

# Understanding laboratory medicine



International Federation of Clinical Chemistry & Laboratory Medicine  
Committee on Public Relations

# Laboratory medicine results: A hidden treasure in health care, providing

**94%** Of objective data in medical records (1)

**90%** Of clinical decisions influenced by critical value reporting (2)

**23%** Of practice guidelines (3)

**23 %** Of companion diagnostics results and constantly growing (4)

1. Hallworth M et al. Current evidence and future perspectives on the effective practice of patient-centered laboratory medicine. *Clin Chem* 2015;61: 589-599.
2. Piva E et al. Laboratory critical values: Automated notification supports (effective clinical decision making). *Clin Biochem* 2014;47:1163-8
3. The Lewin Group. The value of diagnostics: innovation, adoption and diffusion into health care. <http://www.lewin.com/publications/Publication/237/>. Accessed:
4. Heger NE et al. Personalized therapeutics and companion diagnostics: A new paradigm in diagnostics and treatment. *Clin Chem* 2014;60:795-6.

# Why is laboratory medicine important?



Laboratory  
Medicine



- Laboratory Medicine is essential in screening, diagnosis, monitoring and prognosis of diseases
- Laboratory Medicine plays a critical role in monitoring health status and prevention of diseases

## How does it achieve its role?

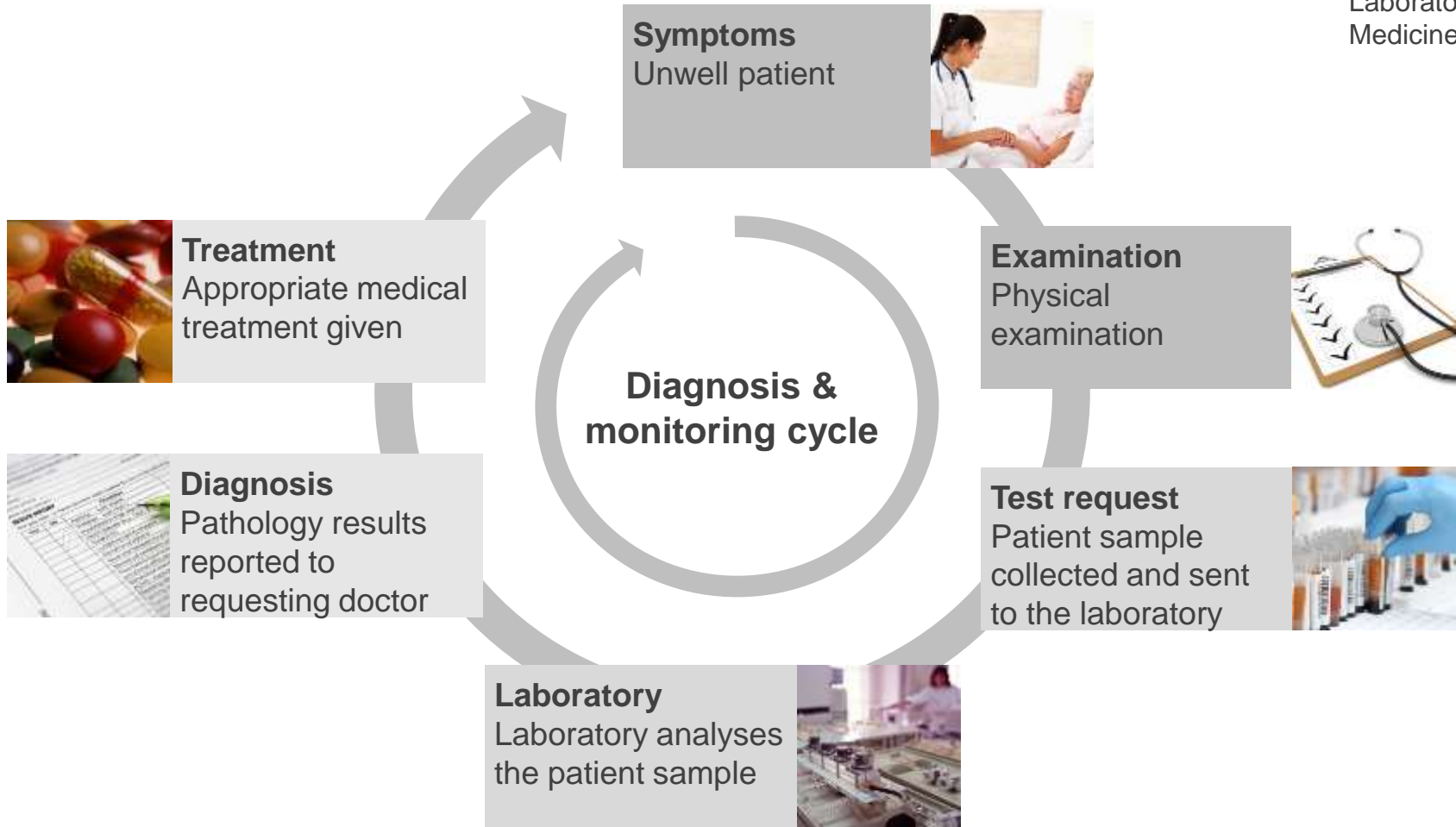


- Directs evidence-based clinical decision making
- Provides high quality laboratory test results
- Ensures optimal test accuracy and precision
- Delivers test results in a timely manner
- Provides expert consultation to healthcare professionals

# What happens to my sample?



Laboratory  
Medicine



# Who can look at my results?



Laboratory  
Medicine



## Laboratory staff

- Strict patient confidentiality regulations apply to test results
- 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?



Laboratory  
Medicine



## Laboratory quality control

- No patient results are released until internal laboratory quality control is acceptable
- Laboratories are regularly monitored by both internal and external quality assurance programs



## Validation and notification

- Highly developed software used to review test results
- Abnormal results require validation by clinical laboratory professionals



## Total Quality Management

- Monitoring of all internal laboratory processes
- External quality assurance programs
- Strict staff training and competency testing
- Accreditation of laboratory by governmental or other regulatory agencies

# Specialties in laboratory medicine



Laboratory  
Medicine



## Biochemistry

Blood & Urine

Hormones  
Glucose  
Lipids  
Liver/ Kidney  
function



## Hematology

Blood cells

Blood type  
Clotting disorder  
Blood products



## Microbiology

Biological fluids

Infections  
Bacteria  
Viruses  
Resistance



## Pathology

Tissues

Cell structure  
Abnormalities



## Molecular Diagnostics

DNA

Genetic traits  
Inheritance

# Laboratory medicine professionals



Laboratory  
Medicine



## Pathologists

- Medical qualification
- Pathology specialist training
- Interpret pathology results



## Clinical Lab Scientists

- Scientific qualification
- Performs test analysis
- Verify results
- Interpret results



## Technicians/ Technologists

- Certification in lab testing
- Assist scientists in laboratory testing



## Phlebotomists

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



## Specimen Receptionists

- Specimen handling & identification
- Patient data entry





Laboratory  
Medicine

# A few practical examples

# Have I had a heart attack?



Biochemistry

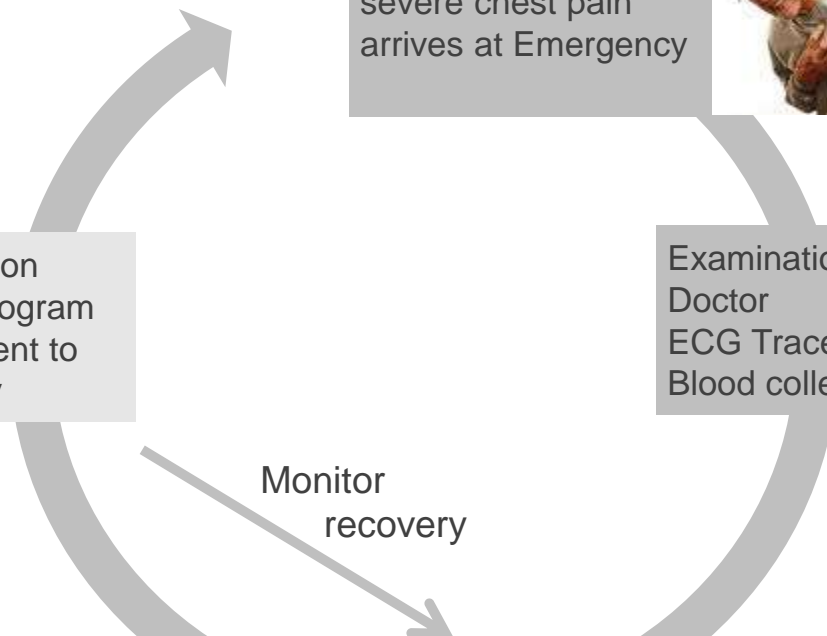
55 year old male with severe chest pain arrives at Emergency



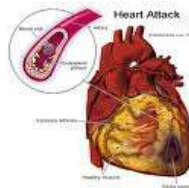
Examination by Doctor  
ECG Trace  
Blood collected



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

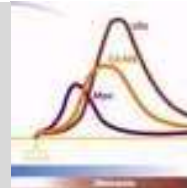


Monitor recovery



Lab results confirm heart attack

Lab tests for cardiac biomarkers (Troponin, CK)



# Does my blood show I am healthy?



Hematology

7 month African American female with abdominal & chest pain present for 3 weeks



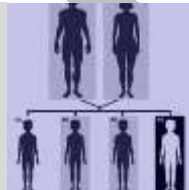
Infant blood collected  
Blood smear analyzed. Sickle cells detected



All family members blood analysed: 'Sickle cells' detected in 1:4 children in family



Parents are both 'carriers' of abnormal haemoglobin gene (HbS)



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

# Do I have an infection?



Microbiology

25 years old female with fever, pain on urination visits general practitioner



Patient urine sample collected



Antibiotics prescribed, based on sensitivity of microorganism cultured

Monitor recovery



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

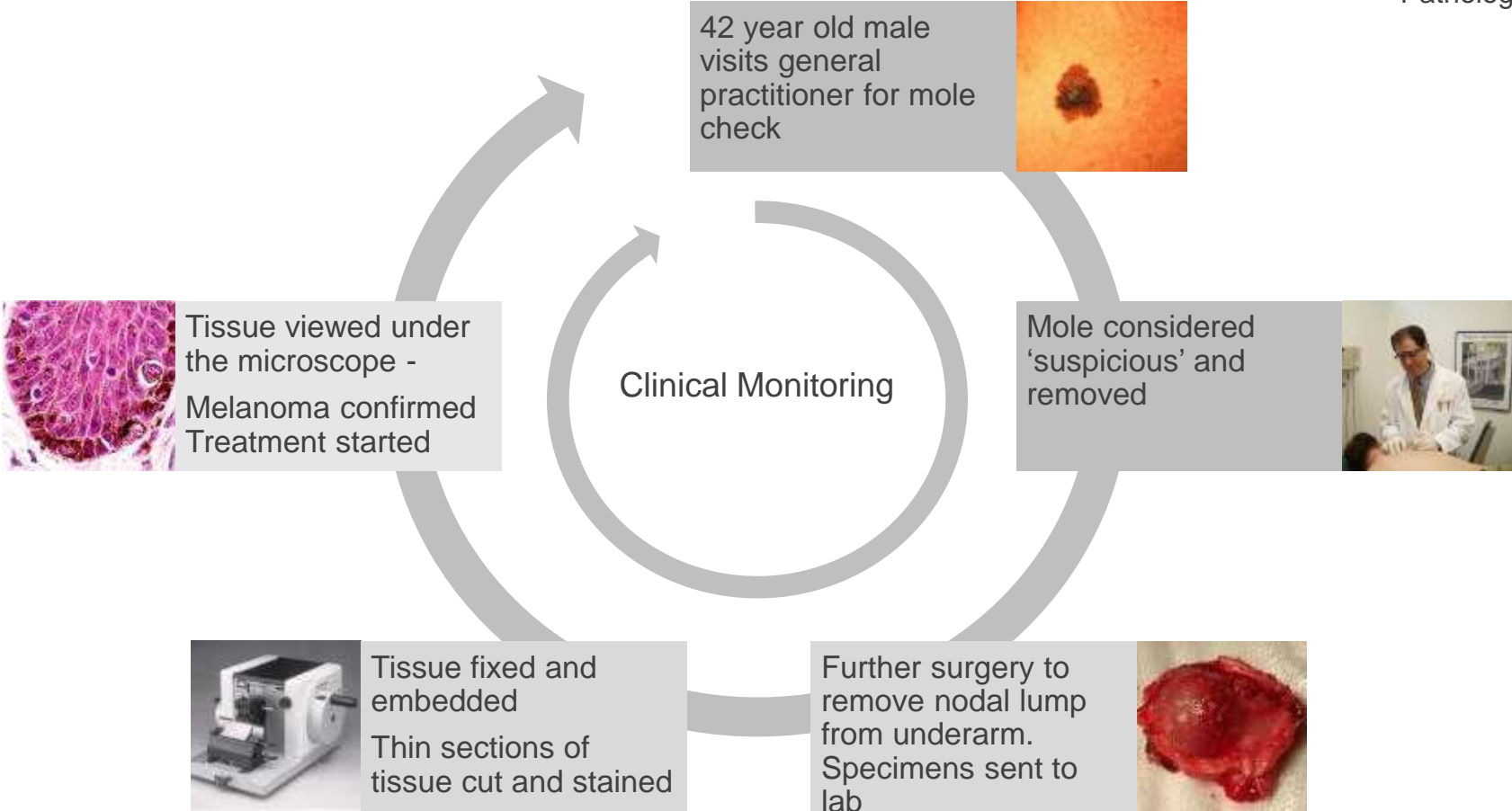
Urine "dipstick" in general practitioner office shows white cells in urine



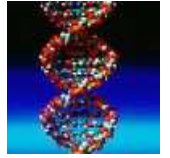
# Do I have skin cancer?



Pathology



# Is my unborn child healthy?



Molecular  
Diagnostics

37 year old female  
G<sub>3</sub>P<sub>0</sub> 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  $\beta$ -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
- Ward-based testing (blood gases)

# ...Lab of the future?



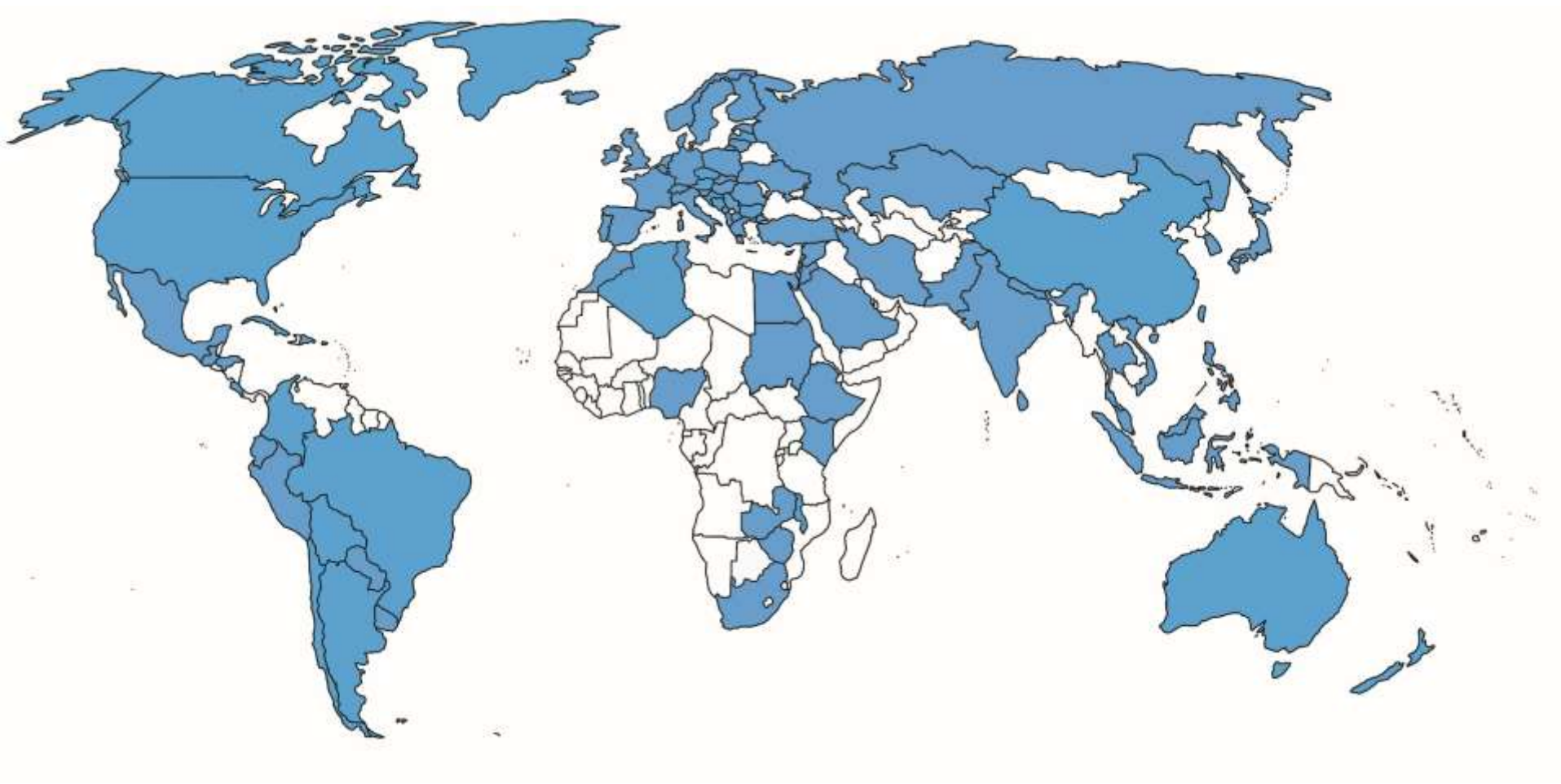
Laboratory  
Medicine



- Lab on a Chip
- Multiplex systems
- Automated Mass Spectrometry
- Biosensors for real-time patient monitoring



# What is being done now? The IFCC



**45,000 Laboratory specialists**

# What does the IFCC do?



Laboratory  
Medicine



## 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

# How can I learn more?



Laboratory  
Medicine

Visit: [www.IFCC.org](http://www.IFCC.org)



 **Lab Tests Online<sup>®</sup>**  
Peer-reviewed Non-commercial Patient-centred  
A public resource on clinical lab testing from the laboratory professionals who do the testing



 **Lab Tests Online<sup>®</sup> UK**  
Peer-reviewed Non-commercial Patient-centred  
A public resource on clinical lab testing from the laboratory professionals who do the testing



 **Lab Tests Online<sup>®</sup> AU**  
Peer-reviewed Non-commercial Patient-centred  
A public resource on clinical lab testing from the laboratory professionals who do the testing



 **Lab Tests Online<sup>®</sup> ES**



**LABS ARE VITAL**

*Find IFCC on Social Media*

