Understanding laboratory medicine

International Federation of Clinical Chemistry & Laboratory Medicine Committee on Public Relations
Laboratory medicine: A hidden treasure in health care

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Description</th>
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<tbody>
<tr>
<td>94%</td>
<td>objective data in medical records</td>
</tr>
<tr>
<td>60-70%</td>
<td>clinical decisions influenced</td>
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<tr>
<td>37%</td>
<td>of practice guidelines</td>
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<tr>
<td>23%</td>
<td>different disease areas &amp; growing number of companion diagnostics</td>
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Why is laboratory medicine important?

### Routine patient care
- Both acute and chronic patient care requires laboratory testing

### Speed and accuracy of results
- Laboratory equipment and methods improved
- High throughput, automated platforms

### Quality laboratory results
- Evidence-based decisions and diagnosis
- Monitor disease progression/treatment
What happens to my sample?

Symptoms
Unwell patient

Examination
Physical examination

Test request
Patient sample collected and sent to the laboratory

Laboratory
Laboratory analyses the patient sample

Diagnosis
Pathology results reported to requesting doctor

Treatment
Appropriate medical treatment given

Examination
Continuous monitoring

Laboratory Medicine
What happens to my sample?

- **Symptoms**: Unwell patient
- **Test request**: Patient sample collected and sent to the laboratory
- **Laboratory**: Laboratory analyses the patient sample
- **Treatment**: Appropriate medical treatment given
- **Diagnosis**: Pathology results reported to requesting doctor
- **Examination**: Physical examination
- **Therapy monitoring**: Disease progression
Who can look at my results?

**Laboratory staff**
- Strict patient confidentiality regulations exist
- Laboratory staff release results to requesting doctor

**Requesting doctor**
- Receives paper or electronic copy of test results
- Doctor discusses results with patient

**Patient**
- May have direct access to test results
- Results are stored in medical record
Are my results accurate?

Internal quality control
• No patient results are released until internal quality control for the method is acceptable
• Defined rules for acceptance of QC

Validation and notification
• Highly developed software used to review results
• Abnormal results require validation by scientist

Quality assurance
• External QA programs
• Strict staff training and competency testing
• Accreditation of laboratory by external agency
Laboratory medicine disciplines

Pathologists
- Interprets pathology results
- Medical qualification
- Pathology specialist training

Clinical Lab Scientists
- Performs test analysis
  - Verifies results
- Scientific qualification - Degree level

Technicians
- Assists scientists in laboratory
- Scientific qualification - Diploma level

Phlebotomists
- Collect blood, urine and other samples from patient
- Blood collection certificate

Specimen Receptionists
- Specimen handling & identification
- Patient data entry
Specialities in laboratory medicine

**Biochemistry**
- Blood & Urine
- Hormones
- Glucose
- Lipids
- Liver/Kidney function

**Haematology**
- Blood cells
- Blood type
- Clotting disorders
- Blood products

**Microbiology**
- Urine
- Fluids
- Infections
- Bacteria
- Viruses
- Resistance

**Pathology**
- Tissues
- Cell structure
- Abnormalities

**Molecular Diagnostics**
- DNA
- Genetic traits
- Inheritance
A few practical examples
Have I had a heart attack?

55 year old male with severe chest pain arrives at Emergency

Examination by Doctor
ECG Trace
Blood collected

Monitor recovery

Cardiac surgeon performs angiogram and inserts stent to re-open artery

Lab results confirm heart attack due to block in artery

Lab tests for cardiac markers (CK, Troponin)
Is my blood healthy?

Parents are both "carriers" of abnormal haemoglobin gene (HbS).

All family members blood analysed: ‘Sickle cells’ detected in 1:4 children in family.

Blood collected from all family members.

Patient will be treated and monitored to increase life expectancy (48 years).

7 month African American female with inflammation of toe, present for 3 weeks.

Haematology
Do I have an infection?

25yo female with fever, pain on urination visits general practitioner

Patient urine sample collected

Urine sent to lab for urine culture and sensitivity testing - UTI confirmed

Urine “dipstick” in general practitioner office shows white cells in urine

Antibiotics prescribed, based on sensitivity of microorganism cultured

Monitor recovery
Do I have skin cancer?

42 year old male visits general practitioner for mole check

Mole considered ‘suspicious’ and removed

Clinical Monitoring

Tissue viewed under the microscope - Melanoma confirmed Treatment started

Further surgery to remove nodal lump from underarm. Specimens sent to lab

Tissue fixed and embedded Thin sections of tissue cut and stained

Pathology
Is my unborn child healthy?

37yo female  $G_3P_0$ considered high risk of abnormal pregnancy

Chromosome number checked for major abnormalities (FISH): Normal pregnancy

Mother's blood screened for markers of Down syndrome: Abnormality found

Placental sample put into sterile culture media – to lab

Placental sample collected using a fine needle (CVS)
Patient Self-Testing & Point of Care Testing

Common, simple POCT
- Urine pregnancy test
- Detects β–HCG elevated in pregnancy

Diabetes management at home
- Blood collected by fingerprick
- Blood glucose result in 2-3 minutes

Point of care testing in general practitioner clinic
- Lipid evaluation – cholesterol, triglyceride
- INR (blood clotting time) for patients on anticoagulant therapy
...Lab of the future?

- Lab on a Chip
- Multiplex systems
- Automated MS-MS
- Biosensors for real-time patient monitoring
What is being done now? – The IFCC

45,000 Laboratory specialists
What does the IFCC do?

**Scientific Activities**
- Develops best practice laboratory guidelines
- Develops reference materials
- Encourages innovation and excellence

**Education**
- Transfers knowledge to laboratories in developing countries
- Encourages global information exchange
- Develops unique education programs

**Public Relations/Communications**
- Promotes profession
- Publishes scientific documents & papers
- Holds international scientific meetings
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