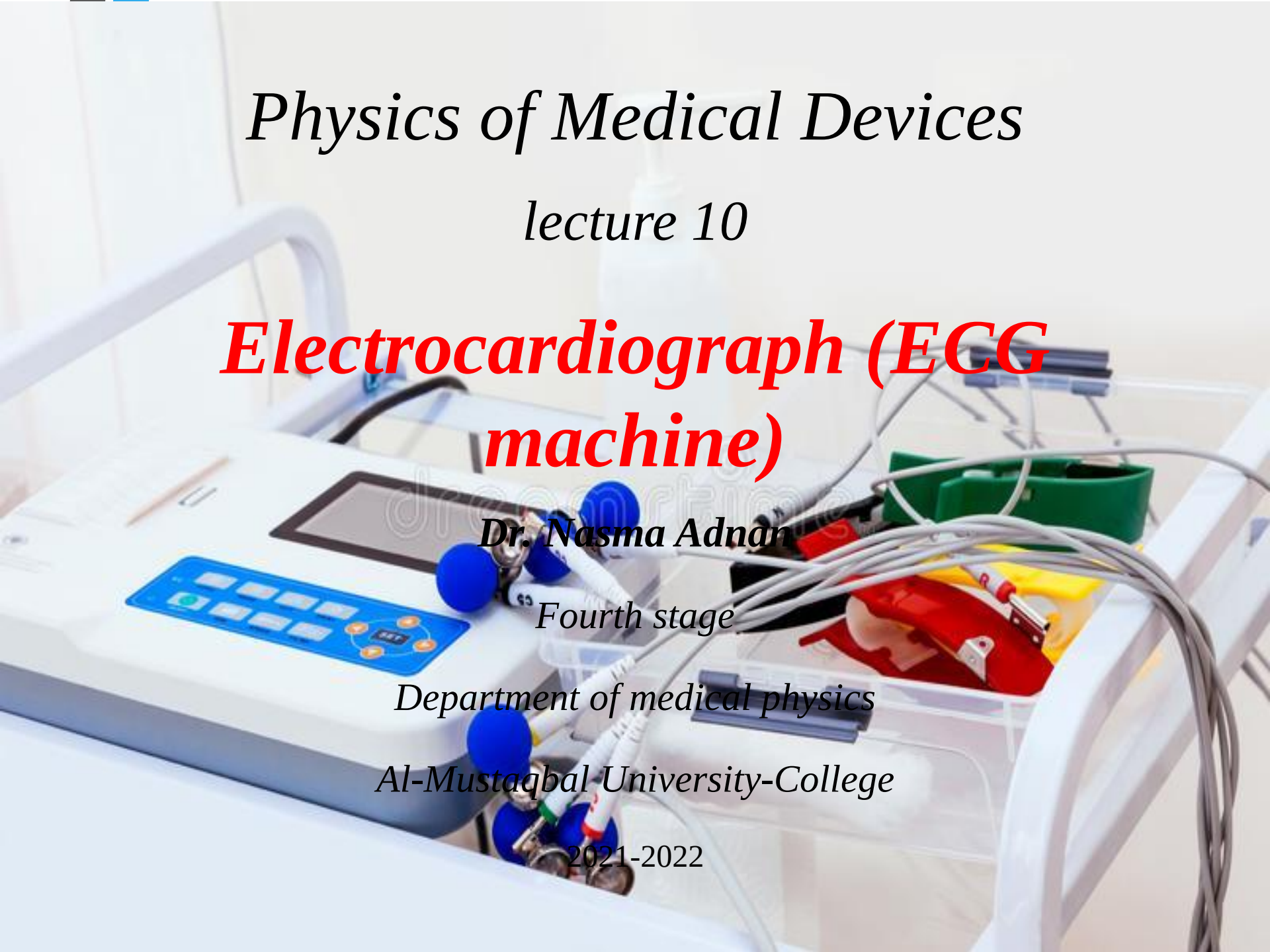
Physics of Medical Devices

lecture 10

Electrocardiograph (ECG machine)



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1. *Introduction*

- Medical device technology is defined as the scientific discipline that applies principles and methods derived from engineering and science to understand, define and solve issues and problems of a biological or medical nature.
- medical devices are divided into three main sections: diagnostic, therapeutic, and supportive.
- diagnostic and therapeutic medical devices:

- Electrocardiography device. ECG جهاز تخطيط كهربائية القلب
- heart pacemaker. جهاز تنظيم ضربات القلب

- Centrifuge .جهاز الطرد المركزي
- Blood pressure device . جهاز ضغط الدم
- endoscope device. جهاز المنظار
- Temperature measuring device. جهاز قياس درجة الحرارة
- Electromyography device (EMG). جهاز تخطيط العضلات
- Intravenous or syringe pump. مضخت الحقن الوريدي
- Spectroscopy device. جهاز التحليل الطيفي
- Electroencephalography EEG جهاز تخطيط الدماغ
- Hemodialysis machine جهاز غسيل الكلى
- Extracorporeal shock wave lithotripsy (ESWL) جهاز تفتيت الحصى

Electrocardiography

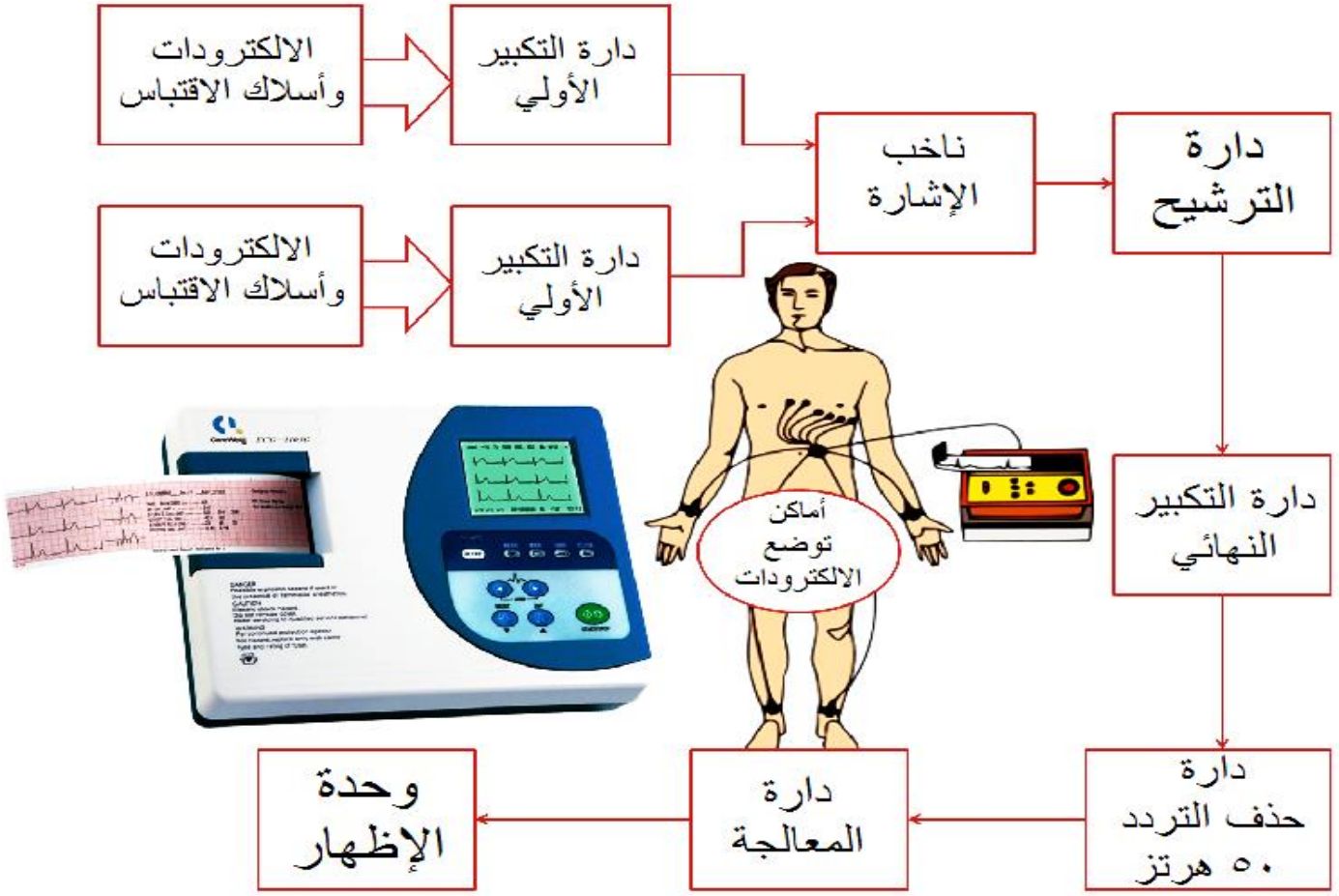
- The electrocardiogram is one of the basic medical devices that must be available in hospitals and clinics.
- On this device, doctors depend on the initial diagnosis of the work of the heart.
- The electrocardiogram records the electrical signals of the heart that are captured from the surface of the body using electrodes and display them on a display screen or print them on specialized paper.
- To record the heart signal, we need five electrodes installed on different areas of the patient's body

ECG components

- ECG devices all share the same principle, but are slightly different in terms of components.
- The device generally consists of the following parts:

1. Calibration المعايرة
2. Sensitivity نقطة الحساسية
3. Position control ضابط الموقع
4. Mark علامة
5. Stylus المؤشر الحراري
6. Stylus Speed تحديد السرعة
7. Fuse قاطع التيار
7. Amplifiers مكبرات
8. Filters مرشحات
9. Ground الارضي
10. Leads الاقطاب
11. C.R.O الشاشة

- Block Diagram for ECG components



❖ What are the electrical connections of the device?

They are the electrodes or electrical sensors that are connected to wires and connected to the device and are divided into the terminal connections that connect to the four ends and the chest connections

Chest leads

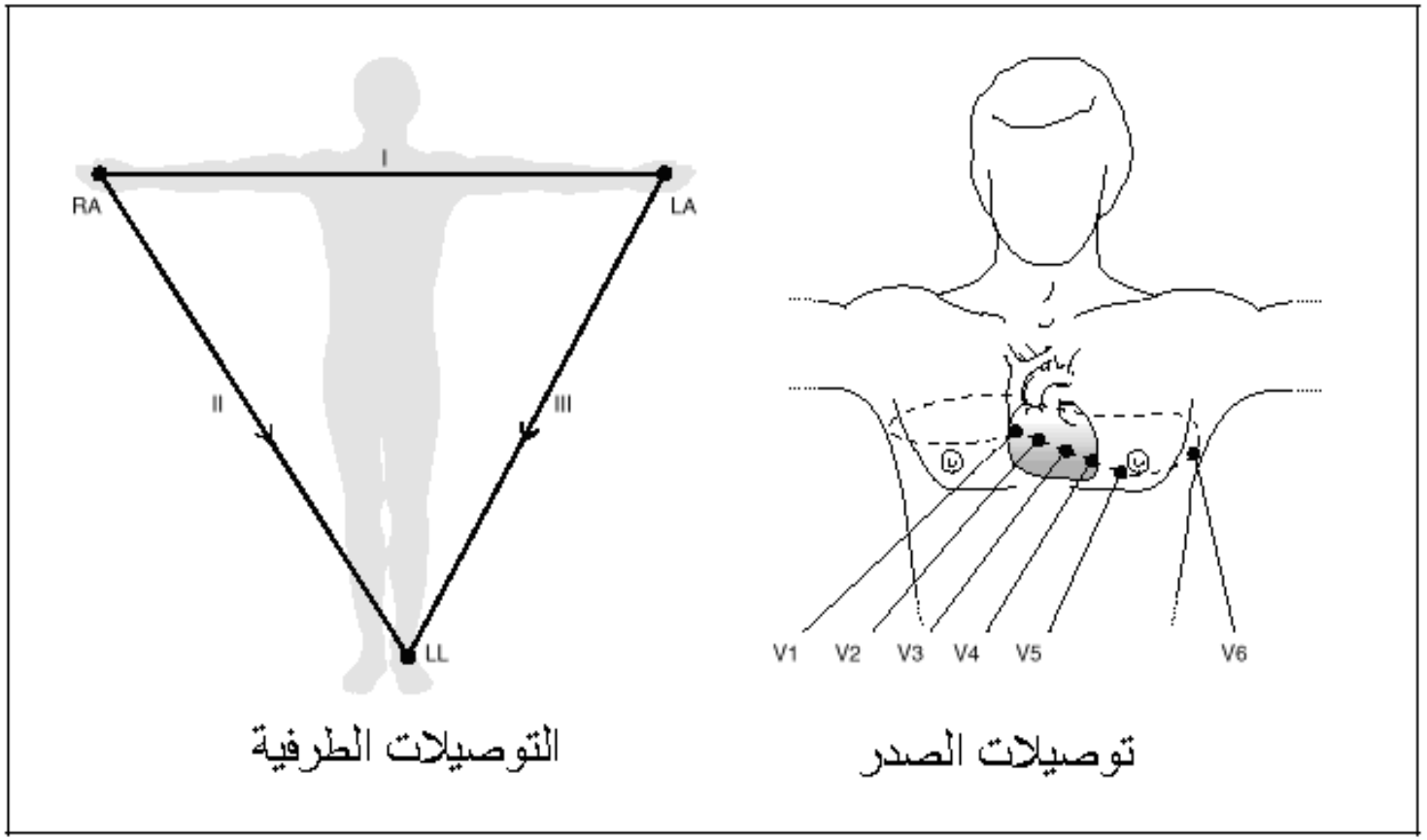
Terminal connections

- In order to avoid errors in connecting the poles, it has been agreed on the colors that distinguish the wires that are connected to each of the electrodes.
- These electrodes are:

1. Right Arm (RA) is yellow
2. Left Arm (LA), black
3. Right Leg (RL), green
4. Left Leg (LL), red
5. Chest (C).

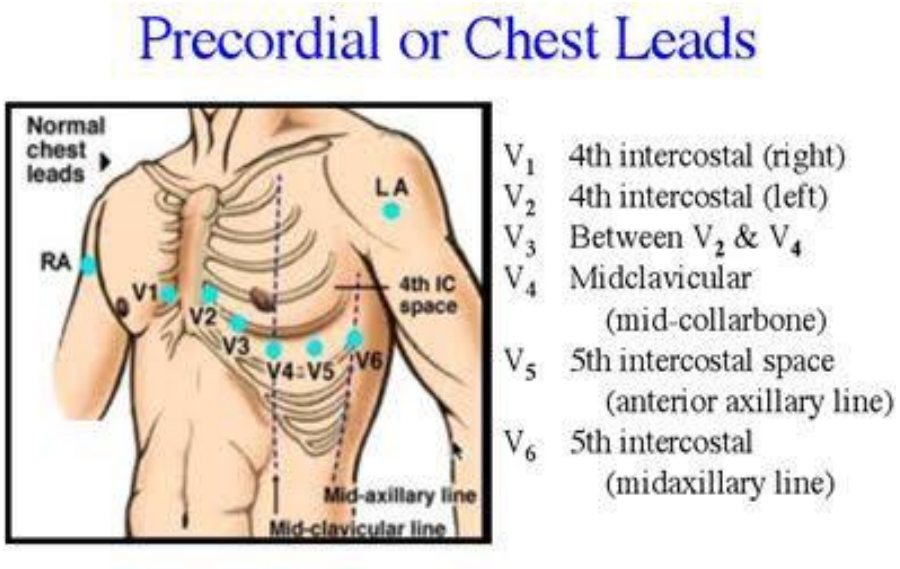
- The electrodes are connected to an electronic device by wires

- In addition to the two-terminal connections (Bipolar Limb Lead) It is I, II, III and it is called (Einthoven triangle) It is connected as shown in Fig



And the places of the electrodes on the chest are as follows

- V1 Rt. 4th intercostal space المسافة رقم 4 التي بين الضلوع على اليمين
- V2 Lt.4th intercostal spaceفي المسافة رقم 4 التي بين الضلوع على اليسار
- V3 : في النقطة ما بينV1 & V2
- V4 : عند قمة القلبAPEX
- V5 :line axillary anteriorفي نفس مستوي قمة القلب عند خط الابط الامامي
- V6 :line axillary-mid في نفس مستوس قمة القلب عند خط الابط المنتصف




CF ECG Electrod
Electrode