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Introduction to a career as a biomedical scientist

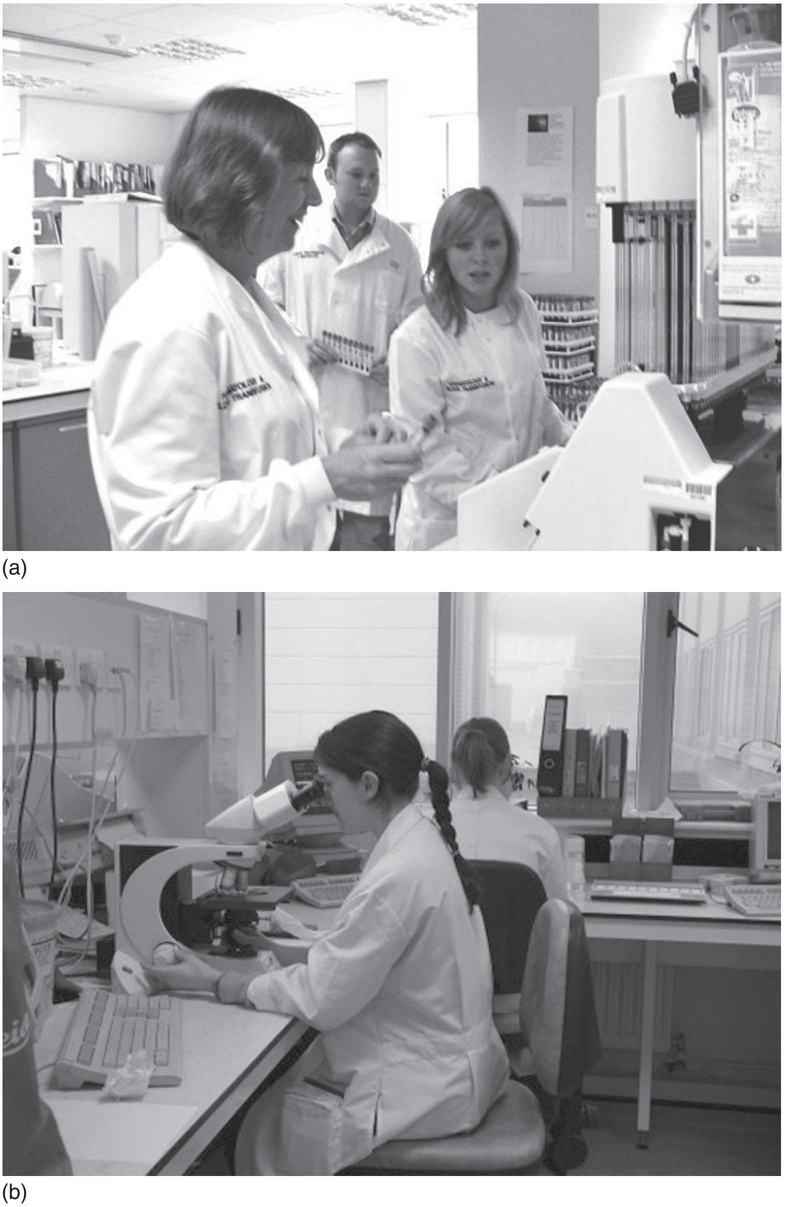
1.1 What is a biomedical scientist?

Biomedical scientists are scientifically qualified, registered practitioners who work in clinical pathology departments. They play a vital role in patient care, by carrying out diagnostic tests on samples such as blood, tissue and urine. As healthcare professionals, biomedical scientists work with a range of staff in hospitals and in primary care, to provide clinical laboratory services. About 70% of clinical diagnoses rely on pathology test results. This means that the laboratory work must be performed to the highest possible standards, that the correct specimen type from the right patient must be tested and that the results must be available, to the staff treating the patient, in good time.

Pathology test results are used to:

- **Diagnose** illnesses. For example, a person with symptoms of tiredness and dizziness might be suffering from iron deficiency anaemia, which could be confirmed by a blood test for haemoglobin concentration.
- **Monitor** conditions. For example, blood HbA1c levels are regularly monitored in diabetic patients to check that their blood sugar levels are well controlled.
- **Screen** for diseases in people who are at risk of having the condition, but do not appear to be ill, such as the test for *Chlamydia* infection.

The laboratory testing is performed or supervised by registered biomedical scientists (Figure 1.1), so although they do not have as much direct contact with patients as doctors and nurses, their contribution is vital. If there were not enough nurses available in a particular hospital, individual wards might have to be closed, whereas with insufficient biomedical scientists to run the pathology service, the work of the whole hospital would be compromised. Since the main role of biomedical scientists is to choose the most suitable testing



(a)

(b)

Figure 1.1 (a) Biomedical scientists discuss the operation of a laboratory analyser. (b) Biomedical scientists examine slides prepared from patient samples under a light microscope

method and then carry out the laboratory work accurately, it is clearly important that they are well trained and work to the highest standards at all times. This means that after the initial training, biomedical scientists have to continue to learn new techniques and keep up to date with scientific advances.

A career as a biomedical scientist can be very rewarding, as practitioners use scientific knowledge and technological expertise to help in diagnosis of disease and prevention of illness. They usually specialize in one clinical area of pathology: cytology, clinical chemistry, haematology, histopathology, immunology, medical microbiology, transfusion science or virology, although some posts cover more than one of these areas. In some pathology departments, biomedical scientists are qualified to carry out tests covering several of these areas, such as chemistry and haematology, where the same analyser can be used for all tests (see Chapter 6). Members of staff who are managers, such as quality managers, training managers and overall pathology service managers, need to be familiar with all disciplines, even if they originally trained and qualified in one area. For those who want to progress, there are many possibilities for career development within biomedical science. Some practitioners specialize in a particular technique or disease, through advanced training and scientific research. Others take on roles outside the traditional laboratory setting such as 'near patient testing' (see Chapter 2), lecturing at a university or working as a representative for a company which makes laboratory equipment and reagents. Biomedical scientists can also develop expertise as managers, which takes them to senior roles within pathology or the wider health service (see below and Chapter 2).

To qualify as a biomedical scientist, both academic and vocational training are required. The academic part of the qualification in the UK is usually a BSc in Biomedical Science which has been accredited by the Institute of Biomedical Science (see below); the vocational training must be undertaken in a approved training laboratory and is designed to show that the trainee has met the Standards of Proficiency set by the Health Professions Council (see below). It is possible to gain an accredited BSc and then take a post as a trainee Biomedical Scientist to complete the vocational training. However, a number of universities across the UK now offer courses which incorporate the vocational training – the so-called 'coterminous' or 'integrated' Applied Biomedical Science degree programmes.

1.2 Early development of clinical laboratory sciences

The idea of examining patients' specimens to aid the diagnosis of clinical disease was used centuries before the underlying science was understood. For example, the ancient literature (from around 1500 BC onwards) includes descriptions of the condition that we now recognize as diabetes mellitus. These relate symptoms of weight loss, extreme thirst and frequent micturation and describe sweet-tasting urine, which implies that someone would test the urine by drinking a little! This seems strange now that we have chemical tests for sugar in the urine (glycosuria) and can observe a colour change rather than a sugary taste, but it is an early example of a how a 'scientific' test can confirm a clinical diagnosis when the symptoms are fairly non-specific. Another example is an account from ancient Greek literature by Hippocrates of the progression of the respiratory infection known as 'consumption' (i.e. tuberculosis), which describes the patient's sputum as typically thick, greenish and sweet. A test involving the patient spitting on hot coals was used to determine the prognosis; a characteristic heavy odour noticed in the sputum, when it was heated on the coals, was taken as a sign that the patient would not survive.

From the 16th century onwards, scientific understanding deepened and broadened, as many discoveries were made and laboratory equipment such as microscopes and glassware was refined. This allowed the invention of more specific and reliable clinical diagnostic tests. By the 19th century, with an understanding of chemistry and the knowledge that the 'sweet taste' in urine is due to the presence of glucose, it was possible to devise a test for glycosuria. It involved adding a reagent containing copper sulfate to the sample and heating. The sugar acts as a reducing agent, changing the copper sulfate to copper oxide, which causes the solution to change colour from blue to reddish brown. Similarly, by the 1880s, once it had been established that infections were caused by microorganisms, light microscopes were powerful enough to detect them and stains were used to highlight them in samples. In this way, Robert Koch was able to identify a bacterium in the sputum samples of patients with 'consumption', which he named *Mycobacterium tuberculosis*. Both the Benedict's test for sugars in urine and the Ziehl – Neelson stain for tubercle bacilli are still used in clinical laboratories in many parts of the world today.

By the turn of the 20th century, as the benefits of science to medical diagnosis had become clearer, doctors were increasingly doing tests on patient's samples. These were usually carried out either by the bedside or in a room nearby that contained the necessary equipment and reagents. The potential for the results of such tests to be used to enhance patient management was recognized and doctors with an interest in laboratory diagnosis started to expand their repertoire. Although there were still some scientists and doctors researching in isolation, there was a demand for diagnostic services from colleagues within hospitals and 'routine' testing of samples began in conjunction with research. The work load therefore increased and hospitals began to employ 'laboratory assistants', who could collect and examine samples. These laboratory assistants were not medically qualified, but had a high level of scientific and technical training and their work contributed to improvements in accuracy and reliability of testing methods. However, as 'laboratory assistant' was not a recognized trade or profession, these workers did not have the protection of a trade union; hospital administrators considered them to be 'unskilled' and paid them low wages. Despite this, there are many examples of intelligent and motivated people who made significant, but unheralded, contributions to medical laboratory science at this time. A small selection of the important developments in medical science which affected diagnostic pathology are given in Box 1.1, but there are many other examples.

Box 1.1 Some examples of significant developments in clinical diagnostic pathology

- Development of the Haematoxylin and Eosin stain by Wissowsky in 1876
- Introduction of agar as a bacterial culture medium and use of covered dishes by Koch and Petri in the 1880s
- Invention of the Gram stain by Gram in 1884
- Characterization of the ABO blood group system by Landsteiner in 1902
- Invention of the radioimmunoassay by Yalow and Berson in 1960
- Development of the technique to manufacture monoclonal antibodies by Milstein and Köhler in 1975
- Invention of the Polymerase Chain Reaction by Mullis in 1983

1.3 Development of the biomedical science profession

By the early 20th century, many people were working to provide technical and scientific support for clinical diagnosis in laboratories all over the UK. However, the opportunities for staff working in different laboratories to communicate experiences and ideas were limited and there was a clear need for a professional organization to facilitate this. A laboratory scientist working in Liverpool, Albert Norman, recognized the requirement for such an organization to support his colleagues. Norman consulted with medical colleagues who had formed the Pathological Society of Great Britain and Northern Ireland in 1906, and so had recent experience of founding and running a professional organization. He always believed that the two professional groups should cooperate closely for the good of patient care. Norman founded the Pathological and Bacteriological Laboratory Assistants' Association (PBLAA) in 1912. The name reflected the nature of the work that laboratory assistants were undertaking at that time. Stains had been developed for use on tissue samples, which allowed the discrimination of cell types and identification of abnormalities when they were examined under the microscope. Agar-based media for the culture of bacteria were also available by this time, which meant that organisms could be grown from patients' samples and stains were used to help visualize pathogens under the microscope. Some basic biochemical tests were also performed.

In order to be a full member of the PBLAA, a laboratory assistant needed to have undertaken 3 years of training and pay a subscription of 5 shillings (which is 25p in decimal currency but was a considerable amount of money at the time!). Through its members, the PBLAA organized scientific meetings, at which findings from research and developments in diagnostic testing techniques could be shared and also social events. Meeting colleagues under the auspices of the professional body, to discuss scientific issues or just to enjoy each other's company, is still important for biomedical scientists today. In 1913, the PBLAA started publication of the *Laboratory Journal*, which was the predecessor of the *British Journal of Biomedical Science*. Then, as now, the purpose was to provide a journal in which members could publish articles describing their scientific research and improvements in techniques to share with each other. This was even more important in 1913 than it is now, as people did not travel as much as they do in the 21st century for work-related purposes, few people had access to telephones and it would be another 80 years before the Internet was invented!

During the First World War, PBLAA members were often conscripted to the front line rather than to work in field hospitals, because they had no formal professional qualifications. This was obviously a waste of their talents and abilities and so after the War, it was decided to introduce written and practical examinations for laboratory assistants. The first examinations were held in 1921 and covered pathological and bacteriological techniques. The idea was to give structure to training and to ensure that laboratory assistants in all clinical laboratories in the country were operating to the same high standards. In 1937, the professional examination comprised two stages, Part I and Part II. A laboratory assistant who passed Part I was eligible to become an 'Associate' of the PBLAA, while the attainment of Part II was necessary to be a 'Member' and was a prerequisite for employment in senior posts. A more senior designation of 'Fellow' was also introduced. In time, advances in pathological sciences led to people concentrating on haematological investigations, blood transfusion or biochemical tests, to the extent that these became recognized as separate disciplines; examinations in these particular subjects were introduced to reflect this and to support the career development of members working in these areas. During the latter half of the 20th century, further discoveries led to the setting up of more specialized sections within pathology, including immunology, virology and cytology and examinations are now offered in these areas also.

In 1943, the PBLAA changed its name to the Institute of Medical Laboratory Technology (IMLT) and its members were known as 'medical laboratory technicians' (MLTs). Professional status for UK members was eventually consolidated by the passing of the Professions Supplementary to Medicine Act in 1960; this made it a legal requirement that MLTs must be registered with the Council for Professions Supplementary to Medicine (CPSM) before practising in the National Health Service. However, by the 1970s, the term 'technician' seemed outdated and not a fair reflection of the high levels of training and qualification required to do the job. Members of the profession were involved in research and development in addition to routine diagnostic work and they wanted a title which acknowledged the scientific nature of their work. The IMLT was renamed the Institute of Medical Laboratory Sciences (IMLS) in 1974 and the new professional designation was Medical Laboratory Scientific Officer (MLSO). There were seven grades of MLSO: two training grades, Junior A and Junior B, the Basic grade, Senior, Chief, Senior Chief and Principal. Registration with the CPSM was achieved through an oral examination after a suitable period of training. This was a prerequisite for employment at the Basic grade and Fellowship (see below) of the IMLS was usually needed for someone to be considered for promotion to Senior MLSO. In 1988, the grade system was altered to trainee MLSO, then MLSO 1, 2, 3 and 4.

The IMLS assumed its current name of the Institute of Biomedical Science (IBMS) in 1994, allowing the introduction of 'Biomedical Scientist' (BMS) as the professional title. In 2004, the NHS implemented a streamlined structure of pay and conditions called Agenda for Change, which put all staff, apart from doctors and dentists, on the same scales. With this came the current nomenclature of registered practitioner, specialist practitioner, etc., and Bands 5–9 for biomedical scientists in the UK. Over the years, the membership and examination systems have been altered several times in response to the changing needs of the profession. Under the current structure, a person in training could join as an Associate member of the IBMS and progress through Licentiate and then Member, to Fellow during their career. The examination system has been designed to underpin the Agenda for Change grading structure, allowing biomedical scientists to gather evidence of how their professional and scientific knowledge and competency are developing. This is intended to help those who wish to obtain promotion to more senior posts and to take on specialized roles such as quality manager or transfusion practitioner.

1.4 Role of the IBMS as the professional body for biomedical scientists in the 21st Century

The Institute of Biomedical Science (IBMS) is the professional body for biomedical scientists in the UK and its stated aim is 'to promote and develop biomedical science and its practitioners' (www.ibms.org). Most current members joined the Institute while training as biomedical scientists in diagnostic laboratories and continued this association as their careers progressed. Thus, while the membership mainly comprises practitioners in clinical laboratories, staff in specialized diagnostic laboratories, researchers and lecturers are also IBMS members. Academic staff, sales representatives and others who are interested in the work of the Institute are also able to join. The main roles of the IBMS are summarized in Box 1.2.

Box 1.2 Roles of the Institute of Biomedical Science (IBMS)

The main roles of the IBMS are to:

- Set professional standards of conduct and practice for members
- Promote the work of biomedical scientists to the general public
- Represent the issues and concerns of biomedical scientists nationally (for example to the media and at the health departments)
- Advise government and national bodies on all issues which involve biomedical science and affect biomedical scientists
- Set academic educational standards and work with universities to accredit degrees which meet these standards
- Set standards of competency for professional practice and provide means of assessment of these standards, leading to recognized qualifications for members who meet them
- Organize a scheme for continual professional development, which is underpinned by scientific meetings at local and national level
- Publish the monthly *Biomedical Scientist* magazine and the quarterly *British Journal of Biomedical Science*
- Provide grants to support members' research activities
- Offer legal and technical services for members who require them
- Award Chartered Scientist status to suitably qualified senior members

The IBMS has a central office in London where full-time members of staff work to assess qualifications of applicants for membership, collect members' subscriptions, organize the Continuing Professional Development (CPD) programme (see Chapter 8), recommend members for Chartered Scientist status, oversee professional examinations, process applications for research grants and coordinate the activities of members at regional and local level (see below). The IBMS publishes a monthly magazine (the *Biomedical Scientist*), which keeps members up to date with news, science and job vacancies, and a quarterly scientific journal (the *British Journal of Biomedical Science*), in which practitioners report research findings. Staff from the central office liaise with government departments (e.g. the Department of Health) and other professional bodies to make sure that biomedical scientists in particular and pathology in general are taken into account in decision making.

Much of the work of promoting and developing the profession is carried out by members, as part of their own professional development. There are regional groups throughout the UK (e.g. North West of England region), plus Ireland, Cyprus, Gibraltar and Hong Kong, and local branches within each region (e.g. Merseyside branch). Members living or working in a particular area can join their local regional group and branch and help to organize scientific and professional meetings and also social events, such as quizzes and outings.

For each specialist area of pathology (e.g. haematology, microbiology) there is a Scientific Advisory Panel (SAP) of practising biomedical scientists, who provide expert advice to the IBMS in their subject area on a variety of issues. Members of these panels are also responsible for organizing the scientific programme in their specialist area at the biennial IBMS Congress, devising continuing professional development activities and setting and assessing IBMS professional qualifications.

There are currently around 16 000 members of the IBMS in the UK and overseas. A biomedical scientist who is a member of the IBMS is showing commitment to their profession in addition to their own personal career development. The Institute depends on ideas and enthusiasm from all its members, to promote the profession and to organize and make presentations at meetings. Table 1.1 gives the categories of IBMS membership as of January 2008 and the requirements to be eligible for each level. There are two types of member: 'corporate' and 'non-corporate'. Those who have the necessary academic and professional qualifications can join the IBMS at the suitable 'corporate' level. Usually a person would start their career as a registered biomedical scientist at Licentiate level and work towards Fellowship over the subsequent 10 or more years. The 'non-corporate' Associate category is available to a range of groups who do not qualify to be Licentiates, Members or Fellows, which includes students. However, students and graduate trainees would be able to apply to become Licentiates after the award of the IBMS Certificate of Competence (Table 1.1). It is clear that biomedical scientists need to gain both academic and professional qualifications to attain higher levels of membership, which are again a mark of the person's dedication to the biomedical science profession.

Table 1.1 IBMS membership categories

IBMS membership category (designation)	Academic qualifications required	Professional qualifications required	Comments
Associate	Enrolment as student on an IBMS-accredited Biomedical Science or Applied Biomedical Science BSc programme *Or* Registered practitioner qualified overseas, but not holding necessary qualifications and experience for full IBMS Membership	Graduate trainee preparing for IBMS Certificate of Competency *Or* Associate practitioner, but not eligible for corporate membership	'Non-corporate' membership category
Licentiate (LIBMS)	BSc Biomedical Science or Applied Biomedical Sciences from IBMS-accredited programme	IBMS Certificate of Competence issued on successful completion of Registration Portfolio	Applicants holding non-IBMS-accredited BSc may meet academic criteria through taking extra modules in an accredited programme
Member (MIBMS)		IBMS Specialist Diploma	Must have been a Licentiate for at least 2 years before applying to become a Member
Fellow (FIBMS)	MSc from IBMS-accredited programme	Higher Specialist Diploma	Must have been a Member for at least 3 years before applying to become a Fellow Prior to 1997, the required qualification was the Fellowship or Special examination
Life member			50 years' service as a member of the IBMS

Members and Fellows who have obtained an MSc, have been in the IBMS for at least 4 years and can demonstrate that they are undertaking continuing professional development (see Chapter 8) are also eligible to apply for Chartered Scientist status. This is indicated by the letter CSci written after a person's name.

1.5 Health Professions Council

The Health Professions Council (HPC) is the regulatory body for 13 healthcare professional groups, including Biomedical Scientists, in the UK. The HPC was set up in 2003 under the Health Professions Council Act 2002, to replace the CPSM, which, as mentioned previously, operated under legislation passed in 1960. By this law, a person working in a clinical laboratory, contributing to patients' diagnoses and using the professional title 'biomedical scientist' in the UK, must be registered with the HPC. Its stated aim is to protect the public who use the services of practitioners belonging to the professions it regulates, as listed in Box 1.3 (www.hpc-org.uk). It does this by setting Standards, which outline the competency, education and behaviour expected of registered practitioners (called 'registrants'). These are summarized in Box 1.4. These sets of Standards are common to all registrants, but interpreted by the relevant professional body (e.g. IBMS, Association of Operating Department Practitioners, British Dietetic Association) for the specific tasks and responsibilities each professional group takes in patient care. The HPC register is available in the public domain on its website, so it is possible to check whether any practitioner is registered and to find their registration number. This makes it easy for employers to ascertain that someone to whom they are about to offer a job is a registrant and also allows anyone to lodge a formal complaint against a clearly identified individual.

Box 1.3 Professions currently regulated by the Health Professions Council*

- Arts therapists
- Biomedical scientists
- Chiropodists/Podiatrists
- Clinical scientists
- Dieticians
- Occupational therapists

Box 1.3 (Continued)

- Operating department practitioners
- Orthoptists
- Prosthetists and orthotists
- Paramedics
- Physiotherapists
- Radiographers
- Speech and language therapists

*Other professional groups may be added to this list as new professions can apply to the HPC to be regulated provided that they meet specified criteria.

Box 1.4 Standards published by the Health Professions Council

Standards of Proficiency: Knowledge and competency that a practitioner must demonstrate to be registered; all registrants must maintain this as appropriate to their job role throughout their career.

Standards of Education and Training: Essential elements of an academic programme which must be contained in a university or college course leading to an award which is in whole or part of the requirement to be a registrant.

Standards of Conduct, Performance and Ethics: Code of behaviour and aptitude that registrants are required to meet, in order that colleagues, patients, clients and the general public will be confident in their suitability to practice.

Standards for Continuing Professional Development: Outline of the responsibility that registrants must take to keep themselves up to date in their area of practice.

1.5.1 HPC standards of proficiency

The vocational part of a biomedical scientist's training is designed to produce competent practitioners who meet all the Standards of Proficiency. This is currently achieved through a portfolio of evidence, according to IBMS guidelines (see below). All biomedical scientists who are on the HPC register are required by law to work according to the Standards of Proficiency at all times. Biomedical scientists who were on the CPSM register when the HPC was created were transferred to the HPC register. Therefore, although only recently qualified practitioners will have completed a portfolio to demonstrate their knowledge of and competency in the Standards of Proficiency, more senior staff have to be familiar with the Standards and be responsible for their actions if they do not meet them. About 23 000 people are registered with the HPC to practice as biomedical scientists, though some of them will be working in the private sector in the UK and others are practising in other countries.

In most countries around the world, training courses for laboratory staff combine theoretical knowledge and understanding with practical experience. Although the basic qualification is often a BSc degree, the content can vary, as it depends on the structure of the healthcare service in each country and the responsibilities that scientifically qualified people take on. This means that while practitioners who trained and qualified outside the UK may be admitted on to the HPC register, each case is considered on an individual basis. Similarly, an IBMS-accredited BSc and HPC registration does not automatically allow a UK biomedical scientist to practice in another country. A probationary period working in a clinical laboratory or studying for an extra qualification may be required.

Table 1.2 gives the HPC Standards of Proficiency as they are given to all professional groups. They have then been 'interpreted' by each professional group to make them appropriate to the different types of work that each registrant profession performs. As the professional body, the IBMS worked with the HPC to provide a suitable version for biomedical scientists. These can be found in the *Health Professions Council Standards of Proficiency – Biomedical Scientists* (www.hpc-org.uk). It is worth noting that the standards in Section 1 are concerned with a person's general professional attitude and awareness of codes of conduct, guidelines and the laws which relate to working in a clinical pathology laboratory. Section 2 relates to the application of scientific and technical principles to the specific work that biomedical scientists carry out, and in Section 3, evidence of knowledge and understanding of the theoretical principles behind the main pathology disciplines is asked for, along with a detailed awareness of the importance of health and safety, which underpins all activities in the laboratory.

For pre-registration training purposes, the IBMS has compiled the Registration Portfolio, which can be used both by students on 'coterminous' or 'integrated' degrees and trainees who are full-time employees in a particular department. This provides lists of knowledge and competence necessary to meet each Standard of Proficiency and gives guidelines about collecting evidence. University courses which are IBMS accredited and incorporate the Registration

Table 1.2 Health Professions Council Standards of Proficiency

Part 1: Expectations of a health professional	
Section 1a: Professional autonomy and accountability	
Registrants must:	
1a.1	be able to practise within the legal and ethical boundaries of their profession
1a.2	be able to practise in a non-discriminatory manner
1a.3	understand the importance of and be able to maintain confidentiality
1a.4	understand the importance of and be able to obtain informed consent
1a.5	be able to exercise a professional duty of care
1a.6	be able to practise as an autonomous professional exercising their own professional judgement
1a.7	recognize the need for effective self-management of workload and be able to practice accordingly
1a.8	understand the obligation to maintain fitness to practice
Section 1b: Professional relationships	
Registrants must:	
1b.1	be able to work, where appropriate, in partnership with other professionals, support staff, service users and their relatives and carers
1b.2	be able to contribute effectively to work undertaken as part of a multi-disciplinary team
1b.3	be able to demonstrate effective and appropriate skills in communicating information, advice, instruction and professional opinion to colleagues, service users, their relatives and carers
1b.4	understand the need for effective communication throughout the care of the service user
Part 2: The skills required for application of practice	
Section 2a: Identification and assessment of health and social care needs	
Registrants must	
2a.1	be able to gather appropriate information
2a.2	be able to select and use appropriate assessment techniques
2a.3	be able to undertake or arrange investigations as appropriate
2a.4	be able to analyse and critically evaluate the information collected
Section 2b: Formulation and delivery of plans and strategies for meeting health and social care needs	
Registrants must:	
2b.1	be able to use research, reasoning and problem solving skills to determine appropriate actions
2b.2	be able to draw on appropriate knowledge and skills in order to make professional judgements
2b.3	be able to formulate specific and appropriate management plans including the setting of timescales
2b.4	be able to conduct appropriate diagnostic or monitoring procedures, treatment, therapy or other actions safely and skilfully
2b.5	be able to maintain records appropriately

Section 2c: Critical evaluation of the impact of, or response to, the registrant's actions

Registrants must:

2c.1	be able to monitor and review the ongoing effectiveness of planned activity and modify it accordingly
2c.2	be able to audit, reflect on and review practice

Part 3: Knowledge, understanding and skills

Registrants must:

3a.1	know and understand the key concepts of the bodies of knowledge which are relevant to their profession-specific practice
3a.2	know how professional principles are expressed and translated into action through a number of different approaches to practice and how to select or modify approaches to meet the needs of an individual, groups or communities
3a.3	understand the need to establish and maintain and safe practice environment

www.hpc-org.uk

Portfolio into their academic programme have flexibility on how they deliver the required training and laboratory experience. Students enrolled on such courses will be advised about how to approach the tasks. For more information on the Registration Portfolio contact the IBMS Registration Department.

Students and trainees who are successful in the IBMS registration portfolio verification are issued with a Certificate of Competence, which is needed to apply to have one's name entered on to the HPC register as a 'registrant practitioner' (although this is subject to satisfactory references and criminal record and health checks). This Certificate is also needed to become a Licentiate member of the IBMS (see Table 1.1), which is important because one cannot be considered for the IBMS Specialist Portfolio unless one is an Institute member.

1.5.2 Role of the HPC in ensuring that practitioners and educators adhere to its standards

Since the HPC standards are published in the public domain, registrants who do not meet them can be called to account, thus protecting the public. A patient, other member of the public or another practitioner can follow a clear complaints procedure if they think that a registrant or academic course is not meeting particular standards. The HPC undertakes to investigate all complaints rigorously. Most concerns are raised about the 'fitness to practice' of a professional registered with the HPC. There is a clear procedure to follow, which makes it fair to both the complainant and the HPC registrant. The issues which can be raised with the HPC about a particular registrant include unprofessional behaviour, incompetence (potentially putting both patients and colleagues at risk), breaking the criminal law (for example, drink driving, possession of class A drugs) or being physically or mentally unfit. The HPC also investigate cases where people have falsely claimed to have obtained the qualifications necessary for entry on to the register, when this is discovered. Similarly, registrants are asked to verify that they are undertaking suitable continuing professional development regularly each time they re-register (see Chapter 8) and potentially fraudulent claims would be looked into. Thus, a registrant can be called to account for not meeting the Standards of Proficiency or the Standards of Conduct, Performance and Ethics in their professional practice. The accusation must be submitted in writing and the person making the complaint must identify themselves to the HPC, so that the matter can be scrutinized thoroughly. The first step is for the complaint to be considered by a panel comprising a number of people, including someone from the same profession as the person under investigation (who can comment on the effect of the registrant's alleged behaviour) and at least one person who is not on the HPC register (who can be more impartial). If this panel decides that there is a case to answer, the matter is passed to either the Conduct and Competence Committee or the Health Committee, as appropriate. At this stage, the allegation is made public – the accused registrant's name and registration number along with a description of the complaint against them are published on the HPC website. A date is also given for the hearing and any person affected by the matter is allowed to attend as an observer.

The outcome of a fitness to practice hearing depends on the situation. Each case is considered individually and the circumstances surrounding the alleged incident or behaviour are taken into account. In some cases, the first panel decides that the HPC registrant has no case to answer. Sometimes, the case is referred to the Conduct and Competence or Health Committee, but they decide not to pursue the matter. When this decision has been made, no further action is taken and the person can resume their full duties at work. If the registrant has done something unwise and unprofessional but there have been no serious consequences (for example, using study and sick leave from one job to work for another employer), they are usually given a 'caution'. This means that they can continue to work as an HPC registrant, but the word 'caution' appears beside their name on the HPC register for a specified length of time. Where the registrant has been struggling to do their job effectively, but has not recognized this (for example, due to illness which has adversely affected their work), they will often have 'conditions of practice' imposed on them. This means that they can continue to work as an HPC registrant, but under supervision and/or after a period of re-training. The HPC would usually review the situation after a suitable length of time (e.g. a year) and decide whether the person is now competent to practice again. In more serious cases, where registrants are suspected of having been working while under the influence of alcohol or drugs or failing to take responsibility for mistakes in their work, they may be suspended from the HPC register for a defined period or even 'struck off' altogether.

1.6 Education and training for biomedical scientists

In the 1970s, clinical pathology departments usually recruited school leavers to train as MLSOs (see Institute of Biomedical Science, above). People joined the laboratory either at 16 years old on leaving compulsory education or, more commonly, at 18 years old, having gained A-levels. Then, as now, few school leavers had a good idea of what the work in diagnostic pathology entailed and they frequently only decided to take up the career after a period of work experience. Trainees were started at the 'Junior A' grade and were sent to college to study part time (on day release) for Ordinary National Certificate and Diploma (ONC/OND) and then Higher National Certificate and Diploma (HNC/HND) in Medical Laboratory Sciences. Within the workplace, they spent several months working in each discipline on rotation, over the course of 2–3 years. Once the period of initial training had been successfully completed, the trainee opted to specialize in one discipline and continued developing their skills and learning more of the theory in that area. They could continue their academic study by taking a BTec or a BSc in their chosen subject, during which time they could be promoted to 'Junior B'. After a further 1–2 years, the trainee would be assessed for registration with the Council for Professions Supplementary to Medicine (see Health Professions Council, above) and became a Basic grade MLSO. During the late 1970s and early 1980s, some laboratories started to recruit graduate trainees, who were started on the Junior B grade and trained exclusively in one discipline. As this became more accepted practice, the opportunity for trainees to rotate through all disciplines became limited and this was eventually stopped.

By the early 1990s, universities began to respond to this preference for graduate recruitment by offering BSc programmes in Biomedical Science, which ran alongside (and in time replaced) the HNC/HND courses. These courses combined teaching of theory with practical training in laboratory skills (Figure 1.2). To ensure that these degree programmes met the profession's requirements, the IBMS set out criteria about the specific knowledge and skills that should be taught in courses, and universities could seek IBMS accreditation for their Honours degree programmes in Biomedical Science. At this time, the pre-registration training for most other healthcare professionals (e.g. nurses, occupational therapists, dieticians) was being changed from a diploma to a degree qualification which included clinical placement experience. In 1995, Biomedical Science followed suit and became a graduate entry profession; this meant that most trainees already had a degree or, if they did not, they were contractually obliged to study for one. The IBMS also laid out minimum standards

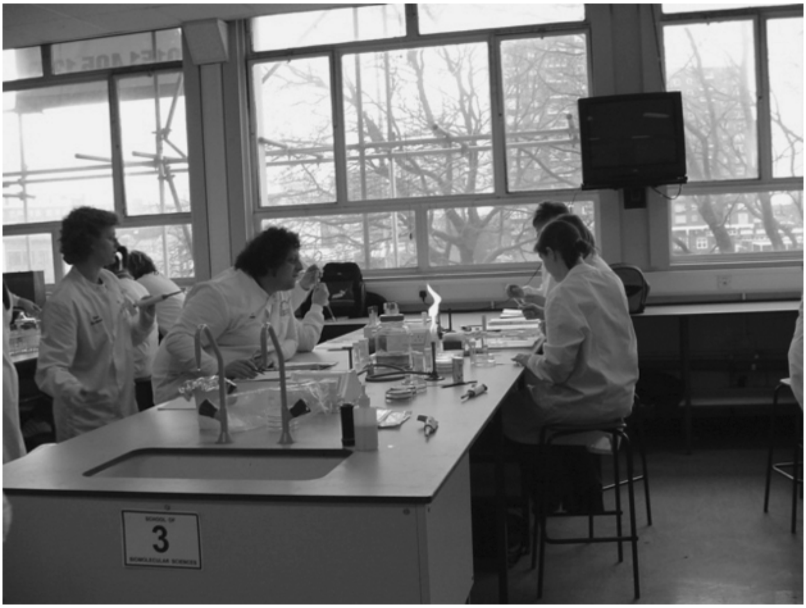


Figure 1.2 Students practice clinical microbiology skills in a university practical class

for laboratories who wanted to take on trainees and granted approval as ‘training laboratories’ only to those who could demonstrate that they met them. Graduate trainees were usually recruited by one of the individual departments within pathology and trained specifically in that discipline. In the early 1990s, the CPSM introduced a ‘log book’, which was a list of tasks which a registered practitioner in that discipline would be expected to be able to perform. When the trainee could demonstrate an understanding of the theory behind a particular laboratory test (for example, by answering questions about it) and was deemed competent in that task by the colleague who had trained them to perform it, then the relevant section of the log book was signed. This was produced by the candidate at their oral examination as evidence that they had successfully undergone a period of structured training.

Until the mid-2000s, this was the pattern of recruitment and training for biomedical scientists in the UK. Since graduates started as ‘trainees’, they were out of step with their colleagues in the other graduate professions on the HPC register, who had completed clinical placement training during their degree and were therefore ‘registered practitioners’ at the time of their graduation. Therefore, the pre-registration training for Biomedical Scientists has now been changed to align it with other professions regulated by the HPC. The key difference is that previously, trainees were expected to acquire detailed, specialized knowledge and competence in a single discipline (for example, so that they could participate in the ‘out of hours service’) before being assessed for

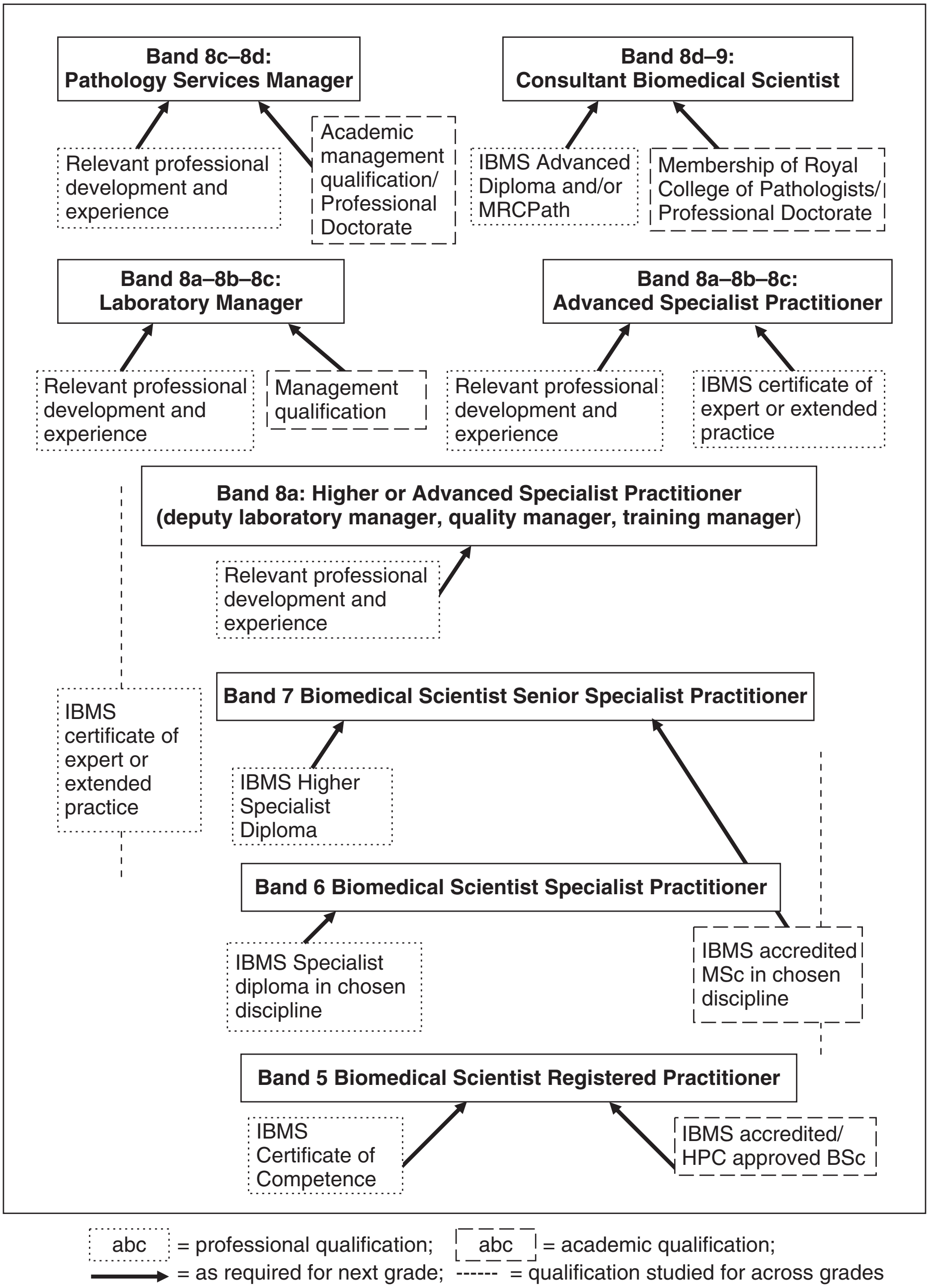


Figure 1.3 Current career pathway for biomedical scientists

registration. Now, it is expected that a newly registrant biomedical scientist will be safe and trustworthy in the laboratory, but will still need training in more depth in the work of the laboratory when they start their first job. This allows for the pre-registration training to give students experience of more than one pathology discipline. Degree programmes for other HPC registrant professions, such as Physiotherapy and Occupational Therapy, include placements in a range of different settings, such as critical care, paediatrics and mental health. For a biomedical scientist, this ‘range of different settings’ might be the clinical chemistry, medical microbiology and histopathology laboratories. Thus, ‘coterminous’ or ‘integrated’ Applied Biomedical Sciences BSc programmes are ideally suited to provide this ‘multidisciplinary’ training. The accredited degree itself covers all areas of pathology and students usually have the opportunity to observe the work in more than one laboratory while on placement, even if they eventually concentrate on one discipline for the majority of their placement time.

One of the reasons for this change is to make undergraduates more aware of the work that biomedical scientists do within the healthcare service and to introduce them to the career possibilities. Those of us who have found our work as biomedical scientists stimulating and rewarding would also like to see people making deliberate choices to join the biomedical scientist profession, in the same way that they choose to be lawyers, nurses or footballers. Figure 1.3 outlines the current career pathway for biomedical scientists. It shows the qualifications and experience that a newly registered practitioner would need to obtain to become an advanced practitioner, service manager or a consultant biomedical scientist. From this, is it clear that a combination of academic and professional qualifications (plus hard work and dedication!) are required, as illustrated by the career pathway case study described in Box 1.5.

Box 1.5 Career pathway case study

Mary is 34 years old and has worked in the Haematology Department of a teaching hospital in a major city for the last 2 years. She started work as a trainee biomedical scientist at her local hospital, after gaining an IBMS-accredited BSc. Three years ago, Mary passed an IBMS-accredited MSc that she had studied for on a part-time basis at a nearby university. With that qualification and 13 years’ experience, she was able to apply for the Band 7 post that she now has at the larger hospital. Mary is working towards taking the IBMS Higher Specialist Diploma (HSD) in haematology, as she would like to take on more senior roles in the future.

She is active in the IBMS, participating in the CPD scheme and organizing monthly lunchtime scientific meetings open to all her colleagues in the Pathology Department and other hospital staff. Therefore, Mary also aspires to obtaining the Fellowship of the IBMS, for which she needs the HSD qualification. Mary has started a distance learning course which is preparing her to take the IBMS Certificate in Extended Practice in Quality Management, since she is interested in eventually working as a pathology quality manager.

1.7 Codes of conduct

Biomedical scientists are bound by law to work safely in the laboratory, process information that they have access to in confidence and treat colleagues with respect (see Chapter 5). They also have two Codes of Conduct with which they must comply. Although it might seem enough to use common sense and accepted practice as guides to behaviour while at work, it is useful for professionals to have codes of conduct for two main reasons: first so that everyone is clear about what is expected of members of that profession, and second so that when someone's behaviour is not satisfactory, it can be pointed out to them unambiguously, with clear suggestions for improvement.

The two Codes of Conduct that biomedical scientists and those training to be biomedical scientists must be aware of and work to at all times, are:

1. the IBMS Code of Professional Conduct (see Box 1.6), as given in Part 1 of *Good Professional Practice for Biomedical Scientists*, 2nd edition (www.ibms.org), which applies to members in all categories including students;

2. the HPC Standards of Conduct, Performance and Ethics, as described in Box 1.4 (www.hpc-org.uk), with which trainees are expected to comply during their training.

Careful study of both codes will reveal that they reinforce the legal requirements to which biomedical scientists must adhere, for example, confidentiality and health and safety legislation (see Chapter 5). However, they are also both concerned with general attitudes, expecting that biomedical scientists will do their best at all times whatever the task in hand. They encourage practitioners to behave politely and respectfully to everyone they meet in a professional capacity. IBMS members and HPC registrants are exhorted not to bring themselves, their profession or the professional body into disrepute. It is important to know these codes because learning to take one's professional duties seriously is a key part of training to be a biomedical scientist.

Box 1.6 The IBMS Code of Professional Conduct

All members of the Institute of Biomedical Science shall always:

1. Exercise their professional judgement, skill and care to the best of their ability.
2. Fulfil their professional role with integrity, refraining from its misuse to the detriment of patients, employers or professional colleagues.
3. Seek to safeguard patients and others, particularly in relation to health and safety.
4. Treat with discretion all confidential and other information requiring protection and avoid disclosure to any unauthorized person the result of any investigation or other information of a personal or confidential nature gained in the practice of their profession.
5. Act in good faith towards those with whom they stand in professional relationship and conduct themselves so as to uphold the reputation of their profession.
6. Strive to maintain, improve and update their professional knowledge and skill.
7. Promote the study and development of biomedical science and the education and training of biomedical scientists.

www.ibms.org

1.8 Conclusion

This chapter has shown that biomedical scientists have a long tradition of working to support patient care, through diagnostic work, research and teaching. They have a legal requirement to be registered to practice in the UK and also a duty to work to the highest standards of professional conduct. Biomedical scientists have opportunities to enhance their skills and knowledge, through training in new areas and taking recognized qualifications, thus leading to a challenging and rewarding career.

Quick quiz

1. Name the three main ways in which pathology contributes to patient care.
2. List the specialist disciplines within pathology.
3. Distinguish between the functions of the IBMS and the HPC.
4. What qualifications are required to become a Fellow of the IBMS?
5. Name the four HPC sets of 'Standards'.
6. State four roles of the IBMS.
7. Why is it necessary for professionals to have codes of conduct?
8. Outline the procedure which is followed if a member of the public makes a formal complaint against an HPC registered practitioner.

Coursework exercises

1. Visit the IBMS website (www.ibms.org) and investigate the full range of professional qualifications that are available to members. Find out in which disciplines one can take the Higher Specialist Diploma and which Certificates of Extended Practice are currently available.
2. Visit the HPC website (www.hpc-org.uk) and find out the registration number of a colleague (with their permission). Find, download and carefully read the Standards of Conduct, Competency and Performance. Think about your experiences in your training laboratory(ies) so far and write a short piece of reflection on whether you have been keeping these standards and how your conduct could improve.
3. Set up interviews with five biomedical scientists – of various ages and grades – and ask them about their training and how they achieved their academic and professional qualifications. Think carefully about your questions so that you obtain useful information from your interviewees. Record your findings as a series of bullet points or in a table. Then write a short reflection on how your attitude to your own career as a biomedical scientist has changed after interviewing these people.

Suggested references

Health Professions Council website: www.hpc-org.uk.

Health Professions Council (2003). *Standards of Proficiency – Biomedical Scientists*, London: HPC, or later edition.

Health Professions Council (2004). *Standards of Conduct Performance and Ethics*, London: HPC, or later edition.
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