Welcome to Online Office Hours!

We’ll get started at 2PM ET
Welcome! We’re glad you’re here! Use the chat box to introduce yourselves. Let us know:

- Your first name
- Where you’re joining us from
- Grade level(s) and subject(s) you teach
Preservation Research and Testing Division (PRTD)
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**Mission:** Ensure long-term access and preservation of the Library’s collections

**Goals span:**
- Analytical requests
- Quality assurance (object housing, building materials)
- Research projects

Full analytical and materials chemistry laboratory
Multispectral Imaging

A non-invasive technique that captures information at specific wavelengths along the electromagnetic spectrum, including those beyond the visible light range.
Equipment

50 MegaPixel Monochrome E7 Camera
Kodak CCD sensor
(8176 × 6132 pixel array with linear dimension of 6.0 microns)
120mm Copal-0 hyperspectral lens
with attached dual filter wheel (UV pass, UV block, R, O, G, B filters)

Light Emitting Diode (LED)
Illumination Panels
Ultra-Violet: 365nm
Visible: 400, 420, 450, 470, 505, 530, 560, 590, 615, 630, 655nm
Infrared: 700, 735, 780, 870, 940nm
Raking: 470, 910nm
Transmitted: 448, 529, 600, 635, 758, 785, 867, 933nm
Full Spectrum Color Images

Compilation of 9 visible bands

Software algorithm calibrated specifically to our color target
A Declaration by the Representatives of the United States of America in Congress assembled.

When in the Course of human events, it becomes necessary for one people to dissolve the political bands which have connected them with another, and to assume among the Powers of the earth, the separate and equal station to which the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation.

He has excited domestic insurrections amongst us, and has excited the host of foreign seditious associates against us.

He has endeavored to bring on the inhabitants of our frontiers the merciless Indian savages, whose known rule of warfare is an undistinguished destruction of all ages, sexes, and conditions of existence.

He has incited treasonable insurrections of our fellow-citizens, with the allurements of fortune and hopes of recovery of property.

He has constrained our fellow-citizens, taken captive in the territory of our United States, to bear arms against their country, to become the executioners of their friends and compatriots, to wage war upon the persons of their fellow-citizens on the high seas in distant countries, to become the executioners of their friends and countrymen.

He has waged cruel war against human nature itself, violating the sacred rights of life and liberty in the persons of a distant people who never offended him, captivating and carrying them into slavery in another hemisphere.
a. Difference between ratios of IR and visible wavebands

b. Cropped version of (a)

c. “Otsu” multi threshold technique to enhance different intensity ranges

d. Assigning pseudo color (& remove transition edges from (c))

e. Joining the dots - pseudo color (artistic interpretation)

f. Removed citizen for clarity of viewing
Alexander Hamilton,
letter to Elizabeth Schuyler, 1780

[Image of handwritten letter]
Alexander Hamilton,
letter to Elizabeth Schuyler, 1780

Do you know my sensations when I see the sweet characters from your hand? Yes you do, by comparing them with your own for my Betsey loves me and is acquainted with all the joys of fondness. Would you exchange them my dear for any other worthy blessings? Is there any thing you would put in competition, with one glowing kiss of [unreadable], anticipate the delights we [unreadable] in the unrestrained intercourses of wedded love, and bet your heart joins mine in fervent wishes to heaven that all obstacles and interruptions May be speedily removed.
Paper Tests – What are the conditions of these?

(Are they any different? Can we tell?)
Paper Tests – Fold Testing

Paper samples folded back and forth, counting folds until break

**Advantages**
- Intuitive!
- Long-lived standard in field

**Disadvantages**
- Destructive
- Wide variability in data
Paper Tests—Tensile Testing

Paper samples pulled in tension until break, measuring force required to stretch

**Advantages**
- Intuitive(ish)
- Large amount of quantitative data

**Disadvantages**
- Destructive (but samples can be miniaturized)
- Expensive equipment

![Tensile Test Diagram](image)
Paper Tests – pH and acidity

Paper samples blended and soaked in water, pH of the extract is measured

Alternative: pH pens and strips (less accurate)

<table>
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<tr>
<th>Advantages</th>
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<tbody>
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Paper Tests – additional methods

**Size Exclusion Chromatography** measures size of cellulose molecules

**Infrared and UV-Vis spectroscopy** measures chemical group vibrations

**Thermal gravimetric analysis** measures heat-induced breakdown

Frequently trading simplicity for **more complex information**

Also advantageous: **minimally invasive**
Mellon Funded Research Project: Assessing the Condition of the National Collection

Overview

- Andrew W. Mellon Foundation Grant (Scholarly Communications)
- $540,000 for 40 months Jan 2019 – Apr 2022
- The research project will provide data to objectively assess the condition of the books held in the United States by performing an in-depth scientific analysis on a representative sample from the time period 1840-1940
- The physical, chemical and optical data will help ensure that large-scale withdrawal of materials does not compromise the overall robustness of cultural heritage collections, informing the shared print, preservation and digitization communities

https://nationalbookcollection.org/overview
Research Library Partner Institutions

- Cornell University
- University of Miami
- University of Washington
- Arizona State University
- University of Colorado at Boulder

*Analyze the same 500 volumes from all partners: LC offered the same 500 from our collections*
Assessing the Physical Condition of the National Book Collection.
What does “identical” look like?
Multiple Paper Types in One Volume
Thank you!

Questions? Post them in the chat box!