blood cultures do not appear to be motile.

Motility results are difficult to determine for anaerobic bacteria. Only a positive result is significant.

Some bacteria are motile at one temperature and non motile when incubated at another.

Some bacteria become less motile in old cultures. Repeat motility testing on a fresh sub culture.

### MOTILITY TEST

Issue no: 2 Issue date: 26.04.10 Issued by: Standards Unit, Department for Evaluations, Standards and Training Page no: 5 of 10  
BSOP TP 21i2

This NSM should be used in conjunction with the series of other NSMs from the Health Protection Agency

[www.evaluations-standards.org.uk](http://www.evaluations-standards.org.uk)

Email: [standards@hpa.org.uk](mailto:standards@hpa.org.uk)

# 1 SAFETY CONSIDERATIONS<sup>3-10</sup>

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

All work likely to generate aerosols must be performed in a microbiological safety cabinet.

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

Compliance with postal and transport regulations is essential

# 2 REAGENTS AND EQUIPMENT

## Hanging drop method<sup>11</sup>

Liquid bacterial culture (incubation times and temperatures may vary depending on the species). Refer to the appropriate identification NSM.

Microscope slide with a central depression (or a ring of petroleum jelly or plasticine may be made on an ordinary microscope slide).

Coverslip

## Semi-solid agar method (Craigie)<sup>4</sup>

Bacteriological straight wire/loop (preferably nichrome) or disposable alternative

## Three coverslip method

Normal microscope slide without central depression

Coverslips

# 3 QUALITY CONTROL ORGANISMS<sup>12</sup>

**Positive control:** *Serratia marcescens* NCTC 10975

**Negative control:** *Acinetobacter Iwoffii* NCTC 5866

## MOTILITY TEST

Issue no: 2 Issue date: 26.04.10 Issued by: Standards Unit, Department for Evaluations, Standards and Training Page no: 6 of 10  
BSOP TP 21i2

This NSM should be used in conjunction with the series of other NSMs from the Health Protection Agency

[www.evaluations-standards.org.uk](http://www.evaluations-standards.org.uk)

Email: [standards@hpa.org.uk](mailto:standards@hpa.org.uk)

# 4 PROCEDURE AND RESULTS

## 4.1 HANGING DROP METHOD

- Place a small drop of liquid bacterial culture in the centre of a coverslip
- Place a small drop of water at each corner of the coverslip
- Invert a slide with a central depression over the coverslip
- The coverslip will stick to the slide and when the slide is inverted the drop of bacterial culture will be suspended in the well
- Examine microscopically (x400) for motile organisms

**Note:** If well slides are not available, a ring of Vaseline or plasticine may instead be made on an ordinary microscope slide

**Positive result:** A darting, zigzag, tumbling or other organised movement

**Negative result:** No movement or Brownian motion only

## 4.2 SEMI SOLID AGAR (CRAIGIE)

- Inoculate the test organism - the central glass tube
- Incubate at the relevant temperature for 18-24 hours
- Subculture from the outer section of the medium

**Positive result:** Organism can be recovered from the outer section of the medium

**Negative result:** Organism remains in the inner tube

## 4.3 THREE COVERSIP METHOD

- Set microscope slide according to Figure 1 below.

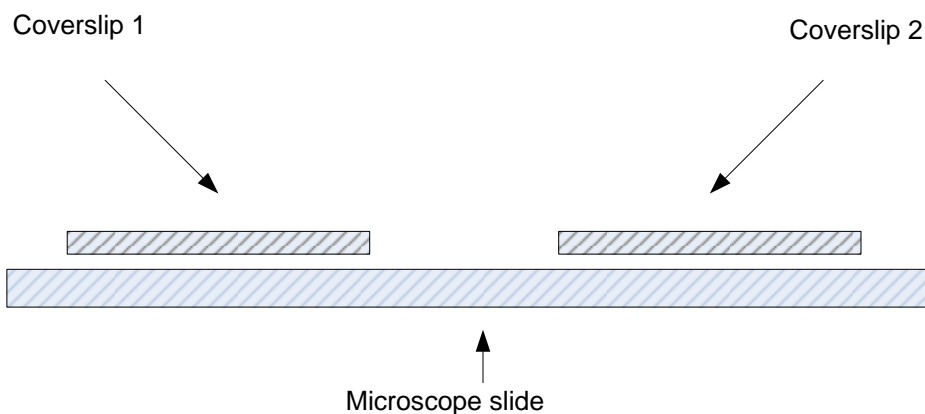


Fig 1.

- Place a small drop of bacterial culture in centre of third coverslip.
- Place a small drop of water at each corner of the coverslip.
- Invert the prepared microscope slide over the third coverslip.

### MOTILITY TEST

Issue no: 2 Issue date: 26.04.10 Issued by: Standards Unit, Department for Evaluations, Standards and Training Page no: 7 of 10  
BSOP TP 21i2

This NSM should be used in conjunction with the series of other NSMs from the Health Protection Agency

[www.evaluations-standards.org.uk](http://www.evaluations-standards.org.uk)

Email: [standards@hpa.org.uk](mailto:standards@hpa.org.uk)

- The coverslip should stick to the other coverslips on the slide and when inverted the drop of bacterial culture should be suspended in the gap between the microscope slide and third coverslip.
- Examine microscopically (x400) for motile organism.

**Positive result:** A darting, zigzag, tumbling or other organised movement

**Negative result:** No movement or only Brownian motion

## 5 ACKNOWLEDGEMENTS AND CONTACTS

This National Standard Method has been developed, reviewed and revised by the National Standard Methods Working Group for Clinical Bacteriology ([http://www.hpa-standardmethods.org.uk/wg\\_bacteriology.asp](http://www.hpa-standardmethods.org.uk/wg_bacteriology.asp)). The contributions of many individuals in clinical bacteriology laboratories and specialist organisations who have provided information and comment during the development of this document, and final editing by the Medical Editor are acknowledged.

The National Standard Methods are issued by Standards Unit, Department for Evaluations, Standards and Training, Centre for Infections, Health Protection Agency, London.

For further information please contact us at:

Standards Unit  
Department for Evaluations, Standards and Training  
Centre for Infections  
Health Protection Agency  
Colindale  
London  
NW9 5EQ

E-mail: [standards@hpa.org.uk](mailto:standards@hpa.org.uk)

### MOTILITY TEST

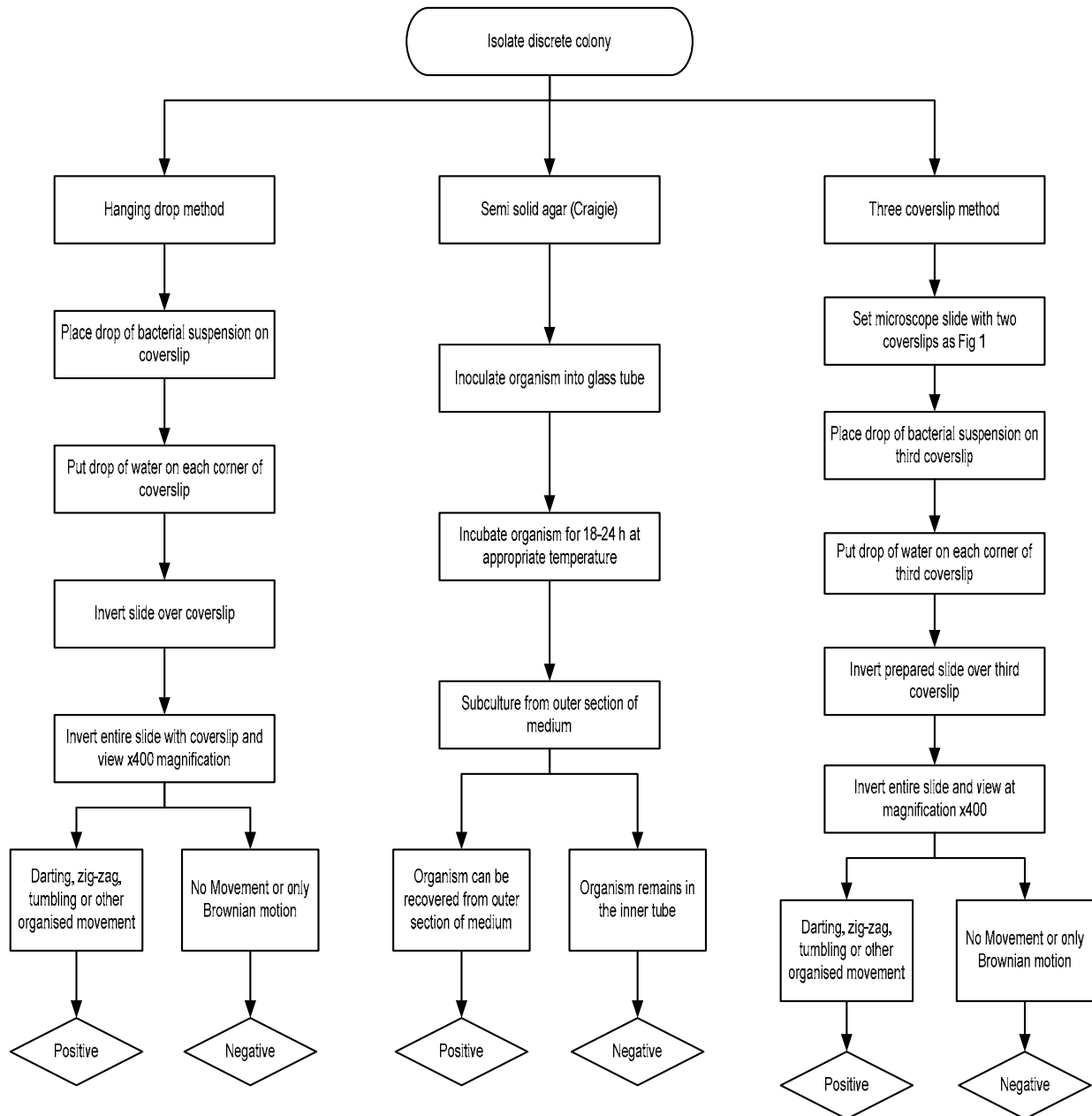
Issue no: 2 Issue date: 26.04.10 Issued by: Standards Unit, Department for Evaluations, Standards and Training Page no: 8 of 10  
BSOP TP 21i2

This NSM should be used in conjunction with the series of other NSMs from the Health Protection Agency

[www.evaluations-standards.org.uk](http://www.evaluations-standards.org.uk)

Email: [standards@hpa.org.uk](mailto:standards@hpa.org.uk)

# APPENDIX: MOTILITY TEST FLOWCHART



Note:

**Positive control:** *Serratia marcescens* NCTC 10975

**Negative control:** *Acinetobacter lwoffii* NCTC 5866

## MOTILITY TEST

Issue no: 2 Issue date: 26.04.10 Issued by: Standards Unit, Department for Evaluations, Standards and Training Page no: 9 of 10  
BSOP TP 21i2

This NSM should be used in conjunction with the series of other NSMs from the Health Protection Agency

[www.evaluations-standards.org.uk](http://www.evaluations-standards.org.uk)

Email: [standards@hpa.org.uk](mailto:standards@hpa.org.uk)

# REFERENCES

1. Department of Health NHS Executive and The Calidcott Committee. Report on the Review of Patient-Identifiable Information. Department of Health. London. 1-12-1997.
2. Bottone EJ. *Yersinia enterocolitica* infections. In: Gorbach SL, Bartlett JG, Blacklow NR, editors. *Infectious Diseases*. 2nd ed. Philadelphia: WB Saunders Company; 1998. p. 733.
3. HSE L5 Control of Substances Hazardous to Health Regulations. Approved Code of Practice and Guidance. 5th ed. HSE Books; 2002.
4. Craigie J. Studies on the serological reactions of the flagella of *B. typhosus*. *J Immunol* 1931;21:417-511.
5. *5 Steps to Risk Assessment: A Step by Step Guide to a Safer and Healthier Workplace*. HSE Books; 2002.
6. *A guide to risk assessment requirements: common provisions in health and safety law*. Suffolk: HSE Books; 2002.
7. *Safety in Health Service Laboratories. Safe working and the prevention of infection in clinical laboratories and similar facilities*. 2 ed. HSE Books; 2003.
8. *Biological agents: Managing the risks in laboratories and healthcare premises 5A.D.* 2008.
9. Public Health Laboratory Service Standing Advisory Committee on Laboratory Safety. *Safety Precautions: Notes for Guidance*. London: Public Health Laboratory Services (PHLS). 1993.
10. Advisory Committee on Dangerous Pathogens. *The Approved List of Biological Agents*. Her Majesty's Stationery Office. Norwich. 2004. p. 1-21
11. *Identification Methods*. In: Collins CH, Lyne PM, Grange JM, editors. *Collin and Lyne's Microbiological Methods*. 7th ed. London: 2004. p. 102-20.
12. Snell JJS, Brown DFJ, Roberts C, editors. *Quality Assurance Principles and Practice in the Microbiology Laboratory*. London: Public Health Laboratory Service; 1999. p. 147-8

## MOTILITY TEST

Issue no: 2 Issue date: 26.04.10 Issued by: Standards Unit, Department for Evaluations, Standards and Training Page no: 10 of 10  
BSOP TP 21i2

This NSM should be used in conjunction with the series of other NSMs from the Health Protection Agency

[www.evaluations-standards.org.uk](http://www.evaluations-standards.org.uk)

Email: [standards@hpa.org.uk](mailto:standards@hpa.org.uk)