BRUCE E. JARRELL, MD, FACS
Executive Vice President and Provost
Dean, Graduate School

Academic Affairs/Graduate School

220 North Arch Street, 14th floor
Baltimore, MD 21201
410 706 2304

bjarrell@umaryland.edu
www.umaryland.edu

UNIVERSITY *of* MARYLAND

April 8, 2019

James D. Fielder, Jr., Ph.D.
Secretary of Higher Education
Maryland Higher Education Commission
6 North Liberty Street
Baltimore, MD 21201

Dear Dr. Fielder:

The University of Maryland Graduate School is requesting Maryland Higher Education Commission authorization to offer a Master's in Cannabis Science and Therapeutics program in fall 2019.

In addition to the enclosed program proposal, please find a letter from Dr. Natalie Eddington, Dean of the University of Maryland School of Pharmacy, to the Senate Judicial Proceedings Committee.

We appreciate your consideration of this request. Please feel free to contact me if you have any questions.

Sincerely,

Bruce E. Jarrell, MD, FACS
Executive Vice President and Provost
Dean, Graduate School

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MHEC
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Cover Sheet for In-State Institutions
New Program or Substantial Modification to Existing Program

Institution Submitting Proposal	University of Maryland, Baltimore

Each __action__ below requires a separate proposal and cover sheet.

- ● New Academic Program
- ○ New Area of Concentration
- ○ New Degree Level Approval
- ○ New Stand-Alone Certificate
- ○ Off Campus Program

- ○ Substantial Change to a Degree Program
- ○ Substantial Change to an Area of Concentration
- ○ Substantial Change to a Certificate Program
- ○ Cooperative Degree Program
- ○ Offer Program at Regional Higher Education Center

Payment Submitted: ○ Yes ● No	Payment Type: ○ R*STARS ○ Check	Payment Amount:	Date Submitted:

Department Proposing Program	University of Maryland Graduate School
Degree Level and Degree Type	Master's Degree
Title of Proposed Program	Cannabis Science and Therapeutics
Total Number of Credits	30
Suggested Codes	HEGIS:　　　　　　　　CIP: 51.2005
Program Modality	○ On-campus　　○ Distance Education (*fully online*)　　● Both
Program Resources	● Using Existing Resources　　○ Requiring New Resources
Projected Implementation Date	● Fall　　○ Spring　　○ Summer　　Year: 2019
Provide Link to Most Recent Academic Catalog	URL: **http://catalog.pharmacy.umaryland.edu/**

Preferred Contact for this Proposal	Name:	Leah Sera, PharmD, MA, BCPS
	Title:	Assistant Professor, Department of Pharmacy Practice and Science
	Phone:	(301) 738-6347
	Email:	lsera@rx.umaryland.edu

President/Chief Executive	Type Name: Dr. Bruce E. Jarrell, Executive Vice President and Provost
	Signature: *Bruce E Jarrell*　　　Date: 04/08/2019
	Date of Approval/Endorsement by Governing Board:

Revised 12/2018

UNIVERSITY SYSTEM OF MARYLAND INSTITUTION PROPOSAL FOR

Master of Science in Cannabis Science and Therapeutics

A. Centrality to institutional mission statement and planning priorities

The University of Maryland, Baltimore (UMB) is the state's public health, law, and human services university devoted to excellence in professional and graduate education, research, patient care, and public service. As a diverse community of outstanding faculty, staff and students, and using state-of-the-art technological support we educate leaders in health care delivery, biomedical science, global health, social work, and the law. We emphasize interdisciplinary education and research in an atmosphere that explicitly values civility, diversity, collaboration, teamwork, and accountability. By conducting internationally recognized research to cure disease and to improve the health, social functioning, and just treatment of the people we serve, we foster economic development in the city, state and nation.

The University of Maryland School of Pharmacy is pleased to submit a proposal for a new Master of Science (MS) in Cannabis Science and Therapeutics . To be successful, the learner must complete all required and elective coursework totaling 30 credits. The program will blend online and face-to-face instruction, and include both synchronous (e.g., live) and asynchronous (e.g., pre-recorded) lectures, readings, and reflections, along with active learning elements, including discussion boards and individual and group assignments. The proposed Master's degree program will commence in Fall of 2019.

Through the MS in Cannabis Science and Therapeutics program, we intend to provide learners with experiences designed to foster a deeper knowledge and understanding of the science, clinical therapeutics, and policy related to medical cannabis. Targeted students include health care practitioners, scientists, growers, policy professionals, and others with an interest in medical cannabis. Students will demonstrate their ability to design therapeutic regimens and monitoring plans, develop safe and effective dosage forms, participate in health policy decision-making processes, and identify potential areas of future research. Our students will learn a wide range of skills that will allow them to be innovative leaders in the emerging medical cannabis industry.

This program will be offered at the Universities at Shady Grove and the University of Maryland, Baltimore. The four core required courses in the program cover the principles of drug action and cannabinoid pharmacology; cannabinoid chemistry and drug delivery; clinical uses and effects of medical cannabis; and an overview of current state and federal laws and regulations along with a historical overview of medical cannabis use. After taking the four foundational courses, students will take four elective courses followed by two final advanced courses (Research Methodology and Expert Seminars and Discussion). Students may choose to take elective courses in the basic sciences, therapeutics, or policy.

The proposed degree is consistent with and will advance the mission of the University of Maryland, Baltimore. Through this new program, we will provide our students with the knowledge and skills needed to make a positive impact on communities in Maryland and beyond.

Alignment with Institutional Strategic Goals

The proposed Master of Science degree will advance UMB's mission *"to improve the human condition and serve the public good of Maryland and society at-large through education, research, clinical care, and service."* Additionally, the program contributes to the fulfillment of related strategic goals for UMB, in a number of significant ways:

- One of the university's key strategic themes is to "*excel at interdisciplinary research and interprofessional education, clinical care and practice, and public service.*" The MS in Cannabis Science and Therapeutics directly responds to this theme by its inclusion of interprofessional team teaching, and interdisciplinary science content focusing on pharmacology, drug delivery, analytic techniques, therapeutics, and policy.

- Another strategic theme of the university is *"innovative curricular and co-curricular initiatives that multiply pathways to diverse careers and leadership opportunities inside and outside of academia."* The MS in Cannabis Science and Therapeutics has been critically designed to prepare graduates for the distinct segments of the medical cannabis workforce, inclusive of science, therapeutics, and policy.

- And finally, the MS in Cannabis Science and Therapeutics will infuse innovations in instructional design throughout the curriculum, thus creating an accessible, relatable and sustainable education program that responds to the needs and characteristics of the learner. This aligns specifically with the university's strategic goal *"on the importance of creating accessible education for individuals already engaged in their professions and developing productive discovery-to-delivery research model that serves as a catalyst for economic development."*

How will program be funded for first 5 years?
The programs will draw upon existing resources. The School of Pharmacy already has qualified faculty and offers PharmD, PhD, and Master of Science Degrees in Regulatory Science, Pharmacometrics, Palliative Care, Pharmaceutical Sciences, and Pharmaceutical Health Services Research. The school has the administrative and advising infrastructure for students.

Institutional Commitment
The School of Pharmacy has the administrative, instructional, advising, and facilities infrastructure in place to operate the programs. In the event that the programs are discontinued, the courses will be offered for a reasonable time-period so that enrolled students can finish. The faculty and administrative infrastructure will still be in place to work with students who have not finished the program.

B. Critical and Compelling Regional or Statewide Need as Identified in the State Plan

A growing number of states now permit the use of cannabis for specific medicinal purposes, and the majority of Americans favor the legalization of cannabis for medical use. Though possession, cultivation, and distribution of cannabis for both medicinal and recreational use (hereafter referred to as "adult use") remain illegal at the federal level, many states have established individual laws and regulations regarding the sale of cannabis for medical purposes.[1] In early 2017, the National Academies of Sciences, Engineering, and Medicine released a comprehensive report based on the review of over 10,000 scientific abstracts from cannabis health research. This report made approximately 100 conclusions related to the therapeutic and health effects of cannabis and suggested approaches to stimulate and improve cannabis research. The report summarizes the effectiveness of cannabis in the treatment of a number of health conditions and diseases, including chronic pain, chemotherapy-induced nausea and vomiting, multiple sclerosis spasticity symptoms, HIV-associated anorexia/cachexia, and post-traumatic stress disorder, among others. In addition, the report also presents a national research agenda for cannabis which is articulated through a series of recommendations including a focus on research standards for ensuring high quality cannabis research, and for federal agencies to fully characterize the impact of regulatory barriers on cannabis research.[2]

California was the first state to permit access to the cannabis plant for medicinal use under physician supervision.[1] As of November 7, 2018, thirty-three states as well as Washington, D.C., Guam, and Puerto Rico will have enacted legislation governing medicinal cannabis sale and distribution; 21 states and the District of Columbia will have decriminalized marijuana and eliminated prohibition for possession of small amounts, while 10 states, including Alaska, California, Colorado, Maine, Massachusetts, Nevada, Oregon, Washington, Vermont, and Michigan, as well as the District of Columbia, will have legalized adult use of marijuana(Figure 1).[5]

Figure 1. State Cannabis Programs in 2018

State Cannabis Programs

Vermont adult use law signed Jan. 22, 2018. Effective July 1, 2018
Limited adult possession and growing allowed, no regulated production or sales: DC, VT

November 2018
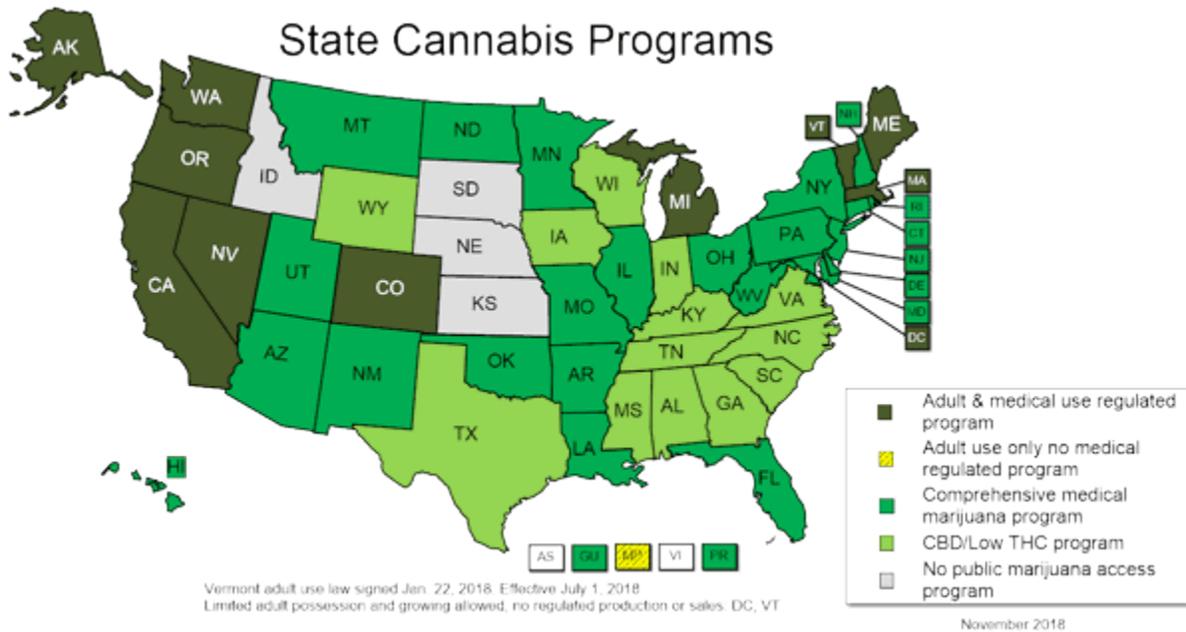
Cannabis is currently established by the U.S. Drug Enforcement Agency's (DEA) Comprehensive Drug Abuse Prevention and Control Act (Controlled Substances Act) of 1970 as a Schedule I controlled substance. All Schedule I substances are defined as having a high potential for abuse, no currently accepted medicinal use in treatment in the United States, and a lack of accepted safety data for use of the treatment under medical supervision.[3] In 2013, a U.S. Department of Justice memorandum (the Cole Memorandum) to all U.S. attorneys advised that in states where marijuana was legal for medical use, prosecution of individuals and operations in compliance with state law was not a federal priority.[4] However, the federal restriction does have other ramifications for medical use. For instance, physicians cannot legally prescribe cannabis, given its Schedule I classification, but may certify or recommend patients for treatment in states where such use is legal. Additionally, medical cannabis expenses are not reimbursable through government medical assistance programs or private health insurers.[1] The Cole Memorandum was rescinded in January 2018 by then Attorney General Jeff Sessions, despite the increasing number of states permitting the legal use of cannabis for medical and adult use.[5]

Medical Cannabis in Maryland

On June 1, 2014, the state of Maryland legalized the use of medical cannabis, with subsequent amendments to the statute on May 12, 2015. This legislation allows for the registry of authorized physicians, patients, caregivers, licensed processors, dispensaries, growers, and independent testing laboratories.[6] The Natalie M. LaPrade Maryland Medical Cannabis Commission (MMCC) develops policies, procedures, and regulations to implement programs that ensure medical cannabis is available to qualifying patients in a safe and effective manner. The MMCC oversees all licensing, registration, inspection, and testing measures pertaining to Maryland's medical cannabis program and provides relevant program information to patients, physicians, growers, dispensers, processors, testing laboratories, and caregivers.[6] MMCC lists more than 500 certified providers, 46 licensed dispensaries, 14 licensed growers, 13 licensed processors, and four independent testing laboratories. The MMCC has also issued another 15 pre-approvals to companies to grow medical cannabis, 15 pre-approvals to companies to process medical cannabis, and 102 pre-approvals to companies to dispense medical cannabis that will be added to the list of licensees once a company has completed compliance with the regulatory requirements and the Commissioners have voted on licensure. Our site selection for this program of the Universities at Shady Grove in Montgomery County recognizes the county's prominence in Maryland's burgeoning medical cannabis industry and the projected need for access to specialized education and training in that part of the state. MMCC lists some 85 certified providers, 11 licensed dispensaries, and one licensed processor, all with Montgomery County addresses. The MMCC has also issued another four pre-approvals to Montgomery County companies to grow medical cannabis and 18 pre-approvals to Montgomery County companies to dispense medical cannabis.

As the number of states legalizing medical cannabis increases, so does the need for an educated workforce to respond to the

demand for medical cannabis with an understanding and expertise regarding the science and therapeutic effects of this medicinal plant. In addition to supporting the medical cannabis industry, this growing workforce will add to the clinical and scientific research of cannabis. **The MS in Cannabis Science and Therapeutics align with the goals of *access, success, and innovation* outlined in the 2017-2021 Maryland State Plan for Secondary Education.** As a blended graduate program, the MS in Cannabis Science and Therapeutics allows for flexibility in learning that will ensure access for both traditional and non-traditional students, thereby helping to maintain Maryland's role as a national leader in having an educated workforce. Additionally, faculty in this program will participate in professional development related to best practices in distance learning to promote innovation in online course design and implementation.

C. Quantifiable and reliable evidence and documentation of market supply and demand in the region and state

The following section summarizes the medical cannabis industry, including market projections, and also provides workforce needs and projections in the state of Maryland, the northeast region, and nationally.

Projected Medical Cannabis Therapeutic Areas 2014 - 2025

The growth of the medical cannabis industry in the United States is projected to increase significantly over the next 10 years. The table below summarizes the projected compound annual growth rate (CARG) for the medical cannabis therapeutic market through 2025. In addition, the table highlights the major therapeutic applications for cannabis. Based on application areas, the market is broadly categorized as chronic pain, mental disorders, cancer, and others.[7] The largest application segment is for chronic pain, which held a market share of 39.9% in 2016. By 2025, chronic pain is expected to emerge as the fastest growing segment, due to increased requirement of pain management across the globe.

Table 1. U.S. Medical Cannabis Market, by Application, 2014-2025 (USD million)[7]													
Application	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	**CAGR% (2017-25)**
Chronic Pain	1,345.4	1,458.7	1,844.5	2,428.4	30,49.9	3,706.6	4,033.4	4,213.6	4,543.5	4,908.9	5,414.6	5,877.8	**11.7%**
Mental Disorders	1,148.4	1,222.4	1,522.5	1,854.2	2,625.2	2,764.5	3,343.5	3,946.8	4,497.1	5,011.8	5,485.1	5,855.0	**15.5%**
Cancer	800.3	825.7	1,020.6	1,216.2	1,460.7	1,745.1	2,058.7	2,333.9	2,564.3	2,714.7	2,817.1	2,844.3	**11.2%**
Others	644.3	690.9	873.3	1,017.8	1,205.8	1,423.8	1,617.2	1,760.8	1,859.0	1,933.0	1,961.6	1,978.8	**8.7%**
Total	3,938.4	4,197.7	5,261.0	6,516.5	7,981.6	9,640.0	11,062.7	12,225.1	13,463.9	14,588.4	15,678.3	16,556.0	**12.4%**

Unites States Cannabis Market and Workforce Projections and Needs

As stated, the projections on the growth of the cannabis industry are very positive based on financial modeling. Figure 2 below presents the legal cannabis market projections from 2014 through 2025 (medical and adult use). There are a number of drivers that inform these projections and are articulated in the following sections on the market analysis on medical cannabis. The workforce projections for the medical cannabis workforce are driven by the growth of the medical cannabis industry.

Figure 2. Total U.S. Cannabis Market, 2014-2025 (USD Billion)

Year	USD Billions
2014	3.94
2015	5.47
2016	7.06
2017	9.11
2018	11.94
2019	15.94
2020	20.98
2021	27.42
2022	34.8
2023	42.21
2024	48.92
2025	54.01
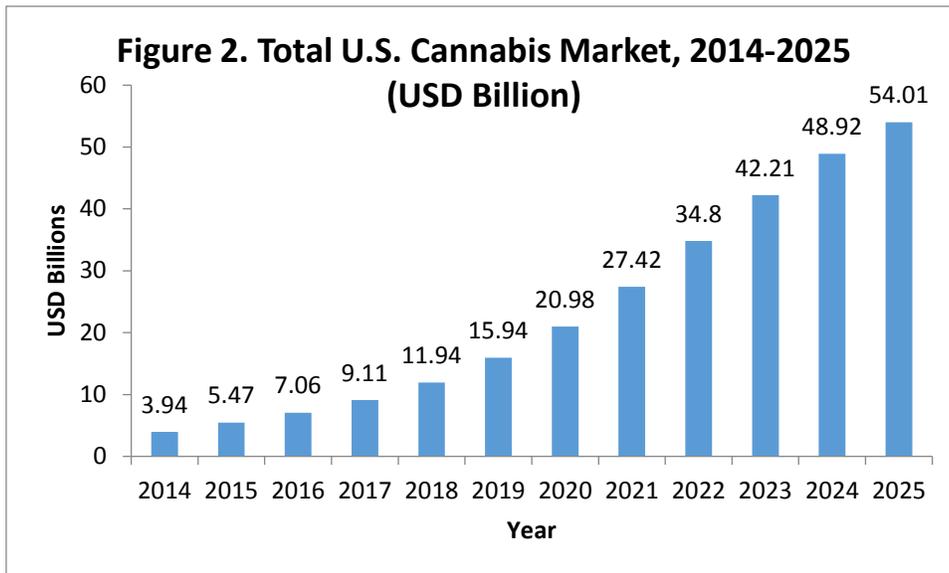
In addition, according to a report published by Arcview Market Research and BDS Analytics, the legal cannabis industry will see a significant upward shift over the next 10 years. The largest group of cannabis buyers will be in North America, going from $9.2 billion spent in 2017 to $47.3 billion in 2027 (both medical and adult recreational use).[8] Based on these projections and the fact that medical cannabis is relatively a new industry, this growth will require a trained workforce in order to achieve the market share projections as outlined above and summarized in Figure 2.

Education and the Cannabis Workforce

Traditional educational programs for health care practitioners, analytical chemists, agriculturists, policy makers, business and sales professionals have not typically included instruction on the science, policy, and therapeutics of medical cannabis. Specifically, health care professionals report significant gaps in their cannabis-related knowledge, and the extent of this educational gap has been the focus of a number of studies. Published surveys of physicians, medical students and residents, nurse practitioners, pharmacists, and pharmacy students have described similar perceived knowledge gaps (Table 2).[9-13] A 2015 survey of Canadian physicians found that the largest knowledge gaps were related to medical cannabis dosing and the development of treatment plans, similarities and differences between cannabis products, and laws and regulations. In this survey, physicians most desired education related to safety, risks, and precautions for medical cannabis use.[9] A related survey of Canadian nurse practitioners similarly found the largest knowledge gap existed for dosing and development of therapeutic plans, laws and regulations, and similarities and differences between cannabis products. Lack of education regarding medical cannabis was reported by 87% of respondents to be a barrier to use in clinical practice, and 76% of respondents ranked the need for education to be strong or very strong.[10] A survey of medical students and residents surveyed indicated that trainees perceived they were "not at all" or only "slightly" prepared to answer patients questions about medical cannabis; approximately 90% reported they were "not at all" prepared to prescribe medical cannabis; and 85% reported they had received no education regarding medical cannabis.[11] A survey of pharmacists in Minnesota indicated that that they have a perceived knowledge deficit related to medical cannabis policies and regulations, that they were inadequately trained in medical cannabis pharmacotherapy, and were unprepared to counsel patients. More than 80% of respondents were very interested in learning more about medical cannabis pharmacotherapy, laws, regulations, and available products.[12] Likewise, pharmacy students reported a lack of confidence in cannabinoid pharmacology, pharmacokinetics, drug interactions, adverse effects, and patient counseling.[13]

Table 2. Perceived Gaps in Medical Cannabis Education Reported by Health Professionals

Perceived knowledge gap	Clinical Discipline				
	Physician	Nurse Practitioner	Pharmacist	Pharmacy student	Medical student/resident
Dosing and development of treatment plans	x	x	NA	NA	x
Laws and regulations	x	x	x	x	NA
Adverse effects and risks of use	x	x	x	x	NA
Characteristics of dosage forms	x	x	x	x	NA
Pharmacology, pharmacokinetics	x	x	x	x	NA
Ability to counsel patients	NA	NA	x	x	x
NA = not asked					

Through the Maryland Medical Cannabis Commission, The School of Pharmacy conducted a needs assessment survey of employees in the Maryland medical cannabis industry to better define the educational needs and interests of this population. Of the 27 individuals who completed the survey, most identified as business or public policy professionals (59%), while 22% identified as clinicians, and the rest identified as "other," including law enforcement and compliance officers, or a combination of health care professionals and business professionals (i.e., dispensary owner). The majority of respondents had been in the medical cannabis industry for five years or less (77%), and only one respondent had been in the industry for more than 10 years. Respondents participated in a number of different roles in the industry, including business administration (18%), plant cultivation/processing (9%), dispensary owner/manager/agent (19%), health care provider (18%), and "other" (36%), a category which includes self-described compliance, regulatory agents, clinical directors, and CEOs. The majority of respondents felt that certain aspects of an educational program were "important" or "very important," including that the program would be primarily online and asynchronous, that many courses would be taught by interprofessional faculty, with flexible scheduling. Finally, a majority of students felt that most topics in the proposed curriculum were "important" or "very important," including cannabinoid pharmacology, pharmaceutics, plant genomics, clinical therapeutics, negative effects and public health implications, federal and state law, and policy.

Professionals who will be interacting with patients in a clinical capacity, including traditional health care workers as well as dispensary employees, must have knowledge of the therapeutic use of medical cannabis across a range of disease states. Additionally, professionals should be able to properly assess symptoms, recommend use of medical cannabis, and monitor the risks and benefits of medical cannabis therapy. The results of the above studies clearly indicate that there is a perceived gap in the knowledge of medical cannabis for health care providers, and signify the need for a better educated workforce that will provide care to patients using medical cannabis. Furthermore, there is a fast-growing number of patients legally using medical cannabis in the state of Maryland, in the northeast region of the US, and nationally (Table 3). To respond adequately to this growing need, educational programming must be developed and implemented to ensure that the perceived gaps in knowledge stated above are addressed.

The table below shows the total number of medical marijuana patients holding identification cards in Maryland, the Northeast region (MD, MA, VT, NY, DC, VA, OH, PA, WV, IL) and nationally (AK, AZ, CA, CO, CT, DE, FL, HI, IL, ME, MD, Na, MI, MN, MT, NV, NH, NJ, NM, NY, ND, OH, OR, PA, RI, VT, WA, and WV) and the number of health care providers in those areas.

Table 3. Medical Cannabis Patients and Health Care Provider Workforce[14, 15]			
	Maryland	Region	National
Patients	47,086	358,959	2,132,777
Health Care Providers	946	10,185	

Medical Cannabis Workforce Projections

A new report from New Frontier Data[16] projects that, by 2020, the legal cannabis market will create more than 250,000 jobs - more than expected from manufacturing, utilities or government jobs. According to the Bureau of Labor Statistics,

manufacturing, utilities, and government jobs are expected to decline significantly by 2024, while the fastest-growing industries are all in health care fields.[17] The cannabis market is experiencing rapid growth due to rising awareness regarding various medical applications such as pain management, appetite enhancement, and other health related effects of medical cannabis. These numbers confirm that medical cannabis is a major economic driver and job-creation engine for the U.S. economy. As the number of states where medical cannabis is legal increases, so does the need for an educated workforce to respond to the demand for medical cannabis with an understanding and expertise regarding science, clinical care, and policy.

Table 4 (below) summarizes the job positions in the cannabis industry in Maryland, regionally, and nationally. It should be noted that the cannabis industry is nowhere near maturity, and so the workforce estimates are not clearly constructed. As stated, the 2020 national workforce projections predict more than 250,000 jobs required for this industry. We have a dramatic shortage of educational opportunities in the state of Maryland, the northeast region, and the US that are focused on the science, therapeutics, and policy of medical cannabis. The cannabis industry will continue to expand significantly over the next 10 years, making this program integral to the training and development of this growing sector of the local, regional, and national economy.

Table 4. Emerging Jobs for Selected Careers Relevant to Master of Science in Medical Cannabis			
Keyword Search	Number of Jobs In MD	Number of Jobs Available in Region	Number of Jobs Available Nationally
Medical Cannabis Dispensary/Manager	426	1,706	2,132
Medical Cannabis Dispensary Associate /Consultant Agent	153	1,023	1,279
Chemist/Laboratory Tech/Quality Control	98	818	1,023
Pharmacist/Pharmacy Technician	83	750	938
Doctor (MD or DO)*	44	545	682
Nurse/RN or LNP	17	341	426
Grower/Processor	68	682	852
Lawyer/Paralegal/Compliance	98	818	1023
Sales/Business/Graphic/Marketing	2	141	174
Total Jobs	989	6,824	8529

D. Reasonableness of program duplication

MHEC's Academic Program Inventory does not include programs in cannabis science, therapeutics and policy, nor are there related programs currently under MHEC review.

E. Relevance to High-Demand Programs at Historically Black Institutions (HBIs)

Bowie State University, Coppin State University, Morgan State University, and University of Maryland Eastern Shore do not offer Master's Degree programs similar to our proposed program.

F. Relevance to the identity of Historically Black Institutions (HBIs)

As above.

G . Adequacy of Curriculum Design, Program Modality, and Related Learning Outcomes

1. **Suggested program description (as it would appear in the Pharmacy School Catalog)**

   Suggested program description (as it would appear in the School of Pharmacy academic catalog)

   The University of Maryland School of Pharmacy's MS in Cannabis Science and Therapeutics provides students with experiences designed to foster a deeper knowledge and understanding of the science, clinical therapeutics, and policy related to medical cannabis. Targeted students include health care practitioners, scientists, growers, policy professionals, and others with an interest in medical cannabis. The four core required courses in the program cover the principles of drug action and cannabinoid pharmacology; cannabinoid chemistry and drug delivery; clinical uses and effects of medical cannabis; and an overview of current state and federal laws and regulations along with a historical overview of medical cannabis use. After taking the four foundational courses, students will take four elective courses followed by two final advanced courses (Research Methodology and Expert Seminars and Discussion). Students may choose to take elective courses in the basic sciences, therapeutics, or policy. The program will follow a blended model, and include both synchronous (e.g., live in-person) and asynchronous (e.g., pre-recorded) lectures, readings, and reflections, along with active

learning elements including discussion boards, and individual and group assignments. To be successful, the learner must complete all required and elective coursework totaling 30 credits. A student will be able to complete the program in two years but may take up to five years as desired to complete all program requirements. The program will meet all terminal performance objectives and allows for specialization (self-determined learning) within the degree.

2. **Terminal Performance Objectives**

   After completing this degree, the graduate will be able to:

   1. Apply knowledge of pharmacology, pathophysiology, clinical assessment, and traditional management strategies of pain and other physical symptoms to identify appropriate candidates for medical cannabis therapy.
   2. Apply concepts of pharmacology, pharmacognosy, pharmaceutics, and pharmacokinetics to determine appropriate cannabis dosing, dosage forms and routes of administration for optimal treatment.
   3. Develop monitoring plans to determine effectiveness of medical cannabis therapy and to detect adverse effects of medical cannabis use.
   4. Apply concepts of analytical chemistry, pharmacology, pharmacognosy, and pharmaceutics to assure safe and effective design, development, and manufacture of medical cannabis products.
   5. Apply knowledge of analytical toxicology methods to identify, quantify, and interpret results related to cannabinoid use and misuse.
   6. Describe negative physical, psychiatric, and psychosocial effects of cannabis in individuals and populations.
   7. Participate in health policy decision-making processes by evaluating primary literature to assist policy makers and prescribers in making well-informed decisions about medical cannabis therapy.
   8. Apply knowledge of historical and current laws, regulations, and policies to identify, analyze, and advocate for emerging issues related to medical cannabis and health.
   9. Identify areas for future research related to science, health effects, and policy of medical cannabis, and describe the challenges associated with such research.
   10. Demonstrate a commitment to excellence through continuing professional development and the education and training of patients, healthcare professionals, regulatory bodies, and other relevant stakeholders.

3. **Student Assessment & Documentation**

The School of Pharmacy and UMB's Graduate School have a culture and support structure to assess program educational effectiveness. An Assessment Committee will review each online course annually using the Quality Matters rubric. Student retention and satisfaction and faculty satisfaction will be assessed continuously. Faculty will be provided with initial and annual educational programs to continue their development as online educators.

An advisory committee that represents disciplines from all of the professional schools at UMB has been assembled and reviews and provides feedback on every aspect of program development, which will continue during implementation.

4. **Provide a list of courses with title, semester credit hours and course descriptions, along with a description of program requirements.**

Course #	Course Name (all 3 credits)	Course Description
Required Core Courses (12 credits) *Students take all four courses (4/4)*		
MSMC 601	Introduction to Medical Cannabis History, Culture, and Policy	In this introductory course, participants will learn about the cultural history of medical cannabis use, and explore how federal law and policy relating to medical and non-medical use of cannabis has evolved in the United States.
MSMC 602	Principles of Drug Action and	This course introduces students to the factors influencing drug action in the body. Students will learn about receptor theory,

Course #	Course Name (all 3 credits)	Course Description
	Cannabinoid Pharmacology	pharmacokinetics, pharmacodynamics, dose-response relationships, and drug tolerance and dependence. This course will develop participants' skills to evaluate cannabis (and its components) from a mechanistic and pharmacologic perspective with the ultimate goal of providing the most appropriate cannabis regimen for individual patients.
MSMC 603	Basic Cannabinoid Chemistry and Drug Delivery	This course introduces students to the chemical characteristics of cannabis components. The course will describe the classification system for cannabinoids, cannabinoid compound ratios in plant materials, cannabis-derived products and their constituents, oils, terpenoids, flavenoids, hydrocarbons and nitrogen containing compounds. This course also introduces students to the science of designing dosage forms. Topics include the formulation, development, evaluation, selection and administration of safe, effective, reliable, drug delivery systems, with a focus on development of medical cannabis products. The wide variety of cannabis delivery systems and routes of delivery and the impact of those delivery systems have on the bioavailability of cannabis will be evaluated in this course.
MSMC 604	Clinical Effects of Medical Cannabis	This introductory course provides an overview of the most common uses of medical cannabis, including pain, anorexia/cachexia, and nausea/vomiting. Students will learn how to assess these conditions and determine when medical cannabis could be a therapeutic option. Side effects, drug interactions, and precautions are also discussed.
Elective Courses (12 credits) *Students take four courses from the six offered (4/6)*		
MSMC 605	Advanced Cannabis Therapeutics I	In this advanced level course, students will learn in-depth about the physiology, pathophysiology, and treatment strategies of selected conditions, including pain, muscle spasm, nausea/vomiting, and anorexia/cachexia. Students will evaluate available evidence, complete case studies, and explore dosing strategies and formulations. Side effects, drug interactions, and precautions are also discussed. (Pre-requisite: MSMC 604 – Clinical Effects of Cannabis).
MSMC 606	Advanced Cannabis Therapeutics II	In this course, students will learn about the physiology, pathophysiology, and treatment strategies of selected conditions, including epilepsy, sleep disorders, anxiety, and post-traumatic stress disorder, among others. Students will evaluate available evidence, complete case studies, and explore dosing strategies and formulations. Side effects, drug interactions, and precautions are also discussed. (Pre-requisite: MSMC 604 – Clinical Effects of Cannabis).
MSMC 607	Negative Physical, Psychiatric, and Social Effects of Cannabis	In this course, students will explore the consequences of cannabis use, including adverse effects and misuse or addiction. Students will evaluate available evidence, analyze case studies, and participate in group discussions. This course explores the effects of cannabis on populations, including effects on the workplace, public spaces, impaired driving, adolescent use, and unintentional poisoning, among others. (Pre-requisite: MSMC 604 – Clinical Effects of Cannabis).

Course #	Course Name (all 3 credits)	Course Description
MSMC 608	Plant Genomics and Pharmacognosy	This course introduces students to the components of the cannabis plant and the resultant biosynthetic pathways that form active and inactive agents. Students will learn the genetic basis for the differences in components between different strains and the subsequent impact on medicinal efficacy, as well as the role that plant components have on the entourage effect. (Pre-requisite: MSMC 602 - Principles of Drug Action and Cannabinoid Pharmacology).
MSMC 609	Advanced Cannabinoid Chemistry and Analytic Testing Methodology	This course relates chemical characteristics of cannabis components to their pharmacological activity. The course covers a variety of cannabis targets, methods for improving drug activity, and the principles of rational drug design and characteristics such as solubility, stability and metabolism. Additionally, this course will explore methodologies for concentration, extraction, and purification of plant constituents, along with scope and limitations of analytical techniques for the identification and quantification of plant and synthetic cannabinoids, contaminants, and adulterants in cannabis products. (Pre-requisite: MSMC 603 - Basic Cannabinoid Chemistry and Delivery).
MSMC 610	State and Federal Cannabis Laws and Policies	In this course, students will be exposed to the federal controlled substances act and state counterparts. This will include a review of schedules I through V and the rules for prescribing and dispensing C-II though C-V. DEA and state inspections, Prescription Drug Monitoring Programs, and registration with state authorities will also be addressed. The course will then move into treatment of Schedule I substances and the differences between marijuana and other controlled substances. Physician recommendations, as opposed to prescriptions, will be addressed in light of the First Amendment. Medical Board actions against physicians will also be included. Since the Controlled Substances Act prohibits the prescribing and dispensing of Schedule I substances, the course will explore, compare, and contrast state laws and regulations regarding medical cannabis and focus on how marijuana was singled out for exemptions at the state level and why the federal government has refrained from prosecutions in the states that have decriminalized it for medical use. The course will also focus on those states that have decriminalized marijuana for recreational use and the likely consequences, if any, in those states. Other topics include but are not limited to authorized caregivers, licensed dispensaries, involvement of pharmacists and other licensed health care professionals in dispensaries, public testing facilities, regulations, state administration, authorized conditions, patients' requirements and restrictions, advertising, location of dispensaries, caregiver requirements, quantity limits, and other regulations. (Pre-requisite: MSPC 601 - Introduction to Medical Cannabis History, Culture, and Policy)
Required Core Advanced Courses (6 credits) *Students take both courses (2/2)*		
MSMC 611	Research Design and Medical Cannabis	Participants in this course envision and plan a pilot project designed to assess clinical, scientific, economic, or public health outcomes related to medical cannabis. Students will learn how to establish a

Course #	Course Name (all 3 credits)	Course Description
		research question, establishing appropriate methods, and select outcomes to assess. Deliverable will be a proposal that is suitable for submission to an institutional review board. Students will also learn how to critically evaluate medical and scientific evidence.
MSMC 612	Expert Seminars and Case Studies	In this course, students will attend expert seminars and webinars discussing current scientific, clinical, and legal issues related to medical cannabis (must be taken in last semester).

5. **How general education requirements will be met –** Not applicable

6. **Specialized Accreditation**

There are no specialized accreditation or certification requirements for this program.

7. **Contract with another university** – Not applicable

8. **Student Support Services**

The program will make use of established mechanisms in UMB's Graduate School and the School of Pharmacy to provide students with clear, complete, and timely information on the curriculum, course and degree requirements, nature of faculty/student interaction, assumptions about technology competence and skills, technical equipment requirements, learning management systems, availability of academic support services and financial aid resources, and costs and payment policies. For example, course materials will be available through Blackboard, a web-interface with which faculty have many years of experience, including with current programs.

Accepted students will have the background, knowledge, and technical skills needed to undertake a distance education program. Minimally, candidates for admission will possess a baccalaureate degree. Target students include health care professionals, scientists, public policy professionals, current medical cannabis professionals, or those who wish to enter this emerging field.

Advertising & Recruiting

The program will be clearly and accurately described on the School of Pharmacy's website and at recruiting events. Recruitment and admissions materials about the program will represent the program and the services available (e.g., need for students to have access to computer that meets the minimum system requirements, broadband internet access, and a headset microphone for participation in web conference).

H. Adequacy of Articulation – Not applicable

I . Adequacy of Faculty Resources (as outlined in COMAR 13B.02.03.11)

The University of Maryland School of Pharmacy faculty are internationally recognized for their expertise across the entire life cycle of drug development and clinical care. Broad interest areas include medicinal chemistry, pharmaceutics, pharmacology, clinical care, and pharmaceutical outcomes and policy. These faculty, whose discoveries are impacting the lives of patients around the world, routinely present at national and international conferences, and publish in high impact peer reviewed journals. Many of the faculty hold Fellow status in associations such as the American Association of Pharmaceutical Scientists, the American Chemical Society, and the American College of Clinical Pharmacy, and most serve, or have served, as consulting, *associate, or principal editors of leading journals in the field, including Pharmacology & Therapeutics, Journal of Experimental*

Medicine, Clinical Pharmacokinetics, Cancer Chemotherapy and Pharmacology, and many others.

The Department of Pharmaceutical Sciences trains students in the design of new drugs and the study of the biological impact of these drugs in the treatment of diseases and disorders. Further divisions within the department include pharmacology, pharmacodynamics, pharmacokinetics, and pharmacogenomics. Within the Department of Pharmacy Practice and Science, faculty train students to perform a full range of medication decision-making functions to serve as part of the patient's health care team. Faculty in the Department of Health Services Research prepare students to improve health among diverse populations through drug-related research, education, and community outreach. Students enrolled in the proposed program will receive the highest quality education by faculty who are uniquely positioned to teach in this field.

Faculty Members	Course(s) Taught	Full time, part time, adjunct

• **Natalie Eddington, PhD, FAAPS, FCP**
  ○ PhD, Pharmaceutical Sciences
  ○ Dean and Professor of Pharmaceutical Sciences, University of Maryland School of Pharmacy
  ○ Executive Director of University Regional Partnerships, UMB
	MSMC 601	Full time

• **Leah Sera, PharmD, MA, BCPS**
  ○ Doctor of Pharmacy
  ○ **Program Co-Director, Master of Science in Cannabis Science and Therapeutics**
  ○ Assistant Professor, Department of Pharmacy Practice and Science, University of Maryland School of Pharmacy
	MSMC 601
	MSMC 606
	MSMC 612
		Full time

• **Jia Bei Wang, PhD**
  ○ PhD, Pharmacology
  ○ **Program Co-Director, Master of Science in Cannabis Science and Therapeutics**
  ○ Professor of Pharmaceutical Sciences, University of Maryland School of Pharmacy
	MSMC 602
	MSMC 611
		Full time

• **Andrew Coop, PhD**
  ○ PhD, Chemistry
  ○ Professor of Pharmaceutical Sciences and Associate Dean for Academic Affairs
  ○ University of Maryland School of Pharmacy
	MSMC 603	Full time

• **Bethany DiPaula, PharmD**
  ○ Doctor of Pharmacy
  ○ Professor, Department of Pharmacy Practice and Science, University of Maryland School of Pharmacy
	MSMC 607	Full time

• **Jace Jones, PhD**
  ○ PhD, Analytical Chemistry
  ○ Assistant Professor of Pharmaceutical Sciences, University of Maryland School of Pharmacy
	MSMC 609	Full time

• **Maureen Kane, PhD** ○ PhD, Chemistry	MSMC 609	Full time

o Associate Professor of Pharmaceutical Sciences, University of Maryland School of Pharmacy o Director, Mass Spectrometry Center		
• **Ashlei Lowery, MD** o Doctor of Medicine o Medical Director, Palliative Medicine Services, MedStar Medical Center	MSMC 604	Adjunct
• **Mary Lynn McPherson, PharmD, MA, MDE, BCPS** o Doctor of Pharmacy o Professor of Pharmacy Practice and Science, University of Maryland School of Pharmacy o Executive Director, Advanced Post-Graduate Education in Palliative Care o Program Director, Online Master of Science and Graduate Certificate in Palliative Care	MSMC 604	Full time
• **Frank Palumbo, MS, PhD, JD** o PhD, Health Care Administration o Doctor of Jurisprudence o Professor of Pharmaceutical Health Services Research, University of Maryland School of Pharmacy Executive Director, Center on Drugs and Public Policy	MSMC 610	Full time
• **Dayna Qato, PhD, PharmD, MPH** o PhD, Health and Pharmaceutical Services Research o Doctor of Pharmacy o Assistant Professor of Pharmaceutical Health Services Research, University of Maryland School of Pharmacy	MSMC 607	Full time
• **Brian Sanderoff, PD** o Pharmacy Doctor o Clinical Assistant Professor, University of Maryland School of Pharmacy o General Manager, Curio Wellness Dispensary	MSMC 605	Adjunct
• **Yan Shu, PhD** o PhD, Pharmaceutical Sciences and Genomics o Associate Professor of Pharmaceutical Sciences, University of Maryland School of Pharmacy	MSMC 608	Full time
• **James Trovato, PharmD, MBA, BCOP, FASHP** o Doctor of Pharmacy o Associate Professor of Pharmacy Practice and Science, University of Maryland School of Pharmacy	MSMC 605	Full time
• **Hongbing Wang, PhD** o PhD, Toxicology o Professor of Pharmaceutical Science, Program Chair, Experimental and Translational Therapeutics, University of Maryland School of Pharmacy	MSMC 608	Full time

• **Fentian Xue, PhD**
  ○ PhD, Chemistry
  ○ Associate Professor of Pharmaceutical Sciences, University of Maryland School of Pharmacy
	MSMC 603	Full time

On-going Training

Opportunities to improve teaching and learning in the program will be identified through a program assessment process as described in Section M. UMB's instructional design team will provide instructional training resources, support, and consultations to faculty involved with the proposed program.

Faculty teaching in this program will have access to the instructional design team available on campus to incorporate best practices when teaching in the online environment.

J. Adequacy of Library Resources (as outlined in COMAR 13B.02.03.12)

The University of Maryland, Baltimore's Health Sciences and Human Services Library (HS/HSL) is an excellent resource for faculty and students. The library carries a wide range of digital resources including electronic books, journals, and databases that support academic instruction and an extensive collection of online interactive resources designed to enhance information literacy. Regular in-person and online training are available in a variety of library-related topics including, but not limited to database use, citation management, effective written communication, and research data management.

Faculty librarians provide extensive expertise supporting instruction, research, and scholarly communication through embedded instruction and personalized research consultations. The School of Pharmacy is assigned a research education and outreach librarian to support academic and research activities, who will provide support to the MS in Cannabis Science and Therapeutics program. During the program, students will complete a variety of projects and presentations that require the review and interpretation of literature, requiring access to resources and personnel from a distance. The HS/HSL maintains proxy services to provide seamless access to electronic books, online journals, and databases from any location. Online course reserves provide an added mechanism to provide limited access to copyrighted materials licensed for instruction without requiring physical access to materials. To ensure students have the same access to personnel resources during the program, all consultation services are available both on campus and online. The program is to be implemented within existing institutional resources.

The Priddy Library at the Universities at Shady Grove (USG) provides similar workshops, training, and consultation opportunities for students on-campus. Librarians from UMB and USG regularly consult to coordinate resources and access needed to ensure students are fully supported in their academic programs at the Universities at Shady Grove.

K. Adequacy of physical facilities, infrastructure and instructional equipment (as outlined in COMAR 13B.02.03.13)

The physical facilities, infrastructure, and instructional equipment at the school of Pharmacy are adequate to initiate this program, which will leverage existing distance learning instructional technologies to support program management and curriculum delivery. Enterprise technologies supporting student information management (e.g. Ellucian Banner), Blackboard Learning Management System, and web conferencing technologies (e.g. Blackboard Collaborate and Webex) are supported collaboratively with infrastructure support provided by UMB's Center for Information Technology Services (CITS), School of Pharmacy, and Graduate School.

Infrastructure and physical facilities within the School of Pharmacy allow course faculty to create and deliver core curriculum elements from existing offices, classroom, and dedicated studio production space. Faculty and administrative staff computers are configured to conduct web conferences and personal recordings as needed to support the delivery of courses and academic advising. For more advanced audio visual production needs, the School houses a state-of-the-art production studio.

Additional audio visual studio space is available in the Health Science and Human Services Library for faculty and students to produce on-camera presentations. Facilities and services at the Universities at Shady Grove provide similar capabilities offering state-of-the-art classroom and meeting facilities. Faculty offices and meeting space replicate functionality at Baltimore-based facilities.

Technology application support is available through existing helpdesks and instructional design/technology staff during operating hours at UMB and USG. Additional 24/7 support is available for web conferencing technologies through existing agreements with vendors for faculty, staff, and students. Information technology staff on both campuses coordinate regularly to ensure continuity of service and infrastructure support.

L. Adequacy of Financial Resources with Documentation (as outlined in COMAR 13B.02.03.14)

Resources

Program will be implemented within existing institutional resources. New tuition revenues coupled with relocation of existing funds supporting the Doctor of Pharmacy Program will support the new MS in Medical Cannabis Science and Therapeutics Program. Fund balance will be used for one-time costs.

Table 1: Resources and Narrative Rationale

Resource Categories	Year 1	Year 2	Year 3	Year 4	Year 5
1. Reallocated Funds	**$655,814**	**$562,657**	**$436,407**	**$299,407**	**$268,907**
2. Tuition/Fee Revenue					
(c + g below)					
a. Number of F/T Students	25	35	40	48	50
b. Annual Tuition/Fee Rate	$20,250	$20,250	$20,250	$20,250	$20,250
c. Total F/T Revenue (a x b)	**$506,250**	**$708,750**	**$810,000**	**$972,000**	**$1,012,500**
d. Number of P/T Students	1	2	2	3	3
e. Credit Hour Rate	$675.00	$675.00	$675.00	$675.00	$675.00
f. Annual credit hours per P/T student	30	30	30	30	30
g. Total P/T Revenue	**$20,250**	**$40,500**	**$40,500**	**$60,750**	**$60,750**
(d x e x f)					
3. Grants, Contracts & Other	**$0**	**$0**	**$0**	**$0**	**$0**
External Sources					
4. Other Sources	**$0**	**$0**	**$0**	**$0**	**$0**
TOTAL (ADD 1 - 4)	**$1,162,064**	**$1,271,407**	**$1,246,407**	**$1,271,407**	**$1,281,407**

Assumes 80% Resident & 20% Non Resident

Expenditures

The unique nature of the program require 4FTE faculty and support staff. Ongoing expenditures include Library Support (curating references and materials not currently in the library), Instructional Design and Instructional Technology delivery costs, marketing & recruitment (including travel), proctors, guest lecturers and IT/software costs. There will also be a periodic need to utilize external consultants to evaluate and update the curriculum over time.

Table 2: Program Expenditures and Narrative Rationale

Expenditure Categories	Year 1	Year 2	Year 3	Year 4	Year 5
1. Faculty (b +c below)	**$112,370**	**$115,361**	**$118,443**	**$121,617**	**$124,887**
Faculty Program Director	$20,000	$20,000	$20,000	$20,000	$20,000
Instructors	$0	$0	$0	$0	$0
Faculty	$520,000	$551,200	$551,200	$551,200	$551,200
b. Total Faculty Salaries	$540,000	$571,200	$571,200	$571,200	$571,200
c. Total Benefits	$140,940	$149,083	$149,083	$149,083	$149,083
2. Administrative (b + c below)	**$70,000**	**$70,000**	**$70,000**	**$70,000**	**$70,000**
a. # FTE	0.7	0.7	0.7	0.7	0.7
b. Total Salary	$49,000	$49,000	$49,000	$49,000	$49,000
c. Total Benefits	$19,404	$19,404	$19,404	$19,404	$19,404
3. Support Staff (b + c below)	**$70,000**	**$70,000**	**$70,000**	**$70,000**	**$70,000**
a. # FTE	1	1	1	1	1
b. Total Salary	$70,000	$70,000	$70,000	$70,000	$70,000
c. Total Benefits	$27,720	$27,720	$27,720	$27,720	$27,720
4. Equipment	**$0**	**$25,000**	**$0**	**$0**	**$0**
5. Library	**$30,000**	**$30,000**	**$30,000**	**$30,000**	**$30,000**
6. New or Renovated Space	**$0**	**$0**	**$0**	**$0**	**$0**
7. Other Expenses	**$285,000**	**$330,000**	**$330,000**	**$355,000**	**$365,000**
8. Contingency Funding	**$0**	**$0**	**$0**	**$0**	**$0**
TOTAL (ADD 1 - 8)	**$1,162,064**	**$1,271,407**	**$1,246,407**	**$1,271,407**	**$1,281,407**

| | $0 | $0 | $0 | $0 | $0 |

M. Adequacy of Provisions for Evaluation of Program

Extensive curricular mapping has been completed to assure each terminal performance objective in Appendix B is introduced, emphasized, and reinforced through required and elective coursework in . Successful completion of coursework will demonstrate student achievement of terminal performance objectives.

All faculty in this program will successfully complete a training program on effective techniques in online teaching as provided by UMB's Baltimore Graduate School. Best practices will be emphasized with liberal use of examples, how to operationalize these techniques, and how to assess success. Faculty will be instructed on "Standards from the QM [Quality Matters] Higher Education Rubric, Sixth Edition" including the eight standards, which cover 42 elements of assessment for an online course. An Assessment Committee will review each online course annually using this rubric to assure quality. If necessary, a corrective plan will be provided by the Assessment Committee to the Program Director. Faculty will be provided with educational programs to continue their development as online educators.

Student retention for the MS in Cannabis Science and Therapeutics will be tracked. Both student and faculty satisfaction will be assessed after each course.

N. Consistency with the State's Minority Student Achievement Goals (as outlined in COMAR 13B.02.03.05).

The University of Maryland, Baltimore enjoys robust cultural diversity and minority student enrollment in all academic programs. Specifically, in 2015, 43.4% of all master's level candidates were minority students and 42.4% of students enrolled in professional practice doctorate programs were of minority status. Clearly, our university makes students of all cultures feel welcome, and they thrive accordingly. As stated above, per the mission statement, the University of Maryland, Baltimore "explicitly values civility, diversity, collaboration, teamwork, and accountability."

The proposed MS in Cannabis Science and Therapeutics program aims to address both UMB and the state's cultural diversity goals. As an online program, delivery enhances minority student access and success. Distance education uses technology to expand access and promote success for learners from diverse communities, and the flexibility inherent in online instruction meets the diverse needs of learners.

Recruitment for the MS in Cannabis Science and Therapeutics will include advertising and targeted recruitment to top health professional programs for African Americans (http://www.bestcollegesforblacks.com/HEALTHPROFESSIONS.html).

O. Relationship to Low Productivity Programs Identified by the Commission

The proposed MS in Cannabis Science and Therapeutics is not directly related to any identified low productivity program.

P. Adequacy of Distance Education Programs (as outlined in COMAR 13B.02.03.22)

Curriculum and Instruction

The program will be a blended instructional approach through distance education using Blackboard as the learning management system (LMS). Upon admission to the program, all students will be assigned to an academic advisor. All course materials will be posted in the LMS and include pre-recorded lectures, pre-recorded video interviews with experts in the field, readings, discussion boards, and links to interactive computer-based exercises. Students will have the opportunity to participate in live, in-person sessions, as well as web conferencing, and online active-learning instruction both independently and in groups.

Many proposed program faculty have extensive teaching experience in distance education, and continued training and support will be provided to all faculty. The program will employ existing technology to produce and deliver pre-recorded lectures (e.g., recording studio), to conduct web conferences (e.g., Blackboard Collaborate) and to design and deliver active-learning instructional activities. The School of Pharmacy has been using distance education technology to deliver our PharmD program at USG for more than 10 years, and for three highly successful Masters programs for more than seven years.

Terminal performance objectives were developed and the curriculum designed to achieve learning outcomes via distance education modalities. Curricular mapping was structured to ensure that each terminal performance objective is introduced in one of the first four courses. Each terminal performance objective is then emphasized in one or more of the elective courses, and all objectives are reinforced in the final two required courses. The choice of electives and specialized tracks allows for self-determined learning as planned by each participant. The program will combine synchronous and asynchronous online learning, providing students with multiple opportunities for interaction with faculty. We anticipate that this program will attract students from myriad disciplines, and our faculty will also represent multiple areas of expertise in the basic and clinical sciences, policy, and administration.

<u>Faculty Support</u>
All faculty teaching in this program will satisfactorily complete a training program on distance education provided by UMB's Graduate School. Education specialists, instructional system designers, and instructional technologists **(listed below)** through the Graduate School will be working hand-in-hand with faculty to develop learning activities.

Mary Jo Bondy, DHEd, PA-C, Assistant Dean, Academic Programs
Dr. Bondy administratively oversees three academic programs, and the Office for Academic Innovation and Distance Education (AIDE). Dr. Bondy also serves as the UMB representative to the University of Maryland System Academic Transformation Advisory Council. As a practicing clinician and accomplished health educator, Dr. Bondy is passionate about elevating health in underserved populations. Dr. Bondy is a recognized master teacher, education leader, and innovator. She has expertise in online education policy, curricular design, and program assessment.

Kevin Engler, MA, Instructional and Curriculum Designer
Mr. Engler holds a Masters of Arts degree in instructional design. Mr. Engler provides instructional design, audio-visual support, and faculty training in the use of instructional technologies. Mr. Engler is knowledgeable in adult learning theory, distance education pedagogical techniques, course development planning, and process management. Mr. Engler is trained and certified in the Quality Matters methodology and the ADDIE (Analysis, Design, Development, Implementation, Evaluation) approach to course design. He has experience and background in writing instructional objectives that utilize Bloom's Taxonomy.

Erin Hagar, MA/MFA, Instructional and Curriculum Designer
Ms. Hagar taught Spanish at the college level and has worked in instructional and curriculum design for colleges and universities since 2000. She previously worked at Montgomery Community College and Johns Hopkins University, helping faculty incorporate new pedagogical practices and technologies into their face-to-face and online courses. Her areas of expertise include faculty development and training, online course design using the Quality Matters standards, and authentic activities and assessments.

Sharon Gillooly, Senior Media Production Specialist
Ms. Gillooly leads media production for the AIDE team. Her main focus is to produce videos that support academic instruction. After a long career in documentary television, she completed a Master's Certificate in Online Instructional Development from Florida State University where her work focused on instructional design and emerging technologies. Ms. Gillooly is especially interested in the use of media to enhance learning.

George Anagnostou, Senior Instructional Technology Specialist, School of Pharmacy
Mr. Anagnostou supervises educational technology support for faculty and students in the School of Pharmacy, including on-campus, distance, and online programs.

William McLean, Multimedia Manager, School of Pharmacy
Mr. McLean manages the audio visual services group in the School of Pharmacy.

Course development will be accomplished in partnership with a program director, teaching faculty, and the instructional design team, who will ensure course materials follow best practices in online education and adult learning theory. Collectively, they will produce the following materials:

- Course-level outcomes and module level objectives
- Course syllabi and student guides that outline objectives, discussion prompts and learning activities, and resources (articles, websites, online videos)
- Assignments and assessments that measure student performance, and clear instructions for completing them
- Grading rubrics

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Appendix A. Example Plans of Study

Master of Science in Cannabis Science and Therapeutics

Year	Semester	Course Number	Credits	Course name
1	Fall	MSMC 601	3	Introduction to Medical Cannabis History, Culture, and Policy
1	Fall	MSMC 602	3	Principles of Drug Action and Cannabinoid Pharmacology
1	Spring	MSMC 603	3	Basic Cannabinoid Chemistry and Drug Delivery
1	Spring	MSMC 604	3	The Clinical Effects of Medical Cannabis
1	Summer	MSMC 607	3	Negative Physical, Psychiatric, and Social Effects of Cannabis
2	Fall – choose 1	MSMC 605	3	Advanced Cannabis Therapeutics I
		MSMC 608	3	Cannabis Genomics and Pharmacognosy
2	Fall – choose 1	MSMC 606	3	Advanced Cannabis Therapeutics II
		MSMC 609	3	Advanced Cannabinoid Chemistry and Analytic Testing Methodology
2	Spring	MSMC 610	3	State and Federal Cannabis Laws and Policies
2	Spring	MSMC 611	3	Research Design and Medical Cannabis
2	Summer	MSMC 612	3	Expert Seminars and Case Studies

Appendix B. Terminal Performance Objectives and Curricular Map

Course: TPO#	601	602	603	604	605	606	607	608	609	610	611	612			Course: MS MC	
1				I	E	E						R			601	Introduction to Medical Cannabis History, Culture, and Policy
2		I	I		E	E						R			602	Principles of Drug Action and Cannabinoid Pharmacology
3				I	E	E	E					R			603	Basic Cannabinoid Chemistry and Drug Delivery
4		I	I					E	E			R			604	The Clinical Effects of Medical Cannabis
5		I						E				R			605	Advanced Cannabis Therapeutics I
6				I			E					R			606	Advanced Cannabis Therapeutics II
7	I									E		R			607	Negative Physical and Psychiatric Effects of Cannabis
8	I									E		R			608	Cannabis Plant Genomics and Pharmacognosy
9	I	I	I	I	E	E	E	E	E	E	E	R			609	Advanced Cannabinoid Chemistry and Analytic Testing Methodology
10	I										E	R			610	State and Federal Cannabis Laws and Policies
															611	Research Design and Medical Cannabis
		I = introduced; E = emphasized; R = reinforced													612	Expert Seminars and Case Studies

TPOs:

1. Apply knowledge of pharmacology, pathophysiology, clinical assessment, and traditional management strategies of pain and other physical symptoms to identify appropriate candidates for medical cannabis therapy.

2. Apply concepts of pharmacology, pharmacognosy, biopharmaceutics, and pharmacokinetics to determine appropriate cannabis dosing, dosage forms and routes of administration for optimal treatment.

3. Develop monitoring plans to determine effectiveness of medical cannabis therapy and to detect adverse effects of medical cannabis use.

4. Apply concepts of analytical chemistry, pharmacology, pharmacognosy, and pharmaceutics to assure safe and effective design, development, and manufacture of medical cannabis products.

5. Apply knowledge of analytical toxicology methods to identify, quantify, and interpret results related to cannabinoid use and misuse.

6. Describe negative physical, psychiatric, and psychosocial effects of cannabis in individuals and populations.

7. Participate in health policy decision-making processes by evaluating primary literature to assist policy makers and prescribers in making well-informed decisions about medical cannabis therapy.

8. Apply knowledge of historical and current policy and cultural perspectives to identify, analyze, and advocate for emerging issues related to medical cannabis and health.

9. Identify areas for future research related to science, health effects, and policy of medical cannabis, and describe the challenges associated with such research.

10. Demonstrate a commitment to excellence through continuing professional development and the education and training of patients, healthcare professionals, regulatory bodies, and other relevant stakeholders.