

Submission for the 2024 Innovation in Co-curricular Education Award

Program: GTDC: Pathways to Policy <https://pathways2policy.gatech.edu/>

Submitted by: Co-Directors Prof. Lawrence Rubin (INTA), Prof. Mark Zachary Taylor (SPP)

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Date: February 9, 2024

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I. DESCRIPTION

Description & Objectives: Created in 2023, GTDC: Pathways to Policy is a new Global at Home program designed for the entire undergraduate community, led by a partnership between the Sam Nunn School of International Affairs (INTA) and the School of Public Policy (SPP). This Washington DC based program offers experiential learning, featuring in-person courses linked with internships, mentorships, extra-curricular activities, and extensive networking opportunities. The GTDC program's objective is to fulfill the Institute's goal of graduating global citizens equipped with the knowledge base, technical skills, and personal experiences necessary to help solve the world's most challenging problems after graduation. GTDC courses are custom selected and designed to deliver the subject-matter training and skillsets, which students then apply and improve in their professional internships. Mentorships, extra-curricular activities, and alumni interactions further diversify, augment, and strengthen the student learning experience. There is no other program like this at Georgia Tech.

Professors Rubin and Taylor designed the GTDC program with input from stakeholders around campus (including students, faculty, admin, and alumni). They have since relocated to Washington DC, where they administrate the program, teach the courses, advise the students, and lead events. They also regularly travel to the Atlanta main campus to recruit students, conduct orientations, and attend to tasks necessary for managing the program, in addition to remaining active members of their respective faculties and fulfilling their usual research and service duties.

Courses: GTDC is an immersive experiential learning program. Students enroll in a full academic course load that fulfills degree requirements, consisting of 6 academic credit hours for two courses. In order to accommodate graduation requirements, GTDC currently offers INTA 3110 (US Foreign Policy) and PUBP 3030 (Domestic Policy Analysis) which fulfill the social science for GT undergraduate students (Core Area E). Each of these courses may also be used towards a minor in either International Affairs or Public Policy. Furthermore, they may be used toward the International Plan, LST minor, or Pre-Law Certificate. Courses are taught by Professors Rubin and Taylor. GT alumni are often incorporated into the classes through lectures and site visits. Considerable in-class activity is directed at improving the students' internship performance—lessons on professional writing, data visualization, the proper use of presentation software, oral presentation techniques, networking strategies, and a “boot camp” for policy analysis. In future years, we plan to expand the course offerings to increase student choice and program flexibility.

Internships: Students enroll in 6 professional internship credit hours in a field of their choice. The professional internships are full-time, roughly 40 hours per week. The students identify and apply for internships on their own, aided by Profs Rubin and Taylor, and making use of GT's impressive alumni network. The only requirements are that the internships be in the DC area and have a policy component. Otherwise students are encouraged to think big about sector and topic. For example, during Fall 2023, GTDC students were employed in internships at the following institutions:

- Office of US Congresswomen, Nancy Pelosi (CA-11)
- Office of US Congressman, Austin Scott (GA-08)
- US Senate, Committee on Agriculture
- Library of Congress, Preservation Research and Testing Division
- Information Technology & Innovation Foundation (think tank)
- US Secret Service
- NESACenter for Strategic Studies (National Defense University)
- Govini Consulting (private firm)

- Centers for Disease Control
- US State Dept, Office of Western European Affairs
- US State Dept, Bureau of Oceans and International Environmental and Scientific Affairs
- US State Dept, Office of Financial Policy Reporting and Analysis

Extra-curriculars: An array of extracurricular activities supplement the classroom experience. Through GT alumni we visited places such as the Pentagon, the Office of the Director National Intelligence, the White House, and Deloitte Consulting’s Government and Public Services practice. On their own, students observed Supreme Court cases, visited the Capitol, and went to talks by senior policy officials and subject experts throughout the city (for example, they visited the Brookings Institution for a fiscal policy presentation and budgeting exercise). These events build bonds between students and alumni, and increase student awareness of Washington DC and its role in global affairs.

GTDC is not all work and study. The students also attended a Washington Nationals baseball game with UGA students. Several students enjoyed a dim-sum brunch with several GT alumni and a top science policy advisor to President Biden. As a class, we did a walking tour of Georgetown, led by a local historian, focused on stories of espionage during WWII and Cold War. We visited the new African-American History & Culture Museum together with lectures on and discussions of Black history. We took a guided evening stroll which detailed the sites and events surrounding the assassination of Lincoln, ending at Ford’s Theater and followed by dinner at the site of John Wilkes Booth’s boarding house (now a Chinese restaurant). On their own time, the students saw a production of Mulan at the Kennedy Center; hiked the Shenandoah Valley; attended embassy events; and visited monuments and museums throughout the city. The students also bonded as a group through movie-nights, card games, and dinners. These nonacademic activities created networking opportunities and strengthened social/professional relationships.

Mentorships: For each student, we also arranged a 1-on-1 mentorship with a GT alum living and working in the DC area. We paid special attention to each student’s personal and career interests in selecting their mentors. For example, we matched our transgender student with a mentor in civil rights and the LGBTQ community. Our female students each got as mentors outstanding women working in Congress. Other students were matched with appropriate professional mentors as well. Students found this experience highly rewarding for the personal bonds they were able to form.

II. ASSESSMENT

To evaluate outcomes, we used a combination of course deliverables, CIOS evaluations, along with qualitative discussions and formal surveys with students, their mentors, and their employers.

Applications/Enrollments: The first year’s program (2023) received 44 applications, out of which we enrolled thirteen students from diverse majors—INTA, PUBP, CHEM, ME, and MGMT, and IAML. As a testament to the program’s success and growing reputation on campus, we received 134 applications for the Fall 2024 class. This constitutes a 300% increase over just one year, exceeding all expectations! Importantly, our applicants’ demographics mirror those of the undergraduate student body. To take just one dimension, the incoming class has students from AE, CE, CS, EIA, INTA, IAML, ISYE, MATH, ME, MGMT, and PUBP. Their interests span artificial intelligence, sustainable cities, space policy, forestry, diplomacy, education, conflict resolution, health, alternative energy, transportation, national security, and poverty alleviation. In other words, GTDC is achieving its goal of campus-wide representation and inclusion. And, as per President Cabrera’s direction at our inauguration ceremony in the U.S. Capitol, we will double our class size to 25 students for Fall 2024.

Course Deliverables: Overall, both courses required students to give professional-level oral presentations and to write for a professional policy audience. Several students had little or no experience with this kind of research and writing. For many students, this improved upon and reinforced their internship responsibilities. Our site visits supplemented the classroom experience by helping them understand the role and interests of government agencies. The course deliverables includes (examples included separately):

INTA 3110 (US Foreign Policy):

- Policy memos, essays, and a research paper;
- Oral presentations
- Participation in a National Security Council simulation on Iran’s nuclear proliferation.

PUBP 3030 (Policy Analysis)

- Team policy briefs
- Oral presentations
- Weekly drills on policy analysis

Internship Experiences: The internships are the pinnacle of GTDC’s experiential learning experience. Here are a few examples of how the program exceeded those learning outcomes.

- An INTA student earned a *Certificate of Appreciation* signed by the Assistant Secretary of State to recognize she received the highest score possible in their internal evaluation;
- A Scheller student collected and analyzed the data for a defense tech firm’s Data Summit in Washington D.C. He developed many of those skills on the job;
- A mechanical engineering student redesigned Congressman Pelosi’s system of tracking constituent records;
- A chemistry major used her analytical chemistry skills to develop a pigment analysis database that allows the Library of Congress to better date historical manuscripts, maps, and textiles;
- A mechanical engineering major researched and wrote an analysis of China’s machine tools industry for a policy think tank.
- Almost every student was rated by their supervisor(s) as “Exceeded expectations (top performer, we would hire them if we could).”

Internship Deliverables: Students were required to submit weekly journal entries discussing their internships, highlighting situations in which knowledge and skills taught in class applied to their work. Students were also required to submit a policy brief, research paper, or other similar report related to their internship (examples submitted separately).

III. LETTERS OF SUPPORT:

We have solicited letters of support from:

- Adam Stulberg (INTA Chair) and Cassidy Sugimoto (SPP Chair)
- Sam Flax (GT Class of 1974 in Industrial Engineering, Instructional Faculty at Georgetown Law, Guest Lecturer in GTDC)
- Robert Knotts (GT Federal Relations, Director of Federal Jackets Program)
- Anais Acree (GTDC student)
- Parker Alderman (GTDC student)
- Navan Kothari (GTDC student)
- Tyler Quillen (GTDC student)

January 23, 2024

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Dear Innovation in Co-curricular Education Award Committee,

We are writing in support of professors Larry Rubin (INTA) and Mark “Zak” Taylor (SPP) for their “GTDC: Pathways to Policy Program” in submission for the 2024 Innovation in Co-curricular Education Award. GTDC is an institute-wide semester in Washington, DC, led by the Schools of Public Policy and International Affairs. This novel program exemplifies Georgia Tech’s interest in creating global citizens through experiential learning. GTDC’s semester program, which includes a classroom component and internship, creates opportunities for the students to develop leadership skills, engage with the practical dimensions to national and foreign policymaking, and gain confidence and respect in working across disciplines and professional cultures. Most importantly, it encourages students to seriously consider public service as a career option, and at the very least, to gain an appreciation for it. It demonstrates that all majors and all students at Tech have policy relevance and teaches them how to have tangible impact in their professional pursuits.


Professors Rubin and Taylor have accomplished a tremendous feat in the creation of this innovative program. These valuable members of our respective faculties dedicated their time and energy for a year and a half prior to the program’s launch to align Institute stakeholders in Atlanta and D.C.; design budgets; work with the registrar’s office; and engage with student groups, faculty, and alumni. The yield from these efforts exceeded our expectations, with 13 incredible success stories in the first year’s cohort. The early responses from the students have been phenomenal. Frequently heard are phrases such as “it was a transformative experience,” “life changing,” “I learned so many valuable skills that I never knew I needed,” and “I learned was how to be independent.” Another testament is the growing reputation of the program. Over 130 students applied for the Fall 2024 program, and fulfilling President Cabrera’s wishes, the size of the program doubled and includes participation from every College on campus.

We have worked arm-and-arm with Professors Rubin and Taylor over this period and have been impressed with their drive, ingenuity, and capacity to provide students with a dynamic innovative experience; one they will long remember upon graduation from Georgia Tech. One of the many highlights from the year was the official launch ceremony at the U.S. Capitol, hosted by President Cabrera, in which three Georgia Senators (Nunn, Ossoff, and Warnock) spoke to our 13 beaming students with over 100 alumni and friends of GT in attendance.

Another compelling dimension to the efforts by Professors Rubin and Taylor has been their creativity at designing informal out-of-class learning experiences to complement student in-class experiences. They conducted social and academic engagements at the Smithsonian African American History Museum, walking tours of D.C., student organized excursions to the Kennedy Center, and class-related site visits to the Pentagon, the Supreme Court, the White House, and the Office of the Director of National Intelligence. Rubin and Taylor designed these experiences such that the students could seamlessly engage with GT alumni, forging organic, substantive, and lasting connections across generations of diverse GT cohorts. The latter stands to yield significant fruit in terms of building networks for the initial cohort to mentor their successors and leverage for future professional pursuits, as well as for GT alumni in DC to come together, give back to the Institute, and elevate the prominence of the GT brand in the nation’s capital.

Professors Rubin and Taylor brought this project to fruition in a short period of time and without sacrificing quality. They brought onboard all stake-holders, including students and alumni. In doing so, they achieved what Tech has desired for several decades—a top-quality, educational presence in Washington, DC and a foundation for future activities. They embody the highest ideals of innovation, undergrad-focused education, practical learning, and professionalism. We hope you agree.

Sincerely,



Adam Stulberg
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Cassidy R. Sugimoto
Tom and Marie Patton Professor and Chair in the School of Public Policy
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GEORGETOWN LAW

Samuel A. Flax

Distinguished Visitor from Practice

January 29, 2024

To the Georgia Tech Center for Teaching and Learning Awards Committee:

It is my pleasure to submit this letter supporting the application of Zak Taylor and Larry Rubin and the Georgia Tech in DC (GTDC) program for the Georgia Tech CTL Innovation in Co-curricular Education Award. I am a professor from practice at the Georgetown University Law Center, where I have taught courses on corporate finance and governance for several years. I am also a Georgia Tech graduate, having received a Bachelor of Industrial Engineering in 1978. Throughout my 50-year association with the Institute as a student and alumnus, I have been concerned that many technically oriented Tech students lack sufficient appreciation for and understanding of the importance and contributions of government and the public sector to the achievement of technical and scientific progress. I first got to know Zak Taylor several years ago when he enthusiastically undertook the role of faculty coordinator for a lecture series that my wife and I endowed in the School of Public Policy intended to promote such appreciation. Given this background and interest, I was pleased to learn early last year of the decision to establish the GTDC program and that Zak along with Larry Rubin would be its co-directors.

Over the last several months, I had several opportunities to interact with Zak and Larry and the first GTDC student cohort both in the classroom and on an informal basis. I have come away from these experiences singularly impressed with the program, its co-directors and its students and believe that it is exactly the sort of opportunity that Georgia Tech should be providing to its student body to develop an appreciation for and understanding of the public sector and technology. When he was planning this fall's curriculum, Zak invited me to teach a GTDC class and I readily agreed. One of the courses I teach at Georgetown Law is a semester long seminar on Corporate Purpose and ESG Issues, and after polling the GTDC students, Zak reported that they would be interested in the subject. (ESG is the sometimes-controversial premise that investors and others should evaluate businesses on non-financial environmental, social and governance metrics as well as on financial performance.) The GTDC classes are generally held in the evening after the students have spent a full day at their internship positions, and yet the students were engaged and interested throughout the nearly three-hour session. Most of the students were quite familiar with the articles from the ESG and public policy reading list I had provided in advance of the class (all of which I also assign to my law students). Most impressively, every student voluntarily answered questions and participated in the discussions during the class, involvement that is better than that of some of my second- and third-year law students. Their observations were thoughtful and incisive, reflecting their curiosity, intelligence and interest in the subject matter.

I also had the opportunity for informal discussions with the co-directors and the students at the class and at several other events over the course of the semester. In addition to being personable, articulate and interesting, the students were uniformly enthusiastic about GTDC and their semester in Washington. GTDC and its pedagogy, as well with the opportunities it offers students to take advantage of a wide variety of educational and cultural (as well as recreational) activities in the Washington-area, reflect the considerable planning, thought and creativity of Zak and Larry.

In sum, the GTDC co-directors have excelled at achieving the Award's goal of increasing "student learning outside the traditional curriculum and help[ing] Georgia Tech achieve its strategic goal of graduating global citizens who can contribute to all sectors of society." They are most deserving of the Award.

Please do not hesitate to contact me if I can provide any additional information. Thank you for your consideration.

Sincerely,
Samuel A. Flax
Distinguished Visitor from Practice
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February 1, 2024

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Dear Innovation in Co-curricular Education Award Committee,

I am Tyler Quillen, a senior undergraduate studying International Affairs at Georgia Tech and one of the recent participants from the inaugural GTDC: Pathways to Policy program. I am writing to you to express my highest possible laudations for the program's leaders Dr. Lawrence Rubin and Dr. Mark Taylor and to recommend them for the Innovation in Co-curricular Education Award. These men showed extreme rigor and dedication to the students they brought to the nation's capital and created a life-changing experience for me and my constituents. In so doing, they have left a profound impact on my education and gifted me with memories I will look back on for the rest of my life.

When I say that Dr. Rubin and Dr. Taylor have changed my life for the better, I mean it in no uncertain terms. The opportunity to travel to, study, and work in Washington, D.C. has given me the greatest education in both theory and practical experience I have ever received in a single semester. Dr. Rubin and Dr. Taylor encouraged me to pursue an internship at the National Defense University, a position I previously would not have dreamed of being accepted for. Despite my doubts, I was accepted into the internship programs for not one but two organizations at the NDU and gained invaluable work experience there. What's more, to be able to contribute to high-level research in some of the foremost institutions in my field has shown me the breadth of my capabilities and endowed me with a confidence I had previously been fearful of accepting. This confidence, my education, professional experience, and the connections I made in D.C. have galvanized my desire to return to the city and bolstered my career prospects to be able to do so.

Furthermore, the GTDC program has not only had profound impacts on me individually but also opened the doorway to great opportunities for the Institute as a whole. Dr. Rubin and Dr. Taylor's program stands to open the doorway for GT students to increase their knowledge and become embroiled in the policy making process as I have. In their championing of this program, they have paved the way for the creation of more worldly and societally contributive students. For this achievement, I believe Dr. Rubin and Dr. Taylor deserve the high praise this award begets.

As the program grows in the years to come, I foresee it only continuing to bear fruit and I look forward to watching it do so. With these accomplishments in mind, I implore you to recognize these men for their actions with the Innovation in Co-curricular Education Award.

Best regards,

Tyler B. Quillen
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January 27, 2023

To Whom it May Concern,

My name is Navan Kothari and I am a second-year business administration major minoring in computing and intelligence at Georgia Tech and I participated in the inaugural cohort for the Fall 2023 GTDC program. In this program I did an internship and took two classes, Policy Analysis (PUBP 3030) and U.S. Foreign Policy (INTA 3110) taught by Professor Taylor and Professor Rubin respectively. The GTDC program was a fantastic experience where myself and 12 other GT students got opportunities to learn about public policy, international affairs, government operations, and develop critical skills in communication, writing, and networking that will be useful for the rest of our lives. I am delighted to write in support of Professor Rubin and Professor Taylor nominations for the CTL Innovation in Co-Curricular Education Award for the GTDC program.

As a business and computer science student, I did not have much initial exposure to PUBP and INTA opportunities. Despite this, both professors did a fantastic job of guiding course instruction for all interests. For example, Professor Taylor invited an alum to talk to us about energy policy. We learned about energy equity, renewable energy, and how energy is distributed. I was so moved by this conversation that I am now working on a VIP project focused on researching energy equity—all because of the exposure provided by my experiences in the GTDC program. Additionally, both courses involved many hands-on activities. Another one of my favorite experiences was a National Security Council Simulation organized by Professor Rubin. All of the students had a designated role (mine was Secretary of Treasury) and we deliberated for two hours about national security concerns such as sanctions, military deployments, and counter terrorism intelligence and threats. This simulation forced us to research and engage in our respective roles deeply, analyze how different players both domestically and internationally would be affected, and communicate these ideas to the group in a clear and concise way. Professor Rubin chose a very innovative way to conduct this class and to this day finds it as one of the best classes I have ever had at Georgia Tech.

Outside of the classroom, both professors made tremendous efforts to provide unique program visits. For example, we had a great experience visiting the Pentagon, getting a tour of the building, and learning from alumni about their impact in national defense. We learned about different programs such as CAPE and got to see the “control room” of the National Counterterrorism Center which was eye opening as we learned about how the U.S analyzes terrorist threats. It was activities like this where many of us were able to connect the dots between our education and the careers many of us wanted to pursue.

Lastly, both professors made efforts to ensure that the skills and experiences garnered from the program were applicable to many areas. In Professor Taylor’s class, we were assigned a semester-long group project where my group focused on affordable housing and researched topics such as zoning reform, voucher access, and ADU development. Our groups learned about different policy aspects from budgets to moral/ethical issues to market/government failures and more. At the end of the semester we presented a 15 minute presentation on our research and policy recommendations that was supported by an extensive research paper. Through this

interdisciplinary project we gained a deeper understanding of critical policy issues in the U.S. and also improved our presentation, writing, and research skills—all which are useful for contributing to society in any way. Professor Taylor did a fantastic job of educating us on the research process and forced us to analyze each aspect of our policy solutions.

Professor Rubin and Taylor provided an invaluable experience that many of us will always remember. Through their efforts, they gave all of the students exposure to policy, international relations, and future careers where we can make an impact on this world. So far at Tech, this has been my best experience and it is something I get asked all about when I talk to professors, employers, and friends. Looking back at the program, I now have a better understanding of public policy challenges, national security decision making, and what a possible career in the government could look like. I am thankful for the guidance and relationships I built with both professors and this program serves as an example of the great work Georgia Tech does in a realm of fields and disciplines.

Sincerely,

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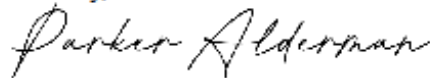
Dear Innovation in Co-curricular Education Award Board,

My name is Parker Alderman (They/he). I am a second-year International Affairs and Modern Languages: German major at the Georgia Institute of Technology. During the 2023 Fall Semester, I participated in the inaugural GTDC: Pathways to Policy program spearheaded by Dr. Mark Zachary Taylor and Dr. Lawrence Rubin. This program provided valuable experiences and opportunities that profoundly impacted my growth and career trajectory.

The GTDC program consisted of four main aspects: professional and cultural excursions throughout the DC area, GT mentors in the DC area, an internship, and classes. Our cohort attended personalized tours and Q&A periods at Deloitte, the Eisenhower Executive Office Building, the Pentagon, the Center for Strategic and International Studies, and the Office of the Director of National Intelligence. Dr. Taylor and Rubin also helped us explore all the area had to offer by leading trips to the African American History Museum, the Lincoln Theater, and even setting up a spy tour in Georgetown! They also connected us with GT alumni as mentors with experience in fields we were interested in pursuing. I had two mentors who not only had experience with advocacy and Civil Rights policy but also knew what it was like to navigate the world through a black and trans lens. Having mentors who had experience in the policy I was interested in and could speak to me on a personal level about our shared identities, made all the difference in the quality of connection and comfort I felt with them. Internships were also an integral part of this program experience and both professors were extremely helpful in finding internship opportunities, reviewing application materials, and helping me secure the funds needed to pursue my first choice opportunity at the CDC's Washington Office. The Public Policy and Foreign Policy classes taught by Dr. Taylor and Rubin, respectively, allowed us to gain skills like policy brief writing and researching that could be applied to our internships.

As aforementioned, the GTDC program was extremely formative and in no small part thanks to the quality of professors we had in Dr. Taylor and Rubin. I came into this experience anxious and not knowing what to expect. However, I left knowing that not only am I truly interested in pursuing a career in the international affairs and public policy spaces, but that I belong and will thrive in these rooms. This program is a must-attend for those considering a career in policy work in DC!

Sincerely,



Parker Alderman (They/he)
Sophomore, Georgia Institute of Technology

Library of Congress Blog excerpt: Preservation Science Intern, Jessica McKenzie, breaks down some applications of analytical chemistry in the Library of Congress, where she uses Fourier Transform Infrared Spectroscopy to expand the Preservation Research and Testing Division's database for pigment analysis. She then demonstrates how she has assisted in applying her work on collection items.

The Art of Color Analysis: Using Analytical Chemistry in Pigment Research

(The following is a post by Jessica McKenzie, Preservation Science Intern, Preservation Research and Testing Division. She is a fourth-year student at Georgia Institute of Technology, pursuing a bachelor's degree in chemistry with plans to continue her education in analytical chemistry.)



A lot of people think of chemistry and think of organic chemistry. It's an infamous subject in which you generally take individual components and combine them in specific conditions to create something else. Analytical chemistry, in my eyes, is the opposite of organic chemistry. For one, the class usually doesn't make people change their majors- if you stick to chemistry long enough to take this course, you're in too deep to back out now. In all seriousness, analytical chemistry typically uses methods to look at a sample and determine its composition. From the compositional data, a wide range of questions can be answered. In the preservation world, these questions include those of authenticity or how a sample can be better preserved. My project at the PRTD expands upon research initiated by a previous intern, Sarah Fong. Sarah worked with Fourier Transform Infrared Spectroscopy (FTIR) to create a spectral database from 50 raw pigments using three different methods. FTIR measures the absorption of infrared light into a sample, which gives information about the bonds in the sample and helps determine the composition. Creating a spectral database will assist members of PRTD in recognizing trends about these pigments and will help them to identify unknown pigments more quickly. My research works to expand Sarah's database with two more FTIR methods. It also works to investigate how these pigment spectra change when they are applied to paper.

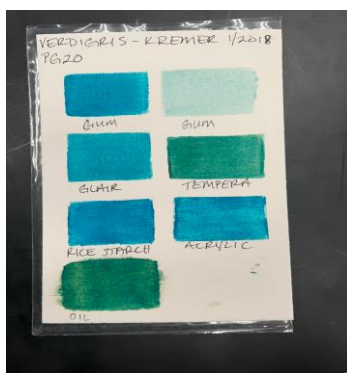


Image 1: Paint-out reference card of a blue pigment, verdigris, from the PRTD's colorant reference collection. This reference card has seven different binders.

Reference cards such as the one above were analyzed using FTIR because each swatch on the page uses a different paint binder. Although reflectance FTIR is considered a surface technique, it does slightly penetrate the substrate. This results in the binder and paper also appearing in the spectra when it is measured. Comparing these spectra to the pure pigment spectra allows us to see what peaks are persisting from the pigment.



Image 2: Image of the verdigris pigment taken with a MiScope, a digital microscope, under 40X magnification.

Verdigris is one pigment I studied in my research, and it is a good example of why expanding the spectral database to include pigments on paper is an important next step in this research. The next image shows my two methods of FTIR using the pure pigment in comparison to the pigment on paper.

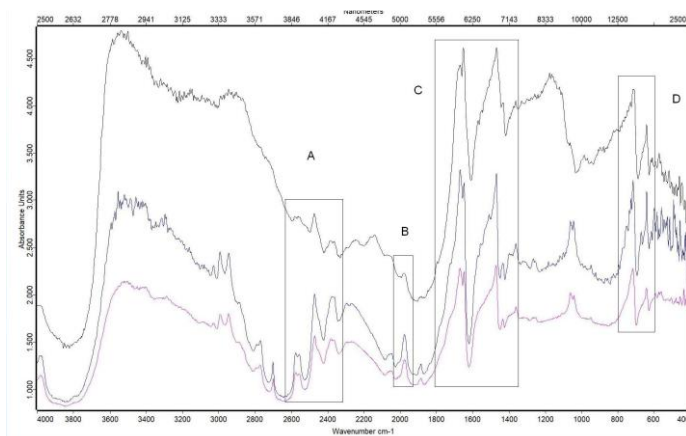


Image 3: Two FTIR spectra of pure pigment samples (pink and blue, lower two spectra) and one spectra of the pigment applied on paper (black, higher spectra). Note that the y-axis values are not correct, as the spectra have been shiaied to better show the similarities.

In the image, the peaks that are showing on all three spectra have been boxed off. I have ignored the range from 3800 to 3200 wavenumbers because this is the area of the spectrum where OH bonds show up, and this peak is oaken influenced by the water in the air. It can be seen, however, that sections A and B are showing as significantly smaller peaks in the paper spectrum than in the spectrums of raw pigment. Meanwhile, some peaks have been completely obscured by larger peaks in the paper spectrum. The fact that so many peaks can be obscured by the paper makes it very difficult to distinguish peaks when looking at samples. The development of this database is very important to be able to determine what peaks are likely to show up regardless of what type of paper or parchment the pigment is applied to.

During my time at PRTD, I was able to assist in taking FTIR measurements of a Portolan chart from the 16th century. This beautiful map was brought into the lab for a pigment analysis, so it was incredible to experience the practical applications of my research. The map had small doodles of ships in the water, and an intricate compass rose. It had four different colored pigments, and multiple spots with each pigment were analyzed to determine if the colors were the same pigment across the map and what the pigments were.



Image 4: The portable FTIR setup for analysis of the Portolan chart.

Because PRTD is developing techniques for portable instrumentation, there is much more flexibility with how rare media from the collections can be analyzed. Items that are difficult to move do not have to make the trip to the lab. Instead, the lab can be brought to the item. In this case, the FTIR was secured onto a tripod, which allowed the instrument to be tilted so it could focus and scan the Portolan. If the instrument were a bulky bench top version, simply scanning the item in this manner would not be possible. The preservation scientists would need to maneuver the item in a way that just isn't good for it, or sampling would have to be involved. Portable instrumentation allows PRTD to explore further applications of analytical chemistry and utilize them to learn more about the many collection items of the Library of Congress.



Image 5: A picture of one of the ships decorating the map.

I would like to thank everyone in the Preservation Research and Testing Division for giving me this opportunity, with special thanks to Amanda Satorius for being an amazing mentor throughout this experience. I have really enjoyed this internship and working with these brilliant individuals at the Library of Congress.

Posted December 14, 2023

<https://blogs.loc.gov/preservation/2023/12/the-art-of-color-analysis-using-analytical-chemistry-in-pigment-research/>