

For this class only

Course materials that are used during class will be printed for you (*excluding primer) if you are registered for class.

ECG Rhythm InterpretationJuly 23rd & 24th, 2018

7:30 a.m. - 3:30 p.m.

Minneapolis VA Health Care System –
Room 4T-111**Description/Learning Outcomes**

This class was designed for health care providers who need to monitor, interpret, and act on cardiac rhythms. Learners will acquire or improve upon their ability to analyze ECG Strips and identify common dysrhythmias. Ample opportunity to practice interpreting each of the rhythms on practice strips is included in the learning experience.

Target Audience/Prerequisite

This class was designed for nurses with no experience reading ECGs; however, other health care professionals are welcome to attend.

*You should **complete** the **ECG Rhythm Interpretation Primer** before class time. It will be assumed you have this knowledge. HCMC employees are encouraged to complete the primer on the LMS.

Required for Class!

You need to have calipers for analyzing the ECG rhythm strips. Calipers are available for purchase at the class for \$15.00. You may also "rent" a pair of calipers (fill out a rental form - no charge - unless you fail to return them). Feel free to bring your own!

Schedule Day One

7:30 - 7:45 a.m. Registration
7:45 - 8:15 a.m. Cardiac Anatomy and Physiology
8:15 - 8:45 a.m. Components of the Normal ECG
8:45 - 9:15 a.m. Cardiac Monitors/Lead Placement
9:15 - 10:30 a.m. Sinus Rhythms
10:30 - 11:30 a.m. Atrial Rhythms
11:30 - 12:30 p.m. Lunch
12:30 - 1:15 p.m. Review
1:15 - 2:15 p.m. Junctional Rhythms
2:15 - 3:30 p.m. Practice

Schedule Day Two

7:30 - 7:45 a.m. Registration
7:45 - 8:30 a.m. Review
8:30 - 9:30 a.m. AV Blocks
9:30 - 11:00 a.m. Practice
11:00 - 12:00 p.m. Lunch
12:00 - 1:00 p.m. Review
1:00 - 2:00 p.m. Ventricular Rhythms
2:00 - 3:00 p.m. Practice
3:00 - 3:30 p.m. Putting It All Together

There are two fifteen minute breaks scheduled each day.

The instructor for this course:

Cleo Bonham, MSN, RN, is a Clinical Instructor at the Minneapolis VA Health Care System.

Please Read!

- Check the attached map for directions to the class and assistance with parking.
- Certificates of attendance will be emailed to class participants once the online evaluation is completed.
- You should dress in layers to accommodate fluctuations in room temperature.
- Food, beverages, and parking costs are your responsibility.
- If you are unable to attend after registering, please notify the Education Department at your hospital or TCHP at 612-873-2225.
- In the case of bad weather, call the TCHP office at 612-873-2225 and check the answering message to see if a class has been cancelled. If a class has been cancelled, the message will be posted by 5:30 a.m. on the day of the program.
- More complete class information is available on the TCHP website at www.tchpeducation.com.

Continuing Education Credit

<p>For attending this class, you are eligible to receive:</p>	<p>12.50 contact hours</p> <p>Criteria for successful completion: All participants must attend the program and complete an online evaluation form to receive contact hours. Note that you must attend the ENTIRE activity to receive contact hours.</p> <p>The Twin Cities Health Professionals Education Consortium is an approved provider of continuing nursing education by the Wisconsin Nurses Association, an accredited approver by the American Nurses Credentialing Center's Commission on Accreditation.</p>
<p>If you complete the primer for this class, you are eligible to receive additional contact hours.</p>	<p>Criteria for successful completion: You must read the primer and complete the online post-test and evaluation.</p>

Evaluation of Learning:

Participants can be validated on their competence in interpreting basic ECG rhythms by completing a test after the course.

Minneapolis VA Health Care System –4T-111-113

One Veterans Drive
Minneapolis, MN 55417

Directions to the MVAHCS

From the East (St. Paul): Take 35E south to West 7th/Highway 5 exit. Turn right at the top of the exit ramp. Continue on 5 to the Fort Snelling exit and stay to the right as you follow the exit around. You will “Y” into traffic coming from the Mendota bridge. Move to the right and exit on 55 west. As you exit on 55 west, it will “Y” almost immediately. Stay to the left and go straight through the stoplight. You will be on Minnehaha. Follow Minnehaha to the stoplight in front of the VA and turn left into the parking lot. If you miss the “Y” continue to the next stoplight (54th) and turn left. Go to stop sign (Minnehaha) and turn left again. Go to the stoplight in front of the VA and turn right into the parking lot.

From the Southeast: Take 35E to 110 west. Take the 55 west/Fort Snelling exit. Go to the far righthand lane as soon as you exit to continue on 55 west. Go over the Mendota Bridge, move to the right lane and exit to follow 55 west. As you exit on 55 west, it will “Y” almost immediately. Stay to the left and go straight through the stoplight. You will be on Minnehaha. Follow Minnehaha to the stoplight in front of the VA and turn left into the parking lot. If you miss the “Y” continue to the next stoplight (54th) and turn left. Go to stop sign (Minnehaha) and turn left again. Go to the stoplight in front of the VA and turn right into the parking lot.

From the North: Take 35W south to 62 east. *Follow directions below.

From the South: Take 35W north to 62 east. *Follow directions below.

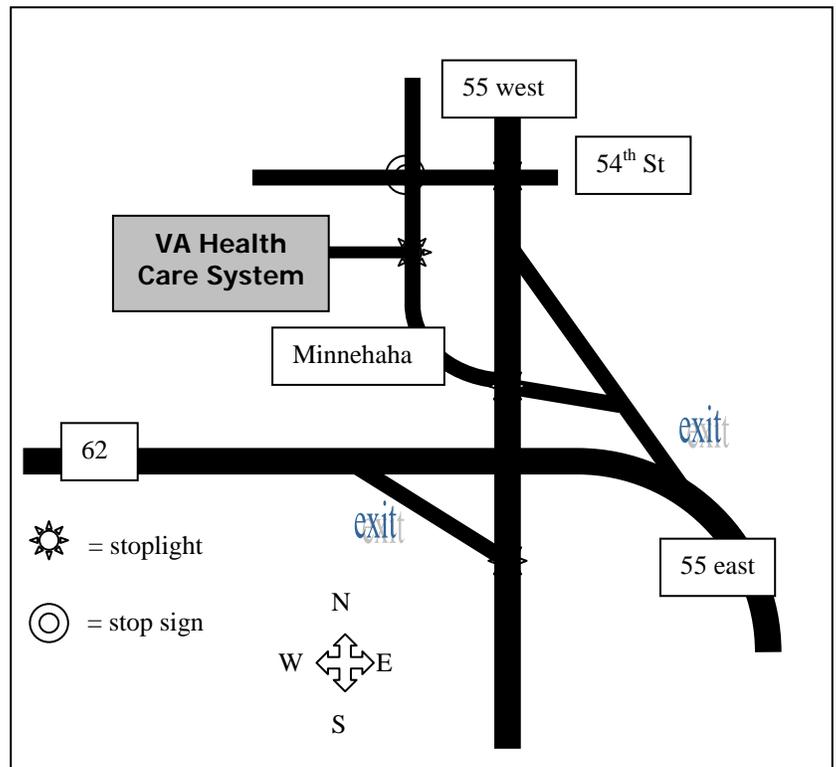
From the West: Take 494 east to 35W north. Take 62 east. *Follow directions below.

***Directions, continued:** Get into the right lane on 62 and exit on 55 west. At the top of the exit ramp, turn left to continue on 55 west. Go to the stoplight (Minnehaha) and turn left. Follow Minnehaha to the stoplight in front of the VA and turn left into the lot.

For All: Park in the Visitor’s Parking Lot to the left (parking is free). Enter through the outpatient entrance and take the elevator to the 4th floor. Enter the education department straight ahead. Rooms 4T-111-113 are straight ahead.

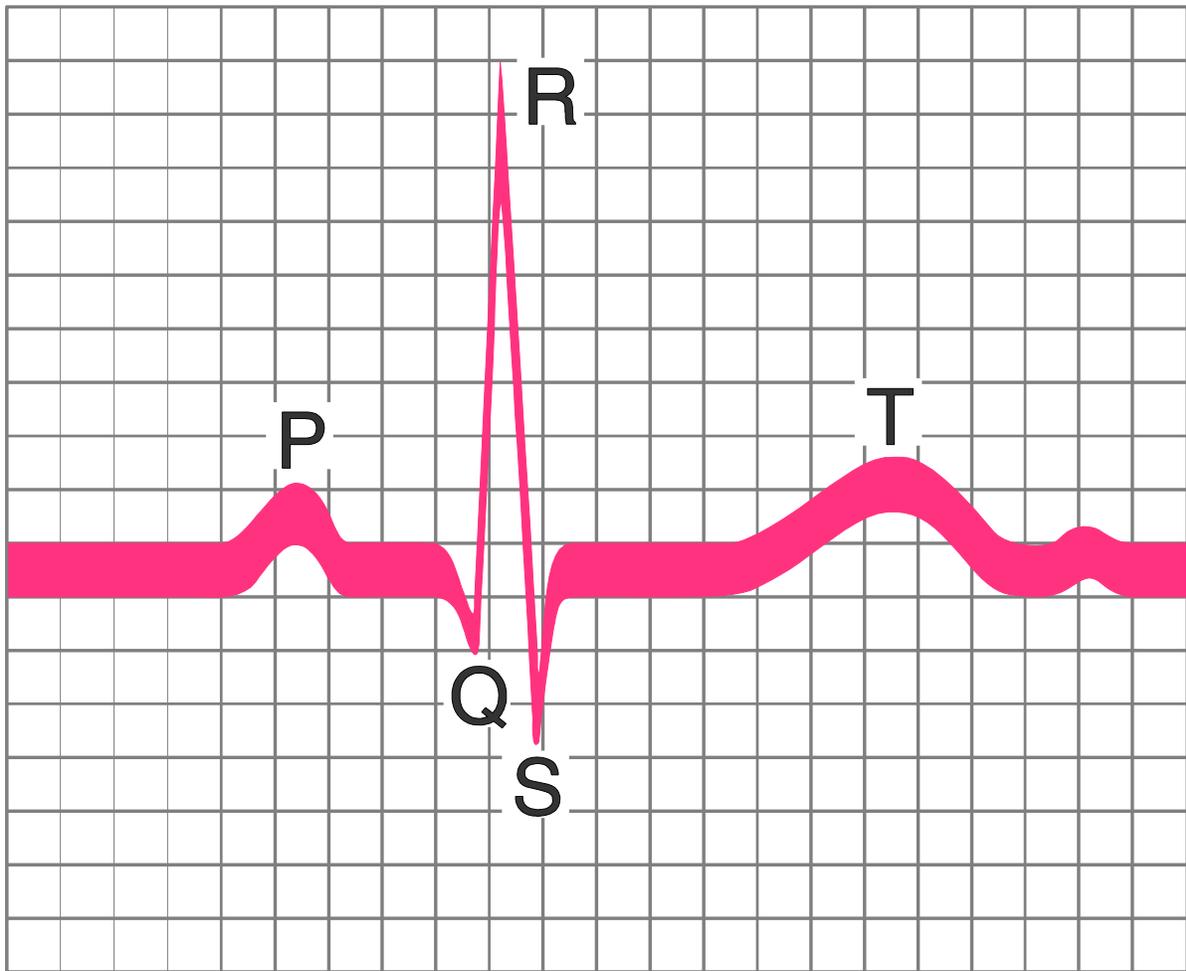
Light Rail Transit: The LRT line stops right in front of the VA. Feel free to utilize the park and ride lots and take the LRT to the VA. Go to the LRT website for information about where to park, fares, and how to ride:

<http://www.metrocouncil.org/transit/rail/index.htm>



ECG RHYTHM

INTERPRETATION PRIMER



ECG INTERPRETATION PRIMER

Introduction/Learning Outcomes

Interpretation of ECGs (Electrocardiograms; also known as EKGs) is one of the building blocks of nursing. Before the actual ECG interpretation can occur, a significant base of cardiac knowledge must be built. The learning outcome of this home study is for learners to self-report an improvement in their knowledge base related to electrophysiology, anatomy and physiology of the normal conduction system, electrode placement, and ECG paper.

Target Audience

This home study was designed for the novice critical care or telemetry nurse; however, other health care professionals are invited to complete this packet.

Content Objectives

1. Describe the electrophysiology behind cardiac electrical action.
2. Identify the normal conduction of electrical current and the waveforms this current produces.
3. Describe the location and function of the following structures:
 - .. Sinoatrial (SA node)
 - .. Atrioventricular (AV) junction
 - .. Bundle of His
 - .. Bundle branches
 - .. Purkinje fibers
4. Identify preparation and placement of ECG electrodes.

Disclosures

In accordance with ANCC requirements governing approved providers of education, the following disclosures are being made to you prior to the beginning of this educational activity:

Requirements for successful completion of this educational activity:

You must read the home study packet and complete the online post-test and evaluation.

Conflicts of Interest

It is the policy of the Twin Cities Health Professionals Education Consortium to provide balance, independence, and objectivity in all educational activities sponsored by TCHP. Anyone participating in the planning, writing, reviewing, or editing of this program are expected to disclose to TCHP any real or apparent relationships of a personal, professional, or financial nature. *There are no conflicts of interest that have been disclosed to the TCHP Education Consortium.*

Expiration Date for this Activity:

As required by ANCC, this continuing education activity must carry an expiration date. The last day that post tests will be accepted for this edition is **December 31, 2020**—your envelope must be postmarked on or before that day.

Planning Committee/Editors*

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*Designates the content expert for the current edition

Contact Hour Information

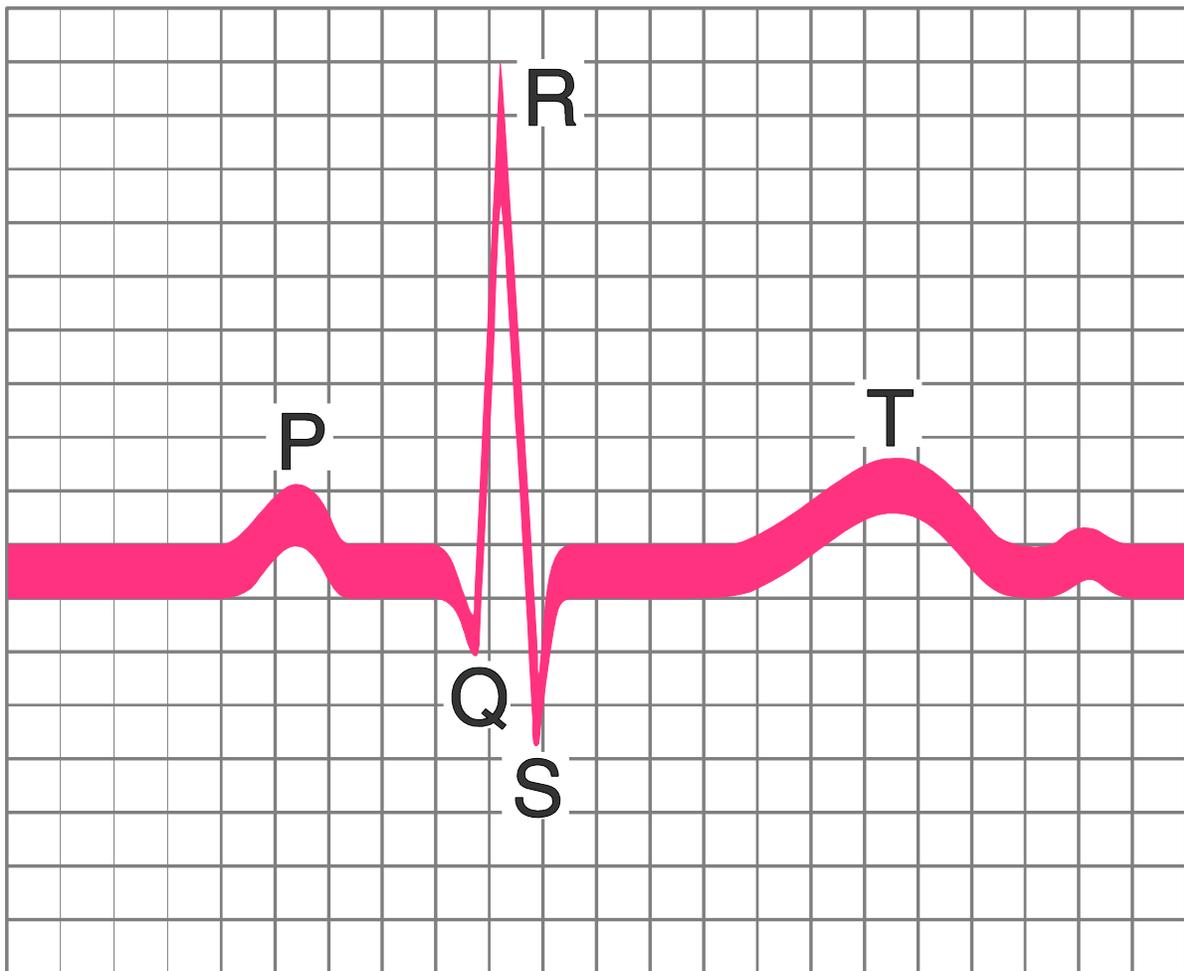
For completing this Home Study and evaluation , you are eligible to receive:	1.00 contact hours <i>Criteria for successful completion:</i> You must read the home study packet and complete the online post-test and evaluation. The Twin Cities Health Professionals Education Consortium is an approved provider of continuing nursing education by the Wisconsin Nurses Association, an accredited approver by the American Nurses Credentialing Center's Commission on Accreditation.
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Please see the last page of the packet for information on submitting your post-test and evaluation for contact hours.

INTRODUCTION

As it beats, the heart generates small electrical currents. A recording of this electrical activity is called an "ECG" (electrocardiograph). The terms EKG and ECG mean the same thing. EKG comes from the German language while ECG comes from English. A standard ECG is obtained by placing electrodes on the patient's body in a specific pattern and monitoring the flow of the electrical activity. The test is entirely painless.

Each of the heart's beats can be divided into three main parts. The first part is the small P wave which represents the atrial contraction. The second part is the tall QRS spike which represents the ventricular contraction. The third part is the large T wave which represents the relaxation of the ventricles. By analyzing the exact pattern of the ECG, healthcare professionals can learn a great deal about how the heart is working.



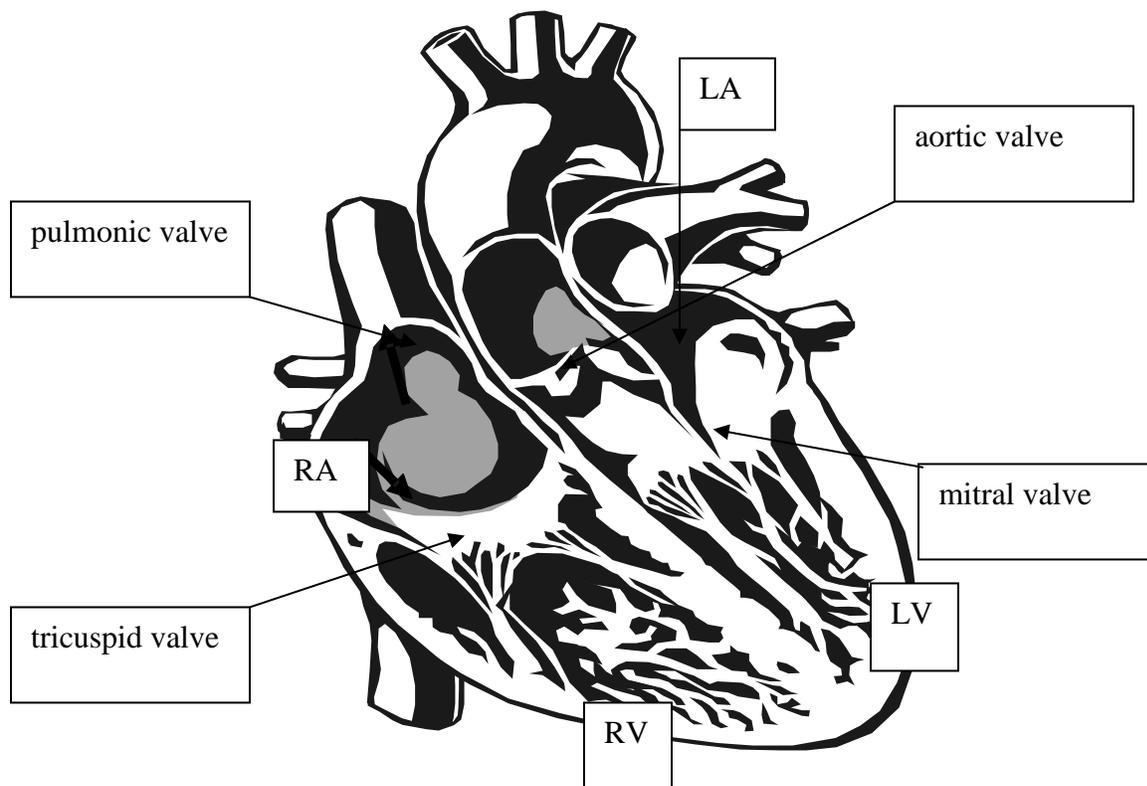
A BRIEF ANATOMY AND PHYSIOLOGY LESSON

Heart Valves

When blood flows through the heart, it follows a unidirectional pattern. There are four different valves within the myocardium and their functions are to assure blood flows from the right to left side of the myocardium and always in a “forward” direction.

The two valves found between the atria and ventricles are appropriately called atrioventricular (A-V) valves. The **tricuspid valve** separates the right atrium from the right ventricle. Similarly, the **mitral valve** separates the left atrium from the left ventricle. When these valves are intact, they prevent backflow of blood from the ventricle to the atrium during ventricular contraction.

The two remaining valves are called semilunar valves (because they look like half moons). The valve located where the pulmonary artery meets the right ventricle is called the **pulmonic valve**. The **aortic valve** is located at the juncture of the left ventricle and aorta. Both semilunar valves prevent backflow of blood into the ventricles.

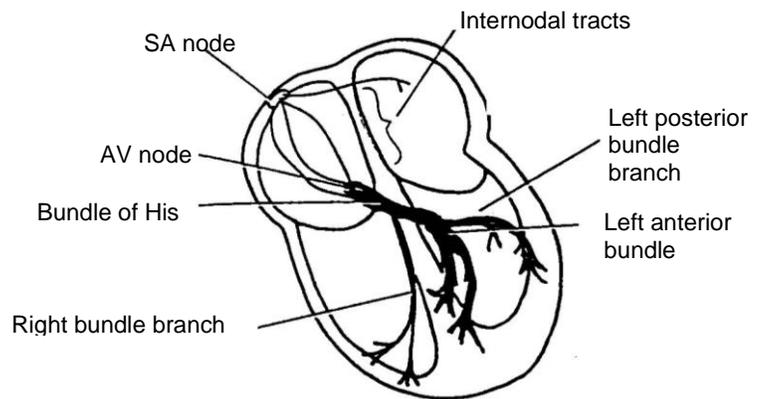


The Conduction System

An ECG is a road map of the electrical activity of cardiac cells during the contraction and relaxation of the heart. The sinoatrial (SA) node, atrioventricular (AV) node, Bundle of His, and down the branches to the Purkinje fibers are the normal pacing sites of the heart. In a healthy person, an ECG should demonstrate an organized, sequential electrical impulse from its beginning at the SA node to its conclusion at the Purkinje fibers. Cardiac electrical activity immediately precedes the contraction of cardiac muscle.

The **Sinoatrial node** (also called the **SA node** or **sinus node**) is a group of specialized cells located in the posterior wall of the right atrium. The SA node normally depolarizes or paces more rapidly than any other part of the conduction system. It sets off impulses that trigger atrial depolarization and contraction. Because the SA node discharges impulses quicker than any other part of the heart, it is commonly known as the natural **pacemaker** of the heart.

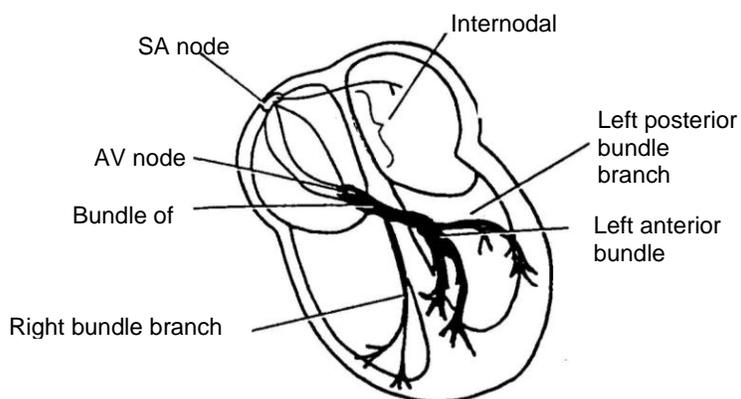
The SA node normally fires at a rate of 60-100 beats per minute.



After the SA node fires, a wave of cardiac cells begin to depolarize. Depolarization occurs throughout both the right and left atria (similar to the ripple effect when a rock is thrown into a pond). This impulse travels through the atria by way of inter-nodal pathways down to the next structure, which is called the AV node.

The impulse is delayed for 0.08 to 0.12 seconds in the **AV node**. This delay allows both atria to depolarize before the impulse continues through the remaining conduction system pathway. The AV node is a cluster of specialized cells located in the lower portion of the right atrium, above the base of the tricuspid valve.

The AV node has two functions. The first function as stated above, is to **DELAY** the electrical impulse in order to allow the atria time to contract and complete filling of the ventricles. The second function is to receive an electrical impulse and conduct it down to the ventricles via the **AV junction** and **Bundle of His**.



After passing through the AV node, the electrical impulse enters the **Bundle of His** (also referred to as the **common bundle**). The Bundle of His is located in the upper portion of the interventricular septum and connects the AV node with the two bundle branches. If the SA node should become diseased or fail to function properly, the Bundle of His has pacemaker cells, which are capable of discharging at **an intrinsic rate of 40-60 beats per minute**. This back-up pacemaker function can really come in handy!

The AV node blocks excessive atrial impulses from reaching the ventricles, thus preventing cardiac output from dropping to dangerous levels as a result of a fast ventricular rate. The AV node also has the ability to act as the pacemaker for the heart should the SA node fail or the impulses from the SA node become blocked.

The cardiac impulse then travels from the AV node to the Bundle of His, which divides into right and left bundle branches that travel to the ventricles. The bundle of His is located in the upper portion of the interventricular septum and connects the AV node with the two bundle branches. If the SA node should become diseased or fail to function properly, the Bundle of His has pacemaker cells, which are capable of discharging at **an intrinsic rate of 40-60 beats per minute**.

The cardiac impulse terminates with ventricular depolarization, which takes place in the Purkinje fibers located in the muscles of the ventricles. The Purkinje fibers penetrate about 1/4 to 1/3 of the way into the ventricular muscle mass and then become continuous with the cardiac muscle fibers. The electrical impulse spreads rapidly through the ventricular muscle, causing ventricular contraction, or systole.

These Purkinje fibers within the ventricles also have intrinsic pacemaker ability. This third and final pacemaker site of the myocardium can only **pace at a rate of 20-40 beats per minute**. You have probably noticed that the further you travel away from the SA node, the slower the backup pacemakers become.

ELECTROPHYSIOLOGY IN BRIEF

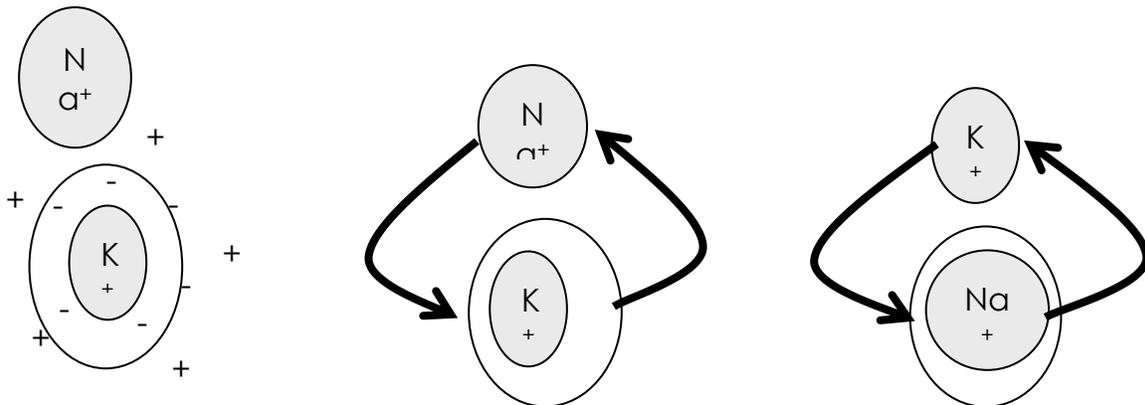
The heart is made up of two types of cells: those that generate or conduct electrical impulses, and those that contract and relax. We are focusing on the electrical cells in this learning activity.

Electrical cells have several unique characteristics:

- ♦ *automaticity*: the cell can generate an electrical impulse without being stimulated
- ♦ *excitability*: the cell can change its internal electrical balance to reach threshold
- ♦ *conductivity*: the cell can move an electrical impulse to the next cell

The Sodium-Potassium Pump

The mechanism that is involved with both automaticity and excitability is called the *sodium-potassium pump*. Look at the illustration below to see how it works:



Resting state=Polarized

Potassium is inside the cell, and sodium is outside of the cell. There is nothing happening electrically.

Depolarization

Potassium leaves the cell and sodium enters the cell very quickly.

Repolarization

Potassium reenters the cell and sodium leaves the cell more slowly.

The Action Potential

Any stimulus that increases the permeability of the membrane to sodium causes an action potential. The action potential has four phases during resting, depolarization, and repolarization. Each phase represents a particular electrical event or combination of electrical events. The fast response is seen with cells that conduct the impulses; the slow response is seen in pacemaker cells:

Phase 0: depolarization

- ♦ sodium rushes into the cell

Phase 1: initial repolarization

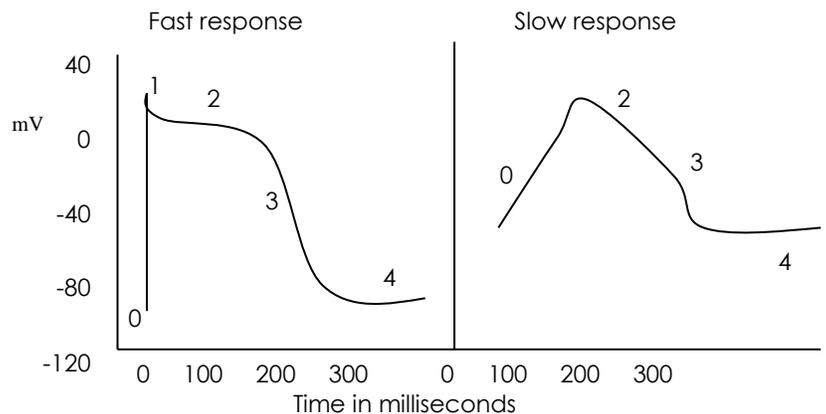
- ♦ chloride rushes in and stops sodium from entering the cell

Phase 2: plateau phase

- ♦ slow inward movement of calcium and slow exit of potassium

Phase 3: sudden repolarization

- ♦ potassium goes out more quickly and the slow calcium channel is inactivated



Phase 4

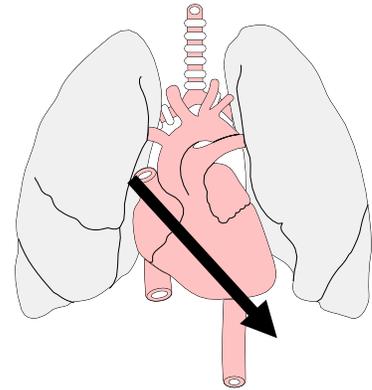
- ♦ potassium returns to the cell and sodium leaves the cell

All of the information on the ionic movement in the cells is fine for physiologists, but what does it mean for electrocardiographic monitoring? The answer: alterations in the movement of ions can affect what happens electrically in the patient's heart. Another answer: we give medications that affect how the ions move into and out of the cell, such as lidocaine (sodium), calcium channel blockers (calcium), and potassium.

The heart beat is usually divided into two main phases called "diastole" and "systole." During the first phase (diastole), the heart relaxes and fills with blood. During the second phase (systole), the heart contracts and pumps out the blood. The heart typically spends about 2/3 of its time in diastole and 1/3 of its time in systole. Keeping this activity well timed is the job of the heart's conduction system.

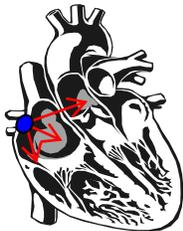
Flow of Electrical Current

In a normal person, the heart is located in the middle of the chest to the left of the mediastinum. The sinoatrial (SA) node is located in the top of the right atrium, the atrioventricular (AV) node is located in the bottom of the atrium, and the bundle branches conduct through the septum and ventricles. Because of this normal flow, the direction of electrical flow (vector) is mainly downward, from right to left.



Impulse origin and atrial depolarization

When the SA node, a pacemaker cell, fires off an impulse, the impulse travels down and toward the right and left atria. The direction -- or vector -- of this flow looks like this:

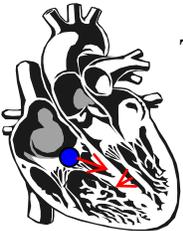


The electrical flow is translated to the ECG as the P wave. The P waveform is relatively small – normally between 1.5 and 2.5 mm in width and less than 3 mm in height.

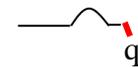


wave. The 1.5 and 2.5 mm

Septal depolarization

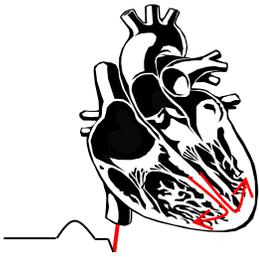


The electrical flow stops briefly at the AV node, and quickly down the common bundle (Bundle of His) the right and left bundle branches to the interventricular septum. The depolarization of the septum causes a small negative deflection – a “q” wave in some leads; and a small positive deflection or “r” wave in others.



then travels and through

Apical and early ventricular depolarization

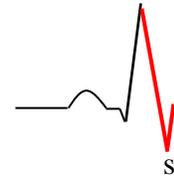


After depolarizing the septum, the impulse moves downward and to the left. This results in a large waveform – either an “R” wave or an “S” wave.

Late ventricular depolarization



The final stage of depolarization takes place in the furthest stretches of the ventricle. The electrical stimulus moves upward, resulting in either a taller “R” wave or a smaller “S” wave.



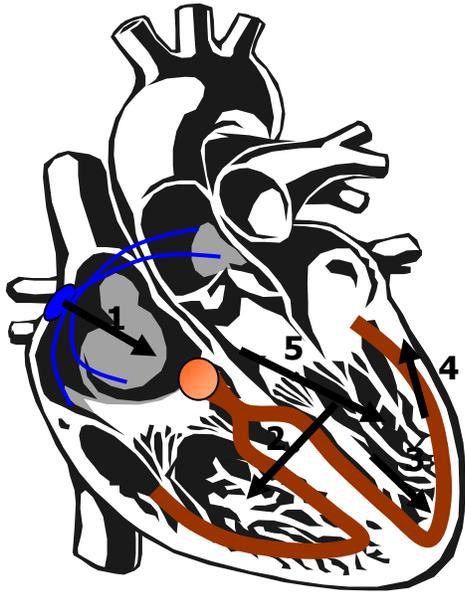
Ventricular repolarization



Finally, the electrical stimulus is completed, ending depolarization. The ions in the cells move back into their normal resting positions, from top to bottom, causing the T wave. The T wave should be the same vector as the mean QRS.



Putting the Whole Thing Together



- 1 = atrial depolarization = P wave
- 2 = septal depolarization = Q wave
- 3 = early ventricular depolarization = tall R or S wave
- 4 = late ventricular depolarization = taller R wave or S wave after the R wave
- 5 = ventricular repolarization = T wave

THE ELECTROCARDIOGRAM WAVEFORMS

The Isoelectric Line

There is a place on the normal ECG rhythm that is electrically neutral - there is nothing electrically happening in the heart at that particular period. This is called the "isoelectric" line. This is located between the end of the T wave and the beginning of the next P wave.

P Wave

- Indicates atrial depolarization
- Shape - round and smooth
- The duration of the normal P wave is < 0.11 secs.
- The height of the normal P wave is < 3 mm

PR Interval

- The time from the beginning of atrial depolarization to the beginning of ventricular depolarization
- The normal duration of the PR is 0.12 – 0.20 seconds

QRS Complex

- Represents ventricular depolarization
- Normal width is < 0.12 seconds (rarely < 0.06 seconds)
- In the bipolar leads (I, II, III), the value of the positive and negative deflections of the QRS (add the small boxes up and down) should be more than 6 mm. Less than 6 mm indicates low voltage.

Where does the QRS complex start?

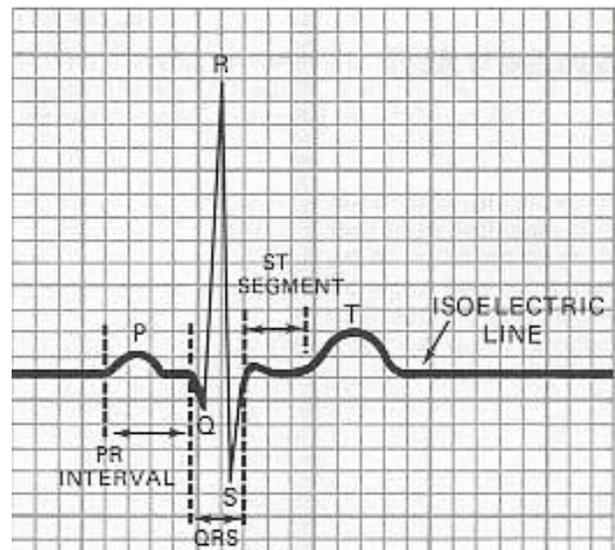
The QRS complex starts with either an upward or downward deflection after the PR interval. If the deflection goes down past the isoelectric line, it is called a "q" wave. If the deflection goes up past the isoelectric line, it is called an "r" wave.

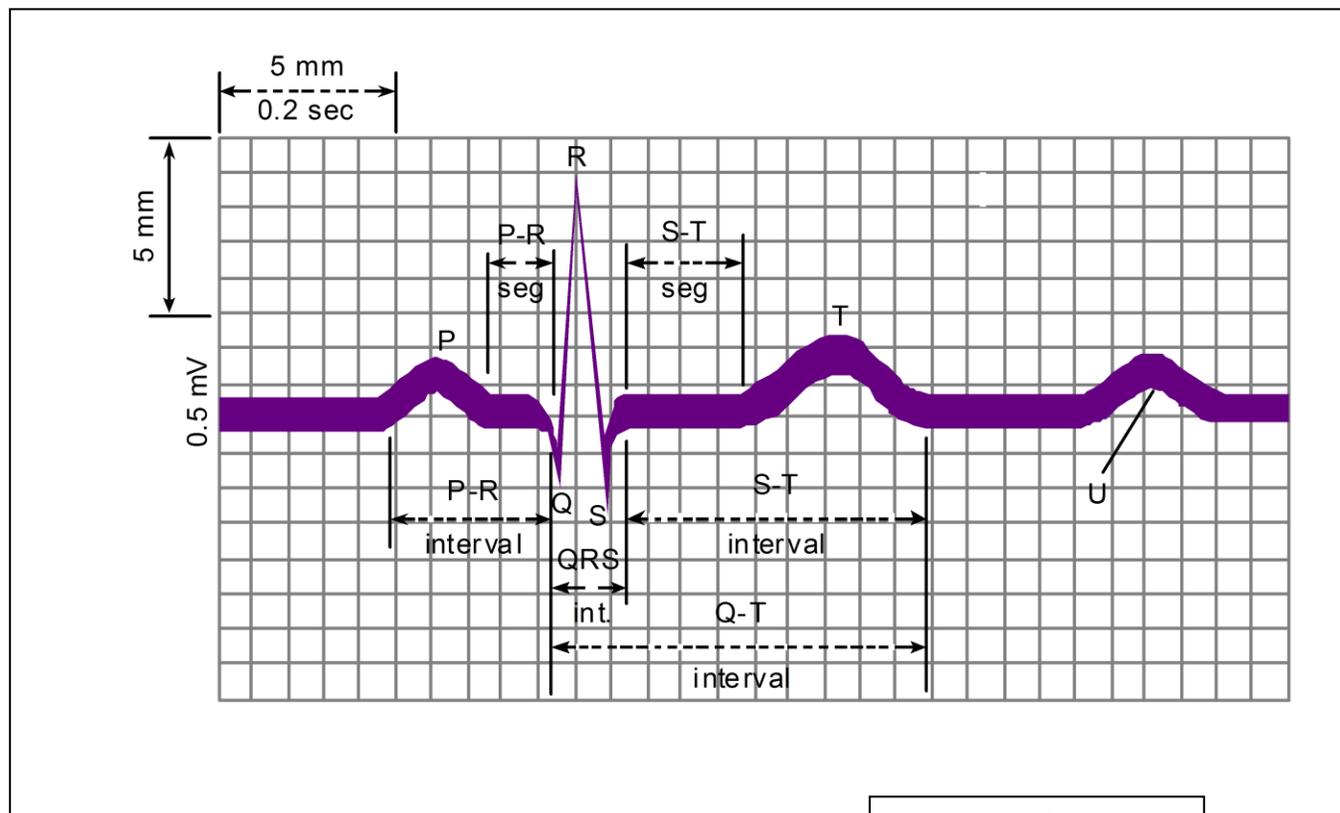
The Q wave

- The "Q" wave is the first negative deflection before an R wave. If there is no negative deflection before the R wave, there is no "Q".

The R wave

- The "R" wave is the first positive deflection after the PR interval. It is sometimes preceded by a "Q" wave.
- In some leads there may not be an "R" wave. Instead, there may be a "Q" wave and an "S" wave (a QS complex).





www.smartdraw.com
Smartdraw.2 Object

ST Segment

- Represents early ventricular repolarization
- The normal ST segment can be 1 mm (one small box) above or below the isoelectric line to be normal.
- The normal ST segment is > 0.08 secs in width.

T Wave

- Represents repolarization of ventricle
- Refractory periods
 - ❖ Absolute refractory period (ARP): The first half of the T wave where an electrical stimulus will not cause a depolarization (regardless of the stimulus strength)
 - ❖ Relative refractory period (RRP): The second half of the T wave, where a stronger than normal electrical stimulus may cause a depolarization

ELECTRODE PLACEMENT AND LEAD SELECTION

Proper **electrode placement** is essential in order to acquire accurate ECG strips. Most ECG monitor manufacturers have a set of placement guidelines specific to their products

General guidelines

- Skin preparation:
 - Shave hair away from electrode placement site.
 - Rub site briskly with alcohol pad or wash well with soap and water and rinse.
 - Rub site with a 2x2 gauze.
 - Place electrode. Be sure that the electrode has adequate gel and is not dry.

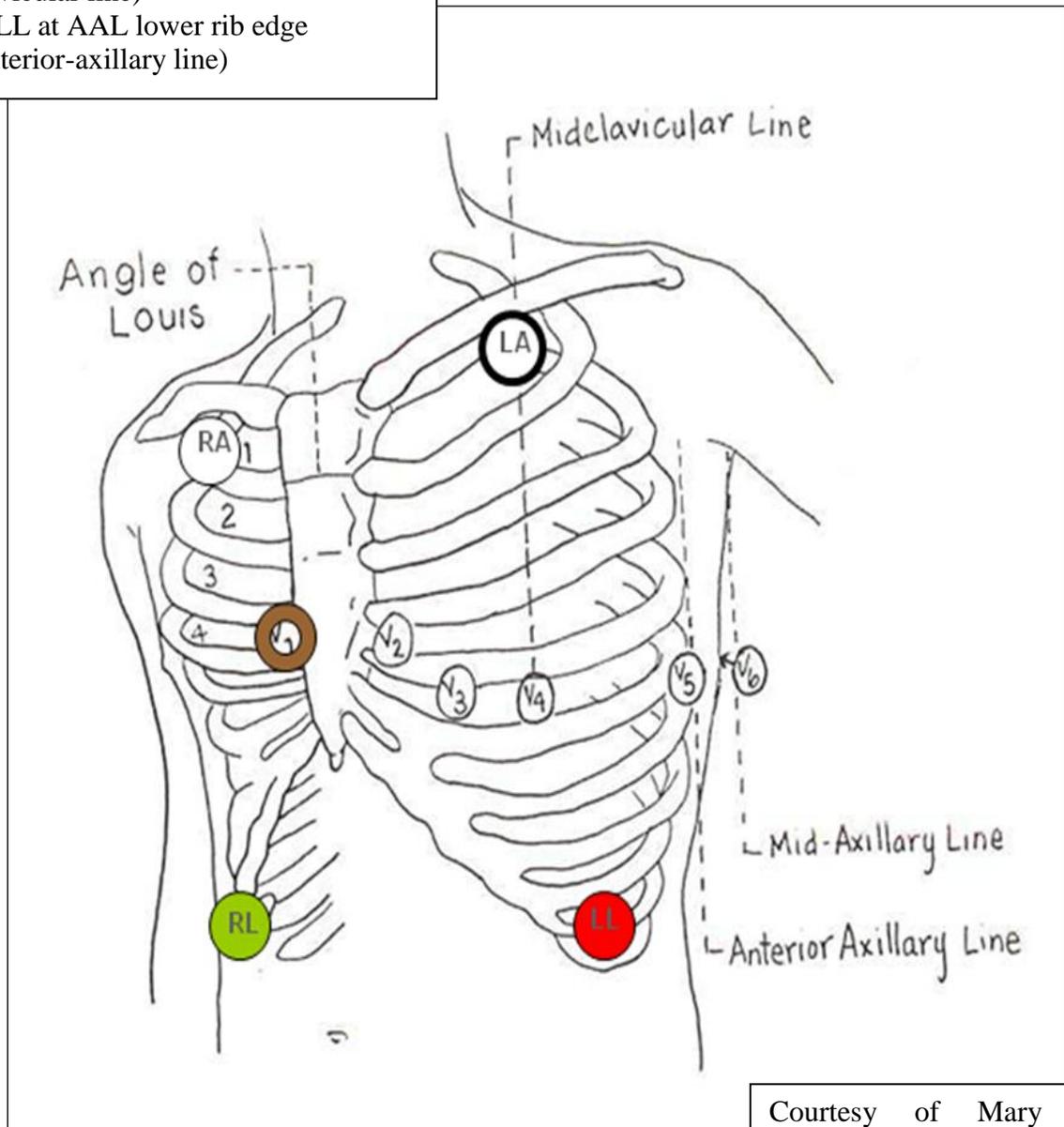
- Lead placement:
 - Depolarization wave moving toward a positive lead will be upright.
 - Depolarization wave moving toward a negative lead will be inverted.
 - Depolarization wave moving between negative and positive leads will have both upright and inverted components.

- More on Lead placement:
 - The ECG cables are often color-coded and labeled for ease of application and to reduce confusion about electrode to lead location.
 - The right arm lead is white, the left arm lead is black, the left leg lead is red, and the ground lead is green. Some ECG cables will also have a brown lead. This is used for monitoring one of the V leads.

Lead Placement: Standard 5-Lead Set-up

Landmarks for Limb Lead Placement

- RA & LA in the hollow of MCL (mid-clavicular line)
- RL & LL at AAL lower rib edge (anterior-axillary line)



Courtesy of Mary Gruber,
HealthEast Care System

How can I remember where to place the leads?

Use the following “memory trick” to help you recall where to place the leads: **“white on right, “clouds (or snow) over grass”, “smoke over fire” and “chocolate is near and dear to my heart”.**

- **“White on right”:** The white lead is placed on the upper right side of the chest
- **“Clouds (or snow) over grass”:** The white lead (clouds or snow) is placed on the right side, while the green lead (grass) is located on the lower right chest, over the lower rib edge.
- **“Smoke over fire”:** The black lead (smoke) is on the upper left side of the chest, while the red lead (fire) is on the lower right chest over the lower rib edge.
- **“Chocolate is near and dear to my heart”:** The brown lead is located just to the right of the sternum at the fourth intercostal space.
*The brown lead may also be placed just to the left of the sternum.

Electrode trouble shooting and tips

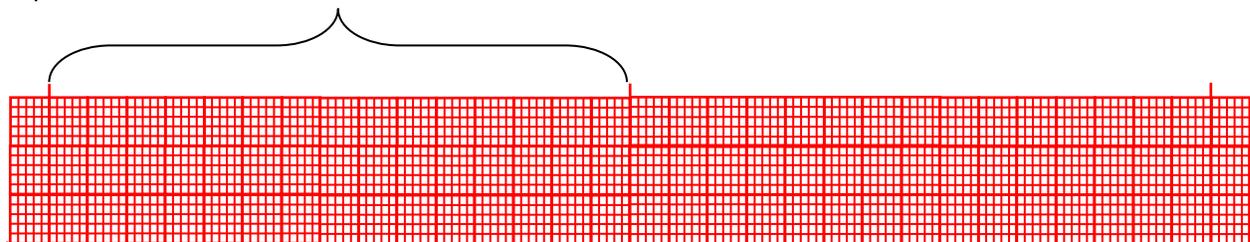
- Change the electrodes every day and make sure the leads are tightly connected.
- Make sure all electrical patient care equipment is grounded.
- Be sure all the lead cables are intact.
- Be sure the patient's skin is clean and dry.
- Patient movement frequently causes interference. For example, the action of brushing teeth may cause interference that mimics ventricular tachycardia (V-tach).

THE ELECTROCARDIOGRAM

In order to interpret the ECG, a paper printout is obtained. All ECG paper is standardized, so that the width and height of the boxes can be easily measured in different patients and different facilities.

The grid of the paper indicates two things: time and amplitude. The “time” refers to the milliseconds it takes for a waveform to traverse the heart. The amplitude refers to the voltage of the electrical current.

Space between “hash marks” = 3 seconds



Amplitude
1 small square = 1 mm = 0.1 mV
1 big square = 5 mm = 0.5 mV

Time
1 small square = 1 mm = 0.04 seconds
1 big square = 5 mm = 0.20 seconds

Heart rate can be easily calculated from the ECG strip:

- When the rhythm is regular, the heart rate is 300 divided by the number of large squares between the QRS complexes.
 - For example, if there are 4 large squares between regular QRS complexes, the heart rate is 75 ($300/4=75$).
- The second method can be used with an irregular rhythm to estimate the rate. Count the number of R waves in a 6 second strip and multiply by 10.
 - For example, if there are 7 R waves in a 6 second strip, the heart rate is 70 ($7 \times 10 = 70$).

STEPS IN INTERPRETING THE ECG

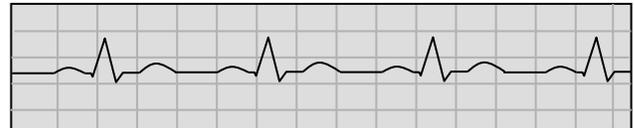
After you obtain an ECG on your patient, what do you do? There is a sequence of steps that is helpful to follow:

1. Assess the rate (atrial and ventricular) and regularity of the underlying rhythm. Assess the usual intervals and widths: PR interval, QRS width, QT interval.

2. Interpret the rhythm itself.

Normal Findings:

- The R-R intervals are regular.
- The P-P intervals are regular.
- There is one P for every QRS.



Abnormal Findings:

- The R-R intervals are irregular.
- The P-P intervals are irregular.
- There is more than one P for each QRS.
- No P waves are visible.

3. Inspect the P wave:

Normal Findings

- P waves should be regular (march out the P-P intervals with your calipers).
- P waves have a symmetrical shape, usually upright and rounded.
- P waves should all look alike (uniform) and should point in the same direction.
- There should be one P for every QRS (or a 1:1 relationship).

Abnormal Findings

- P wave is not followed by a QRS complex.
- There are more P waves than QRS complexes.

4. Inspect the QRS complex:

Normal Findings:

- All the QRS complexes have uniformity throughout (the same size, shape and direction).
- All QRS complexes are of equal duration or width.
- The R to R interval between each QRS is regular.

Abnormal Findings:

- The QRS complexes vary in shape, width and direction.
- The QRS complex is >0.12 seconds wide.
- The R to R interval between each QRS is irregular.

5. Inspect the ST segment -- it may be normal if it is 1mm above or 2mm below the isoelectric line.

Normal Findings:

- The ST segment should be electrically neutral (or near neutral) and should be sitting on the isoelectric baseline (no greater than 1 mm above or below the isoelectric line is normal).

Abnormal Findings:

- There is > 1mm ST segment elevation or depression from the isoelectric line.
- The T wave is in the opposite direction than the R wave.

6. Inspect the T wave for:

- ♦ direction of deflection
- ♦ shape of the T wave
- ♦ amplitude of the T wave



SUMMARY

This independent-learning activity was designed to give you some of the basic principles of ECG interpretation. Understanding what happens electrically in the heart, how the ECG monitors the electrical activity of the heart, and determining placement of electrodes will start you on the path to performing basic ECG rhythm interpretation.

DIRECTIONS FOR SUBMITTING YOUR POST-TEST FOR CONTACT HOURS

1. Go to the TCHP website Home Study page to get the **electronic** post-test (no password is required): <http://tchpeducation.com/homestudies/homestudies.html>
2. The **electronic** post-test will take you to a quick and easy Survey Monkey post-test and evaluation. Fill in your answers and click “done.” Your certificate of completion will be sent to you in a week or 2 (*Note: This process is not automatic so do not expect an immediate return of a certificate of completion*).

Please Note: Survey Monkey does not save your work so plan to do the post-test all the way through.

If you are having difficulty with Survey Monkey, please contact tchp@hcmec.org for help.

Be sure to complete all the information requested on the post-test and evaluation. If required items are skipped, your post-test will automatically be classified as *Incomplete* in the survey system. Plan to complete the entire post-test in one visit as your responses are not saved in the system. The date recorded on your certificate of completion will be the date that your home study is received by TCHP. **Any materials received with a time stamp after the expiration will be discarded.**

TCHP is not responsible for lost or misdirected mail/email. We suggest that you print out your post-test before submitting to keep a copy for your records as the post-test will not be returned with the certificate of completion.

TCHP Consortium Hospital Employees

If you are an employee of a TCHP Consortium hospital (consult www.tchpeducation.com if you are unsure), your certificate of completion will be sent to you via work email. It cannot be sent to your home.

Paid Participants

If you are not an employee of one of the TCHP hospitals, you will need to submit a payment of \$10.00 to TCHP in order to have your home study processed. If submitting a check, please make it payable to **TCHP Education Consortium** and indicate which home study you are paying for. You can also pay online using PayPal (see the website at www.tchpeducation.com under home

studies for information. If you received this packet as pre-reading for a class you are attending, the processing fee is included in the course tuition.

Bibliography

- 1) Coviello, J (2015). ECG interpretation made incredibly easy!, 6th ed. Lippincott Williams and Watkins.
- 2) Fowler, LH. (2017). Cardiovascular Nursing: A comprehensive guide to patient care. Brockton MA: Western Schools.
- 3) Thaler, MS. (2015). The only EKG book you'll ever need, 8th ed. Lippincott Williams and Watkins.