

Guide

Instant Meeting

Booklet

#2



BC Program Committee

December 2009

TABLE OF CONTENTS

The Fibonacci Code	3
Art Fraud Investigation	6

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THE FIBONACCI CODE

PROGRAM CONNECTIONS:

- Beyond You: Explore the Outdoors and Nature #1 or 6
- Beyond You: Try New Things #4
- Beyond You: Learn About Our Environment #4
- Plants and Animals badge #1
- Science badge #5
- Wildflower badge #1, 8

MATERIALS REQUIRED:

- Vending Machine Puzzle on page 5 (one copy per girl or group of girls)
- large number of small stackable objects (checkers, flat buttons, marshmallows, life savers, pennies, etc. If you use pennies, you could donate them to the CWFF after this meeting). You'll need 40-60 per girl or small group of girls.
- one or more of the following for the "Nature Walk" activities:
 - outdoor area with a variety of flowers (or bring cut flowers or pictures of flowers to your meeting)
 - pine cones
 - sunflower seed head
 - pineapple
 - apple and a sharp knife
- paper and pens or pencils
- treasure hunt prizes

ARRIVAL: Vending Machine puzzle.

OPENING: Use your usual opening. In this meeting you will discover a secret mathematical code, find out where it occurs in nature and use it to puzzle your friends.

GAME: The Button-Stacking Game. Play this game individually or in small groups. Each group needs 40-60 small objects that can be easily stacked and counted. Make as many stacks as you can, where each stack contains a specific number of objects as described below. What is the tallest stack you can make, before the stacks fall over?

Start with a stack of 0 and a stack of 1. After that, each stack contains the number of objects in the previous two stacks added up:

- The third stack will contain 1 object ($0+1=1$)
- The fourth stack will contain 2 object ($1+1=2$)
- The fifth stack will contain 3 objects ($1+2=3$)

On a sheet of paper, whiteboard or blackboard, write down the number of objects in each stack, starting with 0, 1, 1, and continuing as far as you can.

This sequence of numbers is called the Fibonacci (fib-oh-NATCH-ee) sequence, named for the mathematician who used it to describe certain patterns in nature (specifically, the

growth of a population of rabbits). The first few numbers in the sequence (as you discovered in the stacking game) are:

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377 ...

NATURE WALK: Now see if you can find Fibonacci numbers in nature!

1. Find 10-12 different kinds of flowers. Write down the name of each flower (or a description, if you don't know the name) and the number of petals it has. If it has many rows or layers of petals, write down the number of petals in each layer. Circle the Fibonacci numbers. Do these numbers show up more often than you expect?
2. Look at the stem end of a pine cone. Notice how the scales spiral out from the centre of the cone. Count the clockwise spirals and the counter-clockwise spirals. (Go to www.mcs.surrey.ac.uk/Personal/R.Knott/Fibonacci/fibnat.html#pinecones for examples.) Usually, you'll find two consecutive Fibonacci numbers. Can you find any pine cones that don't follow this pattern?
3. Repeat activity #2 with the seed head of a sunflower or with a whole pineapple.
4. Cut an apple in half cross-wise through the core. What do you see?

GAME: Divide into groups and design a treasure hunt using the Fibonacci sequence. The sequence might be the key to a secret code, or perhaps you could lay out a treasure map using Fibonacci numbers of paces between landmarks. Challenge the other groups to find a prize using your code or map.

POLL: Fibonacci numbers certainly seem to appear in nature more often than you might expect at first. Is there a reason for this? Poll the girls to see what they think:

- a) Fibonacci numbers are actually the key to a secret message that was developed by super-intelligent aliens and placed in Earth's natural world for us to find. If we could decode the message, we'd learn the secret of eternal youth.
- b) The spirals on pine cones, pineapples and sunflowers, and the number of petals on plants, are determined by the shape and structure of plants and how they grow. The Fibonacci sequence is a mathematical model that helps describe the way things grow in nature, so that's why Fibonacci numbers show up so much.
- c) There is no reason for it; the whole thing is just one big, freaky coincidence.

CLOSING: Take another look at the Vending Machine Puzzle. Do your answers look familiar? End with your usual meeting closing.



VENDING MACHINE PUZZLE (FOR THE FIBONACCI CODE INSTANT MEETING)

You have a bunch of loonies and toonies, and you want to buy a snack from a vending machine. How many different ways can you put your loonies and toonies into the machine to pay for each item? You put your coins into the vending machine one at a time, and you can add them in any order. Some have been done as examples. Can you fill in the missing ones?

Snack	Price	Possible Ways to Put In Loonies and Toonies to Buy Snack	Number of Ways
Chocolate Bar	\$1	Loonie	1
Pop	\$2	Loonie + Loonie Toonie	2
Chips	\$3	Loonie + Loonie + Loonie Loonie + Toonie Toonie + Loonie	3
Cup-o-Soup	\$4		
Bag of cookies	\$5	Loonie + Loonie + Loonie + Loonie + Loonie Loonie + Loonie + Loonie + Toonie Loonie + Loonie + Toonie + Loonie Loonie + Toonie + Loonie + Loonie Loonie + Toonie + Toonie Toonie + Loonie + Loonie + Loonie Toonie + Loonie + Toonie Toonie + Toonie + Loonie	8
Gourmet Ice Cream Bar	\$6		
Microwave Pizza	\$7		

ART FRAUD INVESTIGATION

THEME: CSI Challenge, art and art forgeries.

GOAL: To introduce Guides to forensic science related to art forgeries and to earn the CSI Challenge crest.

PROGRAM CONNECTIONS:

- Discovering You: Discover What's Important to You #4
- Discover Your Creativity #4
- Beyond You: Try New Things #4, 6
- Career Awareness badge #2, 5
- Physics badge #8
- Chemistry badge #8

MATERIALS REQUIRED:

- Spot the difference puzzles
- Activity materials as noted below

ARRIVAL: "Spot the Difference" puzzle. For puzzles using famous paintings, look for a copy of *Art Fraud Detective* by Anna Nilson at your local library or bookstore.

OPENING: Use your usual opening, then perform the play, "The Case of the Missing Rembrandt". This can be performed by girls or by Guiders. Materials required:

- copies of the script
- props and costumes as noted in the script.

Discuss the paintings in the play. Do you like them? What do you think makes them masterpieces?

INTRODUCTION: Rembrandt's self-portrait was painted in 1630 in Leiden, Holland. It was stolen from the National Museum of Sweden in 2000 and recovered in 2005. The question is, how do we know the recovered painting is the real thing and not a forgery? Art experts look at lots of different things when they are trying to authenticate a painting. For example:

1. General look of the painting: Does it look like a real Rembrandt? Does it include details that are from the wrong time or place? Needs knowledge of the original artist, art history.
2. Provenance: Is there a paper trail proving where the painting came from and where it has been since it was painted? A certificate of authenticity, letters or journals that mention it, bills of sale, etc.? If there is no paper trail, or if some of these documents turn out to be forgeries, the authenticity of the painting might be called into question.
3. Support: What is the painting painted on? If it's on a wooden panel or canvas stretched over a wooden frame, is it a type of wood that was available at the time and place the painting was done? Sometimes the tree rings in the wooden support can be analyzed to determine the age of the support. Are the saw marks on the wood consistent with the tools that were available at that time? Mechanical saws were

invented during the Industrial Revolution, about 1800. Before then, only manual saws could have been used to cut the wood.

4. Type of paint: Oil paints were developed in Europe about 1410. Acrylic paints didn't become available until the 1950s. Is the type of paint used consistent with what was available when the painting was supposedly painted?
5. Specific colours of paint: Different pigments (colours) have been available at different times in the history of art. Art experts examine the pigments to find out exactly which pigments were used in a painting. Then they decide if those pigments were available when the painting was supposedly painted.

The tests provide data (facts) about the painting. The art expert has to interpret the test results, often by comparing them to a known reference, to decide if the painting is authentic or not. Sometimes they can't say for certain, either because they don't have enough reference information or because the test results don't tell them what they need to know. They might need to do more tests before they can be sure. Often it is easier to say for sure that a painting is a fake than to be absolutely certain it's authentic.

PROVENANCE PUZZLE: Read the letter mentioning the painting. Are there any details that prove it is real or fake? Materials required: copies of the letter (one for each girl or small group of girls).

FORENSIC SCIENCE ACTIVITIES: Depending on the size of your unit, these may be set up as stations that the girls rotate through in small groups. You may decide to have a Guider or other adult play the role of the expert "technician" (or, if you can find one, get a real art expert to visit your unit).

Identifying the Yellow Pigment: Materials required: copy of the pages "Identifying the Yellow Pigment".

Identifying the Type of Paint: Materials required:

- Copy of the page "Identifying the Type of Paint"
- Two pieces of wood, one painted with acrylic paint and one with oil paint
- Cotton balls
- Nail polish remover with acetone
- Latex/vinyl gloves (optional; watch for allergies)

Analyzing Saw Marks: Materials required:

- Copy of the page "Analyzing the Saw Marks"
- Two pieces of wood, one cut with a manual saw and one with a mechanical saw
- One piece of wood, representing the painting support, that can be cut either with a manual or mechanical saw (your choice)

Give each girl a copy of the Forensic Test Results sheet and ask them to fill it out as they work through each of these activities.

CLOSING: Ask the girls to share their conclusions. Did they have any difficulty deciding whether the painting is authentic? Any confusing or conflicting test results?

End with your usual meeting closing. Don't forget to order your CSI Challenge crests!

PLAY: THE CASE OF THE STOLEN REMBRANDT

A short play based on a real-life robbery of the National Museum of Sweden.

www.rd.com/your-america-inspiring-people-and-stories/true-art-crime-heist-case-of-the-stolen-rembrandt-/article107241.html

CHARACTERS:

- Scene 1: A guard, two police officers
- Scene 2: Art expert Robert Wittman, one or more police officers
- Scene 3: Robert Wittman (in disguise), a crook, one or more police officers

PROPS:

- Two telephones
- A suitcase full of "money"
- Framed prints of three paintings: Renoir's "Conversations"; Renoir's "La Parisienne"; Rembrandt's "Self-Portrait" (1630) (or imitations).

SCENE 1: December 22, 2000. Outside the National Museum of Sweden in Stockholm

Guard: Help! Police! The National Museum has been robbed!

Police #1: What was taken?

Guard: Three paintings. One was a self-portrait by Rembrandt. The other two were portraits by Renoir. They are very valuable paintings. The Rembrandt alone is worth \$40 million! The thieves got away in a speed boat on the river.

[Police Officer #2 comes running up, carrying Renoir's "Conversations".]

Police #2: We got one of the Renoirs back! But the bad guys got away. I'm afraid there's no trace of the other two paintings!

SCENE 2: March 25, 2005. An office in Los Angeles.

[The phone rings. Robert Wittman answers]

Wittman: Hello, Robert Wittman, FBI Art Expert, speaking.

Police: Hello, Mr. Wittman. I wonder if you would mind coming over. We've just come across a painting while we were arresting some drug dealers. It's a portrait of a woman. Can you come take a look at it?

Wittman: I'll be right there! [Hangs up the phone and heads to the police station.]

Wittman: Well, I've examined the painting and checked our database of works of art. I'm certain this is the painting "La Parisienne" by Renoir that was stolen from the National Museum of Sweden five years ago!

Police: Wow—a genuine Renoir! Amazing!

Wittman: There is still one painting missing—a self-portrait by Rembrandt.

Police: Well, we've questioned one of the thieves, and he did mention the whereabouts of another painting. He even gave us the names and phone number of the people who have it!

Wittman: This is our lucky break! Here, I'll tell you what we're going to do...

[They huddle together, whispering plans.]

SCENE 3: A hotel room in Stockholm.

[Robert Wittman, working undercover, makes a phone call. The crook answers on his cell phone.]

Crook: Hello?

Wittman: Hello. I am an art expert working for a very wealthy crime lord in America. I understand you have a very valuable painting. I would like to buy it for my boss.

Crook: I'll meet you at your hotel. Bring a suitcase filled with \$250,000 in cash. If the money looks good, then I'll bring you the painting.

[The crook arrives, looking nervous and jumpy. Wittman opens the suitcase and flashes the money; the crook grins.]

Crook: I'll be back in a few minutes with your painting! [He leaves]

[Time passes. Wittman paces the room, checking his watch often.]

[The crook returns with a painting in a large bag, which he hands to Wittman. Wittman opens the bag and takes out the painting.]

Wittman: Ah, Rembrandt's self-portrait—a masterpiece! [Passes the money to the crook, then says very loudly,] IT'S A DONE DEAL!

[The door bursts open and the police rush in.]

Police: FREEZE! [They arrest the crook and take him away.]

Wittman: Well, there's that case closed. Now this beautiful painting can go back to the museum, where it belongs.

PROVENANCE LETTER

Athens, Greece

August the 15th, 1635

My dearest Sarah,

My journey is nearly at an end. My business here has been very satisfactory—I have purchased shares in a small penguin farm that I believe will turn a handsome profit—but I have missed you terribly. I cannot wait to return home to England and to you.

I have a wedding-present for you. I meant it to be a surprise, but I cannot keep a secret from you. It is a painting—a self-portrait by a very promising local artist named Rembrandt van Rijn. It is not an expensive gift, I admit; I paid a mere \$25 (US) for it. But I believe the painting will be worth a considerable sum in the future. This artist is a master at capturing human feelings in his portraits.

I will be home to you next Tuesday. My flight will arrive at Heathrow Airport just after noon. I cannot wait to see you.

Yours affectionately,

Richard

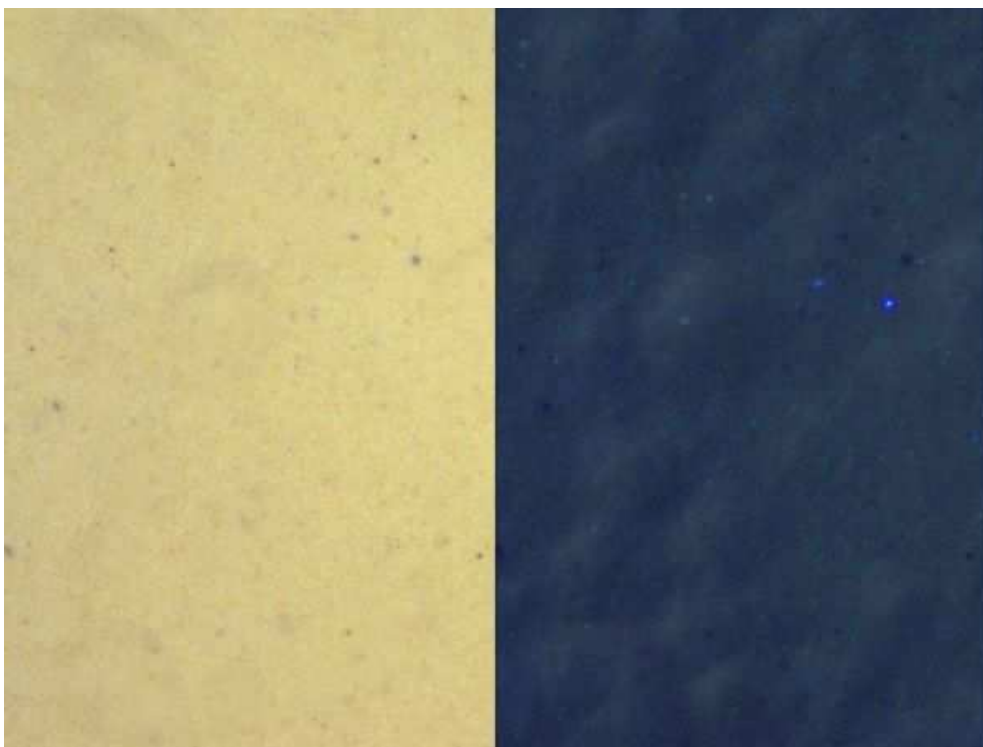
IDENTIFYING THE YELLOW PIGMENT USING NATURAL AND ULTRAVIOLET LIGHT



I looked at the yellow pigment in the painting under natural and ultraviolet light. Here is a photograph of what I saw.

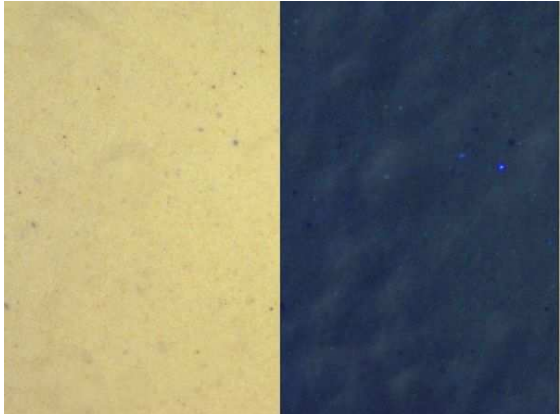
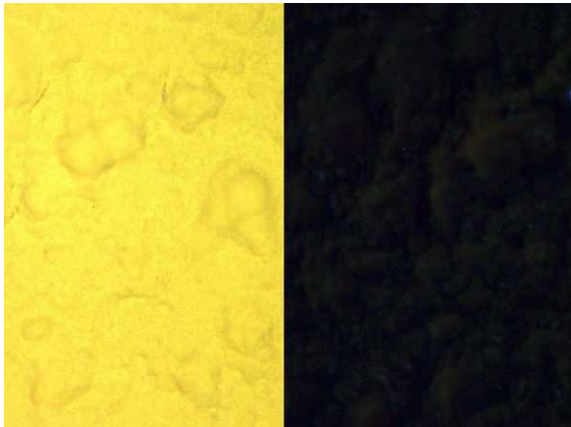
TECHNICIAN'S TEST DATA:

This is a colour photograph of the yellow pigment in the painting. The left side is under natural light; the right side is under ultraviolet light.



Source of all colour photographs: MFA Boston: CAMEO. 2009. Museum of Fine Arts, Boston. 25 May 2009.
<http://cameo.mfa.org/index.asp>

REFERENCE INFORMATION:

Type of Yellow Pigment	Reference Colour Photo
Naples Yellow: <ul style="list-style-type: none">• Has been used for at least 3500 years.• Most commonly used in paintings from about 1750 to 1850.	
Chrome Yellow: <ul style="list-style-type: none">• Used in paintings from 1814 to about 1850.	

INTERPRET THE DATA:

Compare the technician's photograph with the reference colour photos.

Which kind of yellow pigment do you think the artist used? What does this tell you about the painting?

Write your results on your Forensic Test Results sheet.

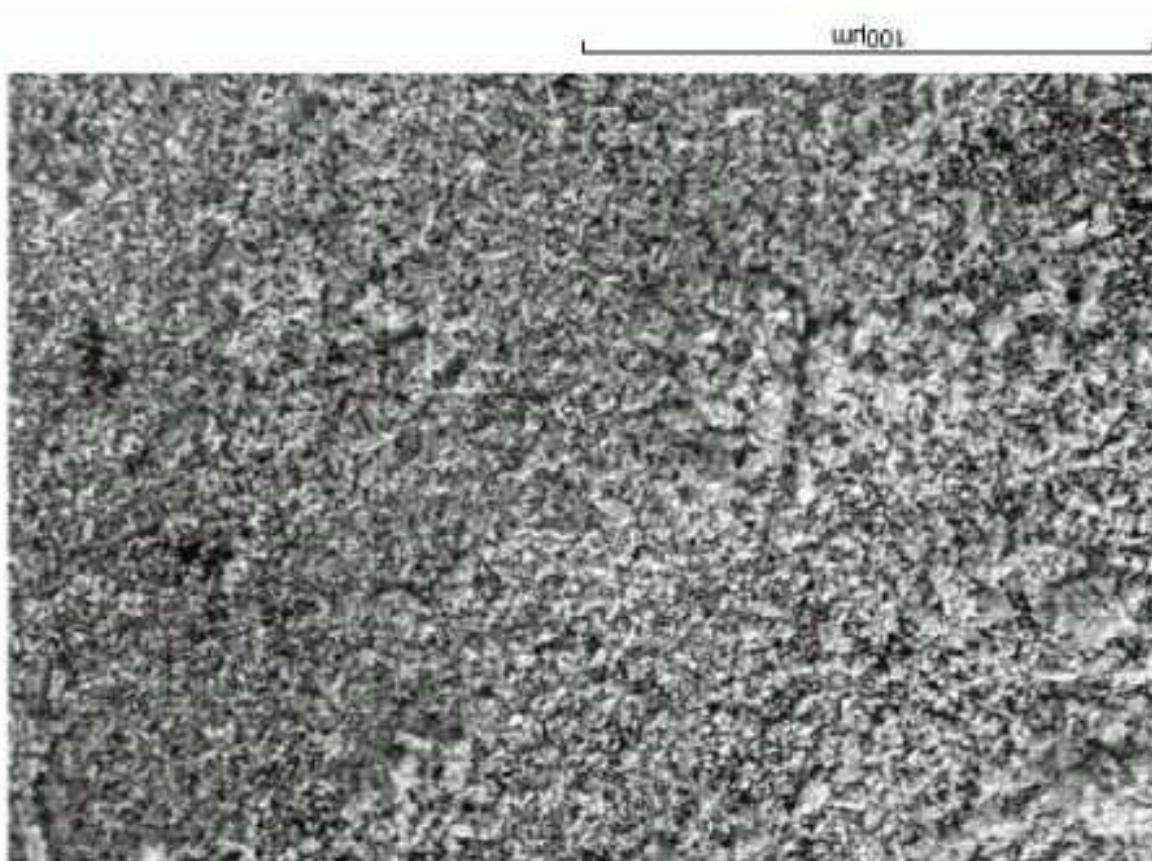
IDENTIFYING THE YELLOW PIGMENT USING A SCANNING ELECTRON MICROSCOPE (SEM)



I looked at the yellow pigment in the painting using a scanning electron microscope (SEM). I've printed out an image of what I saw for you to interpret.

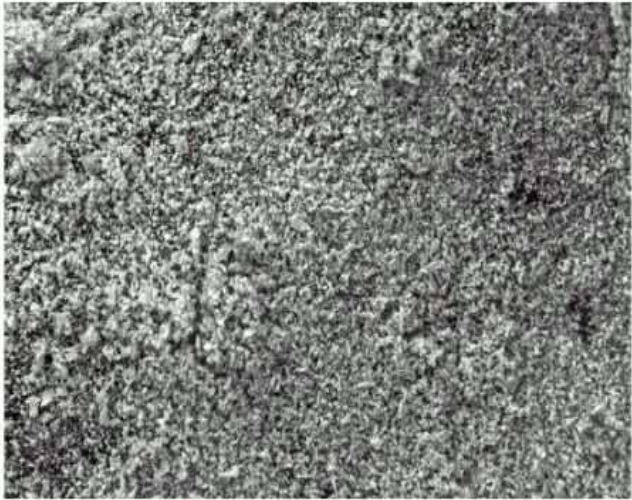

TECHNICIAN'S TEST RESULTS:

This is an SEM image of the yellow pigment in the painting.



Source of all SEM images: MFA Boston: CAMEO. 2009. Museum of Fine Arts, Boston. 25 May 2009.
<http://cameo.mfa.org/index.asp>

REFERENCE INFORMATION:

Type of Yellow Pigment	Reference SEM Image
Naples Yellow: <ul style="list-style-type: none">• Has been used for at least 3500 years.• Most commonly used in paintings from about 1750 to 1850.	 100µm
Chrome Yellow: <ul style="list-style-type: none">• Used in paintings from 1814 to about 1850.	 100µm

INTERPRET THE DATA:

Compare the technician's print-out with the reference SEM images.

Which kind of yellow pigment do you think the artist used? What does this tell you about the painting?

IDENTIFYING THE TYPE OF PAINT



I took a tiny sample of paint from the painting and put it in acetone. The paint sample dissolved. Does that mean it's acrylic or oil paint?

TECHNICIAN'S TEST DATA:

A sample of paint from the painting dissolved in acetone.

REFERENCE INFORMATION:

Type of Paint	When Used by Artists
Acrylic	Since the 1930s
Oil	Since about 1410

INTERPRET THE DATA:

Test two kinds of paints to find out what happens when they come in contact with acetone.

1. Put on a pair of latex gloves.
2. Using a cotton ball, rub a small area of the reference sample of acrylic paint with nail polish remover (acetone).
3. Using a clean cotton ball, rub a small area of the reference sample of oil paint with nail polish remover (acetone).

What do you notice? What does this tell you about the painting?

Write your results on your Forensic Test Results sheet.

ANALYZING SAW MARKS ON THE PAINTING'S WOODEN SUPPORT





I have obtained a piece of the wooden support from the painting that shows saw marks along one of the long edges. How does it compare to the reference samples of wood?

TECHNICIAN'S TEST DATA:

Saw marks are visible along one of the long edges of the wood from the painting's support.

REFERENCE INFORMATION:

Type of Saw		When Used by Artists
Manual		For as long as humans have cut wood with saws
Mechanical		Since the Industrial Revolution (about 1800)

INTERPRET THE DATA:

Compare saw marks made by a mechanical saw and saw marks made by a manual saw.

1. Look closely at each reference sample of wood, at the side marked with a star.
2. Compare saw marks from a manual saw with those from a mechanical saw.
3. Compare the two reference samples with the wood from the painting's support.

What kind of saw was used to cut the wood for the painting's support? What does this tell you about the painting? Write your results on your Forensic Test Results sheet.

FORENSIC TEST RESULTS

Test		What You Observed	What Does This Tell You About the Painting?
Type of Paint	Acrylic		
	Oil		
Saw Marks	Manual		
	Mechanical		
Yellow Pigment	Natural and Ultraviolet Light		
	Scanning Electron Microscope		

Conclusion: Is the painting authentic, or is it a forgery?