

**CWRU Action Form for Majors/Minors/Programs/Sequences/Degrees**  
(instructions on back)

Docket # \_\_\_\_\_

College/School: College of Arts and Sciences

Department: None. The major will be administered by the Institute for the Science of Origins

PROPOSED: ☒ major  
☐ minor  
☐ program  
☐ sequence  
☐ degree

TITLE: Bachelor of Arts in Origins Sciences (aka BA with Origins Major)

EFFECTIVE: fall (semester) 2015 (year)

**DESCRIPTION:**

**Requirements**

Origins sciences seek to increase human understanding of the origin and evolution of complex systems, from the creation of the universe itself to the evolution of life in all its variety, to the emergence of the many components of human culture; from the most distant past, to the present and into the future. The Origins Major seeks to introduce the student to the wide range of underpinning sciences and then enable him/her to delve more deeply into at least one aspect of origins, whether physical, biological or cultural.

The major therefore consists of 3 components in addition to the Arts and Sciences General Education Requirements -- the Science core, the Origins core, and the Origins Focus. For the focus, the student must complete a total of at least three 300-level courses (and their pre/co-requisites) drawn from at least 2 broad areas of concentration: Cosmology and Astrophysics, Planetary Science & Astrobiology, and Integrative Evolutionary Biology. (More details are provided below.) Students will develop an educational plan in consultation with their major advisors as sophomores and submit that plan for approval by the Origins Major supervisory committee.

Of the 120 credits needed for graduation with a BA in Origins, 43-49 are SAGES Requirements of the CAS, 39 are additional major requirements -- 15 in the Science Core, 15 in the Origins Core, at least 9 in the Origins Focus, although the latter often have pre-requisites. Sample educational plans (attached) suggest that that would add 0-9 "required" credits. The balance of the 120 are then open electives. Majoring in Origins would give the student added value in applying to medical school or to science-related MBA & JD programs, or in pursuing a career in science writing. Significant overlap exists with majors in origins-related sciences, making it straightforward for students to consider a second major in one of those sciences or to otherwise prepare themselves for disciplinary graduate programs in Anthropology, Astronomy, Biology, Chemistry, Cognitive Science, Geosciences, Applied Mathematics, Paleontology and Physics, among others. The required credit hours are similar to those in other natural and mathematical sciences, so the possibilities of completing minors or second majors in arts, humanities and social sciences are similar, and are facilitated by the fact that the proposal is for a BA.

**SAGES Requirements of the College of Arts and Sciences (43-49) (summary)**

- First Seminar (4)
- Two University Seminars (6)
- Writing Portfolio
- Departmental Seminar (3) (students not completing another major are strongly encouraged to complete a DS in a department associated with their areas of Origins concentration)
- Senior Capstone (6) (students not completing another major are strongly encouraged to complete a SC in a department associated with their areas of Origins concentration)
- Two 3- or 4-semester hour Arts and Humanities courses (6-8)
- Two 3- or 4-semester hour Natural and Mathematical Science courses (6-8 -- fulfilled by required courses of the major)
- Two 3-semester hour Social Science courses (6 -- can be fulfilled by elective courses of the major)
- One 3- or 4-semester hour Quantitative Reasoning course (3-4 -- fulfilled by required courses of the major)
- At least one 3- or 4-semester hour course identified as a global and cultural diversity course (3-4)

**General Degree Requirements (0)**

Two semesters of physical education

**Science Core (29, of which 14 overlap CAS SAGES Requirements, and 15 are additional)**

- MATH 121 & 122, or 125 and 126 -- 2 courses --8 credits (MATH 121 fulfills Quantitative Reasoning requirement)
- PHYS 115, 121 or 123 and 116, 122 or 124 -- 8 credits (fulfill Natural and Mathematical Sciences requirement)
- CHEM 105 & 106, 2 courses --6 credits (fulfill Natural and Mathematical Sciences requirement)
- BIOL 214 & 225, 2 courses --7 credits (fulfill Natural and Mathematical Sciences requirement)

**APPROVED**

*Arts Executive Committee 3-20-15  
Faculty of the College 3-27-2015  
Dean of the College 3-27-2015*



### Origins Core (15)

- Optional: ORIG 101 = 1 credit
- ORIG 201 & 202, 2 courses -- 6 credits
- MATH/ORIG 301 Modeling -- 3 credits
- ORIG 351--3 credits taken twice = 6 credits

At the discretion of the Origins committee, 3 credits of ORIG 360 or 370 may be substituted for 3 credits of ORIG 351

### Origins Focus (9 credits plus pre-requisites)

Each student, in collaboration with his/her major adviser, will design a course of study that integrates a wide spectrum of Origins fields, including at least two of the following three broad categories:

- Cosmology and astrophysics
- Integrative evolutionary biology (including biochemistry, physical anthropology, paleontology, and evolutionary cognitive science)
- Planetary science & Astrobiology

This course of study should include at least three advanced non-ORIG classes and their prerequisites. These will normally be 300-level or above courses, however the Origins Major Committee will consider inclusion of appropriate 200 level courses, subject to the approval of the originating department. The Committee will also consider inclusion of ORIG-351 or ORIG 360 if a compelling case is made that no existing non-ORIG course will meet an important set of educational goals.

The proposed curriculum, presented as a comprehensive educational plan, must be submitted to the Origins Major committee for approval by the conclusion of the spring semester of the sophomore year. Subsequent revisions to the plan are encouraged, but must be submitted for approval by the committee at least two weeks before the beginning of the semester preceding the one in which the revisions have effect.

**Students are strongly encouraged to include an Origins research experience in their educational plans.**

Credit hours required by major:  $(28-37) + 29 + 15 + 9 + (0-9) = 81-99$

Additional credit hours of open electives required for graduation -- 39-21

Total Required Credit Hours: at least 120

### ORIG Courses (Course action forms submitted separately)

- ORIG 101 Origins Prologue: Life, the Universe and Everything. A one-credit course that introduces students to the research interests of Origins faculty, and thereby to some of the possibilities for student research or focused study. Taught every spring and fall semester. **This is a new course.**
- ORIG 201: Origins I. From the Beginning. A three credit quantitative introduction to cosmology, astrophysics, planetary science and geology. Taught every spring semester. **This course is cross-listed with EEPS101. ORIG201 students will undertake enhanced assignments including greater quantitative components.**
- ORIG 202: Origins II. Life in all its diversity. A three credit quantitative introduction to evolutionary biology, paleontology, physical anthropology and cognitive science. Includes several weeks taught at the CMNH. Taught every fall semester. **This is a new course.**
- ORIG 301/MATH??? Mathematical Modeling Across the Sciences: A three credit course on mathematical modeling, cross-listed with MAMS. Taught annually. **This is a new course.**
- ORIG 351: Topics in Origins. A three-credit special topics course in an Origins discipline. On mutual approval by the Faculty Steering Committee of the Origins Major and the relevant department, can be cross-listed with a departmental course. Such approval will imply that the department is prepared to waive any associated pre-requisites that are not required Origins Major classes. Taught at least once per academic year. Could be taught by a CAS faculty member, a SOM faculty member, or a CMNH curator. **This is a new course.**
- ORIG 360: Independent Study in Origins. A 1-3 credit offering available on an *ad hoc* basis to students wishing to pursue in depth study in an appropriate origins topic who can identify an appropriate Origins faculty member to supervise the activity on a *pro bono* basis. **This is a new course.**
- ORIG 370: Research in Origins. A 1-6 credit offering available on an *ad hoc* basis to students wishing to pursue independent research in an origins topic who can identify an appropriate Origins faculty member to supervise the activity on a *pro bono* basis. **This is a new course.**



## Justification

The Origins major is designed to attract and serve students looking for a broader, more integrative scientific education, one less exclusively focused on a particular discipline than our traditional majors, or even on a particular pairwise disciplinary boundary than some of our cross-disciplinary majors. A description that has resonated with some, is that we are creating “liberal sciences” degree, that parallels the traditional “liberal arts” degree in its flexibility, and shares the outlook that it is not necessary “pre” anything, but rather that it is an invaluable diverse education. It is notable that just as the value of a liberal arts degree is being questioned in this country, China is vigorously seeking to emulate it. A “liberal sciences” degree suggests a greater emphasis on scientific and mathematical thinking than a conventional liberal arts degree, but without the same disciplinary concentration as a traditional major, or, as we think of it, possessing a greater flexibility for the student to link areas of concentration.

Despite not being exclusively “pre-anything” in particular, the expected set of interested students will include those with specific professional objectives, certainly (and designedly) including medical school, but also encompassing management (especially science and technology based management and entrepreneurship), law (especially environmental and intellectual-property law), and journalism (especially science journalism). For each of these, securing a wide scientific knowledge base—both wider and deeper than our general education requirements demand—is valuable preparation. However, we believe that the audience for this major will also include not just those who are intentionally pre-professional, but also those who are just broadly curious.

One could argue, and we do, that this broader knowledge base will also prove valuable for a career in scientific research in an environment where interdisciplinary and multidisciplinary thinking is often valuable and even essential. We expect that students recognize this even more than do faculty, and that they will see connections that are not obvious to us from the outset. For this reason the requirements for the major allow for considerable flexibility, exercised within the context of faculty oversight of an educational plan. Nevertheless, the requirements insist on the need to gain expertise, if not the usual disciplinary mastery, in at least two separate thematic areas. Recognizing that this target audience will also include those whose intentions evolve toward the pursuit of graduate work, almost by necessity rooted in a traditional disciplinary major, the Origins major is designed to be compatible with BA programs in the related scientific disciplines, and we include in our submission educational plans that demonstrate that compatibility. At the same time, as a BA program it can readily be paired with arts, humanities, and social science majors.

## The value to CWRU of this target audience

In an era in which CWRU is no longer seeking to matriculate more students, the business argument for a new major cannot simply be that it will attract more applicants. A new major must allow us to attract more *desirable* students that we couldn’t otherwise, to attract desirable students at a lower discount rate, and/or to continue to attract desirable students in the face of increasing competition.

One such specific opportunity identified above pertains to pre-medical students. Our current pre-med offerings are excellent but standard, and thus hard to differentiate from similar offerings at other research universities. As training for medical school, a broader scientific education might well be of greater value for many future doctors than the level of specialization inherent in standard biology, (bio)chemistry or biomedical engineering majors. The Origins Major gives pre-meds greater flexibility to avoid the usual pre-med tracks if they prefer. As described by the CWRU VP for Enrollment, the proposed program promises to provide CWRU with something distinctive to offer in this very competitive segment of the market.

The Origins Science major is also an opportunity within the natural sciences to make more concrete our frequent ambition and oft-stated claim to make tangible and compelling connections for our students with other University Circle institutions. The Cleveland Museum of Natural History will be an active partner in the Origins Science major. CMNH curators will teach in the major on a regular basis. Significant segments of Origins courses will be taught at the CMNH. Research opportunities will be identified for Origins majors working with CMNH curators, both in the laboratory and in the field. Again, the VP for Enrollment expects this real connection to the CMNH to be an attractive point of distinction for the most competitive slice of the undergraduate market.

## Metrics and Goals

We suggest the following metrics and associated goals by which the major be evaluated over a pilot period of approximately 5 years:

1. Enrollment
  - Year V Goal: The Origins major will enroll no less than 10 majors per year.
2. Attractiveness
  - Year V Goal: At least 30 early action applicants per year will indicate interest in the Origins major.
  - Year V Goal: The majors will include at least 10 per year who indicated interest in the major as matriculants, and:
    - i. have higher total SAT (or equivalent) scores than the average for the 2014 incoming class; and/or
    - ii. have a lower discount rate than the average for the 2014 incoming class; and/or
    - iii. are members of under-represented minorities or low-income groups.
3. Retention
  - Year V Goal: the four year graduation rate for Origins majors who indicated interest in the major as applicants, will not be less than that for other STEM majors.
4. Satisfaction
  - Year V Goal: the satisfaction rate for Origins majors who indicated interest in the major as applicants, will not be less than that for other STEM majors.

Is this major/minor/program/sequence/degree: ☒ new  
☐ modification  
☐ replacement

If modification or replacement please elaborate: \_\_\_\_\_

Does this change in major/minor/program/sequence/degree involve other departments? ☐ Yes ☐ No

If yes, which departments? \_\_\_\_\_

Contact person/committee: Glenn Starkman

SIGNATURES: Michael Weiss Digitally signed by Michael Weiss  
DN: cn=Michael Weiss, o=Case Western Reserve University, ou=College of Arts and Sciences, email=michael.weiss@case.edu, c=US  
Date: 2014.10.15 20:38:17 -04'00' DATE

ISO Major Committee Chair: \_\_\_\_\_

ISO Director:  10/6/2014

Biology Department Chair: Christopher Cullis 10/8/2-14

Chemistry Department Chair: Mary Barkley Digitally signed by Mary Barkley  
DN: cn=Mary Barkley, o=Case Western Reserve University, ou=College of Arts and Sciences, email=mbarkley@case.edu, c=US  
Date: 2014.10.09 17:51:49 -04'00'

Mathematics, Applied Mathematics and Statistics Department Chair: David A Singer Digitally signed by David A Singer  
DN: cn=David A Singer, o=Case Western Reserve University, ou=Department of Mathematics, email=david.singer@case.edu, c=US  
Date: 2014.10.09 22:16:45 -04'00'

Physics Department Chair: Kathleen Kash Digitally signed by Kathleen Kash  
DN: cn=Kathleen Kash, o=Case Western Reserve University, ou=Department of Physics, email=kathleen.kash@case.edu, c=US  
Date: 2014.10.10 07:30:45 -04'00'

Anthropology Department Chair:  10/16/14

Astronomy Department Chair: Chris Mihos Digitally signed by Chris Mihos  
DN: cn=Chris Mihos, o=Case Western Reserve University, ou=Department of Astronomy, email=mihos@cme.edu, c=US  
Date: 2014.10.13 08:43:51 -04'00'

Biochemistry Department Chair: Michael Weiss Digitally signed by Michael Weiss  
DN: cn=Michael Weiss, o=Case Western Reserve University, ou=College of Arts and Sciences, email=michael.weiss@case.edu, c=US  
Date: 2014.10.13 20:37:36 -04'00'

Cognitive Science Department Chair:  2014.10.13 08:54:30 -04'00'  
11.0.9

Earth, Environmental, and Planetary Sciences Department Chair: James A. Van Orman Digitally signed by James A. Van Orman  
DN: cn=James A. Van Orman, o=Case Western Reserve University, ou=Department of Earth, Environmental and Planetary Sciences, email=james.vanorman@case.edu, c=US  
Date: 2014.10.14 11:16:11 -04'00'

College/School Curriculum Committee Chair: V. Hayward/cas 3-27-2015

College/School Dean(s):  March 27, 2015

FSCUE Curriculum Committee Chair: \_\_\_\_\_

File copy sent to: ☐ Registrar ☐ Office of Undergraduate Studies/Graduate Studies  
☐ Other: \_\_\_\_\_





CASE WESTERN RESERVE  
UNIVERSITY EST. 1826

Richard W. Bischoff  
Vice President for Enrollment  
Enrollment Management  
10900 Euclid Avenue  
Cleveland, Ohio 44106-7055  
Visitors and Deliveries  
11318 Bellflower Road  
Office 216.368.5445  
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richard.bischoff@case.edu  
admission.case.edu

Updated September 10, 2014

### Letter in support of the proposed Bachelor of Arts in Origins Sciences

I am writing to enthusiastically support the addition of a major in Origins Sciences. The proposed major supports multiple enrollment goals for the university.

- Origins Sciences supports a broad message about the different ways in which Case Western Reserve University can prepare students for medical school and its interdisciplinary nature aligns with the forthcoming changes to the MCAT. Case Western Reserve is perceived to be good at preparing students for medical school. For us to be able to maintain this reputation, we must enhance the narrative. Origins Sciences gives us a way of doing this. The fact is that our narrative right now isn't that different from other institutions. We must enhance this narrative simply to maintain our current position.
- Employment after graduation is a top concern of parents and students. Origins Sciences provides a terrific example of how a student can translate broad intellectual interests into less common graduate school and career interests; science-related MBA or JD programs, careers in science writing or careers in consulting (especially for science and engineering based companies) amongst others. A program such as Origins Sciences supports the argument that CWRU is unusually good at preparing students for graduate or professional school as well as careers.
- Origins Sciences highlights our location in University Circle and partnerships with neighboring institutions, providing an additional example of how we leverage unique resources, in this case the Cleveland Museum of Natural History, to support undergraduate education. This is a very appealing differentiator for students and parents.

Because of how major data is reported, it is very hard to gauge the actual number of interdisciplinary science major degrees that are being earned at other institutions. However, a quick search of "'interdisciplinary science' major" shows an abundance of universities with such majors. If you look at AAU private institutions that report a large number of interdisciplinary graduates, you see what appear to be rather substantial interdisciplinary science programs at the undergraduate level.



Medicine Health and Society at Vanderbilt or Philosophy-Neuroscience-Psychology at Wash U are examples.

My expectation is that origins sciences would behave very much like anthropology or cognitive science. We will recruit several high ability students who know what it is, but more will be attracted by the narrative and discover it while they are here. The fact is few high school students will have had the exposure to understand what origin sciences is coming out of high school.

From an enrollment perspective, support for Origins Sciences is about increasing our ability to compete for more of the students we want most to enroll. The major will appeal to high ability students with broad intellectual interests. Even amongst our pre-med students it will make us more appealing to the more broadly intellectual potential medical student. It gives students a reason to choose CWRU over other universities that on the whole may be more highly ranked or more expensive for their families.

Please feel free to contact me at 216.368.0978 or [richard.bischoff@case.edu](mailto:richard.bischoff@case.edu) if I can provide further support.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Richard W. Bischoff', followed by two vertical lines.

Richard W. Bischoff



From: **Christopher Cullis** <[cac5@case.edu](mailto:cac5@case.edu)>  
Date: Fri, Oct 17, 2014 at 3:39 PM  
Subject: Re: Origins Major proposal signature form  
To: Glenn Starkman <[glenn.starkman@case.edu](mailto:glenn.starkman@case.edu)>

Dear Glenn,

"I acknowledge that by signing the proposal for a BA with a major in Origins Sciences I am stating that the Department of Biology will identify the appropriate instructors/advisors for the teaching/advising roles discussed in the proposal.

**Christopher Cullis**  
Francis Hobart Herrick Professor and Chair of Biology  
Case Western Reserve University  
10900 Euclid Avenue  
Cleveland, Ohio 44106-7080  
Phone: 1 216 368 3557  
Fax: 1 216 3689 4672  
e-mail: [cac5@case.edu](mailto:cac5@case.edu)



----- Forwarded message -----

From: **Kathleen Kash** <[kxk43@case.edu](mailto:kxk43@case.edu)>

Date: Fri, Oct 17, 2014 at 2:14 PM

Subject: Re: Origins Major proposal signature form

To: Glenn Starkman <[glenn.starkman@case.edu](mailto:glenn.starkman@case.edu)>

Dear Glenn,

I acknowledge that by signing the proposal for a BA with a major in Origins Sciences I am stating that the Department of Physics will identify the appropriate instructors/advisors for the teaching/advising roles discussed in the proposal.

Yours truly,

Kathy



----- Forwarded message -----

From: **James Van Orman** <[jav12@case.edu](mailto:jav12@case.edu)>

Date: Friday, October 17, 2014

Subject: Origins Major proposal signature form

To: Glenn Starkman <[glenn.starkman@case.edu](mailto:glenn.starkman@case.edu)>

Dear Glenn:

I acknowledge that by signing the proposal for a BA with a major in Origins Sciences I am stating that the Department of Earth, Environmental and Planetary Sciences will identify the appropriate instructors/advisors for the teaching/advising roles discussed in the proposal.

Best,  
Jim

--

Sent from Gmail Mobile

10/17/2014

Case Western Reserve University Mail - Origins



Glenn Starkman <gds6@case.edu>

## Origins

1 message

**Michael Weiss** <Michael.Weiss@case.edu>

To: Glenn Starkman <glenn.starkman@case.edu>

Thu, Oct 16, 2014 at 2:34 PM

Dear Glenn,

I acknowledge that by signing the proposal for a BA with a major in Origins Sciences I am stating that the Department of Biochemistry will identify the appropriate instructors/advisors for the teaching/advising roles as discussed in the proposal.

With warm regards,

Mike

Michael A. Weiss, M.D., Ph.D.  
Cowan-Blum Professor and Chair  
Department of Biochemistry



10/17/2014

Case Western Reserve University Mail - acknowledgement



Glenn Starkman <gds6@case.edu>

## acknowledgement

1 message

**David Singer** <david.singer@case.edu>  
To: Glenn Starkman <gds6@case.edu>

Thu, Oct 16, 2014 at 3:42 PM

Glenn,

I acknowledge that by signing the proposal for a BA with a major in Origins Sciences I am stating that the Department of Mathematics, Applied Mathematics and Statistics will identify the appropriate instructors/advisors for the teaching/advising roles discussed in the proposal.

David Singer

Professor and Acting Chair  
Department of Mathematics, Applied  
Mathematics, and Statistics  
Case Western Reserve University  
Cleveland, OH 44106-7058  
(216) 368-2892



Glenn Starkman &lt;gds6@case.edu&gt;

**Origins Major Proposal**

1 message

**Todd Oakley** <todd.oakley@case.edu>

To: Glenn Starkman &lt;glenn.starkman@case.edu&gt;

Thu, Oct 16, 2014 at 2:39 PM

Dear Glenn,

I acknowledge that by signing the proposal for a BA with a major in Origins Sciences I am stating that the Department of Cognitive Science will identify the appropriate instructors/advisors for the teaching/advising roles discussed in the proposal.

More specifically, I wish to emphasize that COGS 201, Human Cognition from an Evolutionary and Developmental Perspective, is a foundation course in the department as well as, under the present proposal, an elective for the Origins Major. The course is taught every Fall term. The course has been taught for the past three years by Professor Vera Tobin, but has also been taught in the past by Professor Mark Turner, and will likely be taught in the future by Professor Todd Oakley. Thus, there are at present at least 3 faculty who could serve as advisors.

Sincerely,

Todd Oakley  
Professor & Chair of Cognitive Science  
President, [International Association for Cognitive Semiotics](#)

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10/17/2014

Case Western Reserve University Mail - Re: Origins



Glenn Starkman <gds6@case.edu>

## Re: Origins

Chris Mihos <mihos@case.edu>

To: Glenn Starkman <glenn.starkman@case.edu>

Thu, Oct 16, 2014 at 9:26 PM

Hmm not sure what happened then. Here it is again.

On Oct 13, 2014 9:00 AM, "Chris Mihos" <mihos@case.edu> wrote:

Hi Glenn,

I've signed off on the Origins major. This note also confirms our plans for staffing Origins-related courses.

As you and I discussed, given the teaching capacity in Astronomy, it is unlikely we will be able to offer "new" Origins courses any time soon, but we would certainly welcome Origins majors into our ASTR 221/222 courses (and subsequent 300-level courses). We anticipate ASTR 222 would be one of the "appropriate 200 level courses" that would count as 300-level Origins Focus course for students doing the cosmology and astrophysics track. Since these courses are required for our Astronomy majors and minors, we offer them every year, so they will always be available on the schedule. We are also happy to contribute to advising for Origins majors who are doing the cosmology and astrophysics track and have identified a faculty mentor in astronomy.

Chris

Chris Mihos  
Professor and Chair of Astronomy  
Case Western Reserve University



Glenn Starkman <gds6@case.edu>

## Origins Major

1 message

**Lawrence Greksa** <lp92@case.edu>

To: Glenn Starkman <glenn.starkman@case.edu>

Thu, Oct 16, 2014 at 3:39 PM

Committees Evaluating the Proposed Origins Major:

The Origins major includes no required Anthropology courses. Nevertheless some Anthropology courses are likely to be of interest to Origins majors. Some of these are taught by regular faculty and are offered regularly, others are taught by adjunct faculty and have a history of being taught regularly. The department anticipates this to continue, especially to the extent that Origins majors increase demand for Anthropology courses. The department also anticipates that appropriate members of the department will agree to serve as advisors of Origins majors seeking to develop an Anthropology-related focus.

Lawrence P. Greksa  
Professor and Chair  
Department of Anthropology  
236 Mather Memorial  
Case Western Reserve University  
Cleveland, OH 44106  
PH: 216-368-6777  
FAX: 216-368-5334



10/17/2014

Case Western Reserve University Mail - Origins Major



Glenn Starkman <gds6@case.edu>

## Origins Major

1 message

Mary D. Barkley <mdb4@case.edu>

To: gds6@case.edu

Thu, Oct 16, 2014 at 3:11 PM

I acknowledge that by signing the proposal for a BA with a major in Origins Sciences I am stating that the Department of chemistry will identify the appropriate instructors/advisors for the teaching/advising roles discussed in the proposal.

Mary D. Barkley  
M. Roger Clapp University Professor of Arts & Sciences  
Chair, Department of Chemistry  
Case Western Reserve University  
10900 Euclid Avenue  
Cleveland, OH 44106-7078  
(216) 368-0602  
(216) 368-0604 fax  
(216) 409-8839 cell  
(216) 397-3349 home

**Proposal for a Bachelor of Arts in Origins Sciences ("Origins Major")**  
**Sponsoring unit: the Institute for the Science of Origins**

**1. How is the proposed program important to the sponsoring department/interdisciplinary program?**

- a. Discuss the relationship between the proposed new program and current programs (graduate and/or undergraduate), including its impact with respect to allocation of resources.**

The Institute for the Science of Origins is the principal outgrowth of the Origins Alliance. It includes as institutional partners CWRU, the Cleveland Museum of Natural History and *ideastream* (<http://www.ideastream.org>). At CWRU the ISO involves tens of faculty from a broad range of disciplines in the CAS, the SOM, the SODM, and WSOM.

The ISO does not currently administer any other degree-granting programs. (The Evolutionary Biology Major is closely affiliated with the ISO, and directed by Patricia Princehouse, Outreach Director and a Fellow of the ISO, but predates the ISO and is independent.) There are plans afoot in the context of a developing proposal for a Center for Evolution and Human Health for a graduate program (initially at the Master's level), and there continue to be discussion about potential PhD programs through this possible Center, or through the ISO, or through ISO-related departments, but none of these potential initiatives are at the same stage of maturity as this proposal.

The ISO views the Origins Science Bachelor of Arts major as a central future activity, and has since its inception. One of the ISO's three Goals is to "**Educate the discoverers and disseminators of tomorrow,**" and the first of two sub-goals is to "create and implement an undergraduate major in Origins that utilizes the resources of the partner institutions and their departments." (See <http://www.case.edu/origins/about/goals.html>.) The ISO has resisted realizing this goal until it felt the time was right, i.e., when the ISO would be on sufficiently firm footing that it was responsible to create an undergraduate major.

Creating an undergraduate major in Origins Sciences achieves many purposes. As discussed in turn below, these include creating a distinctive undergraduate major that will be attractive to a desirable student demographic (as elaborated below), contributing to CWRU's national and international reputation, fostering collaboration among disciplines, and increasing collaboration with partner cultural and research institutions in University Circle. As an interdisciplinary and multi-institutional partnership, advancing such "external" goals are of inherent importance to the ISO. However, we would additionally emphasize ways in which the major is specifically important to the ISO: we expect that "running" this inter/multidisciplinary major will increase ties among the ISO



scientists themselves, fostering collaborations, leading to new grant applications, and in so doing enhance the reputation of CWRU as a national/international research university. We anticipate that the students will help drive such new collaborations and expect that the alumni of the program will make positive contributions to the ISO, including philanthropic ones. We foresee that future Origins alumni/ae will also provide a valuable national/international academic network as long-term members of the ISO community.

**2. What is the perceived need or market for the program? Please provide supporting documentation.**

The Origins major is designed to attract and serve students looking for a broader and more integrative scientific education, one less exclusively focused on a particular discipline than our traditional majors, or even on a particular pairwise disciplinary boundary than some of our cross-disciplinary majors. A description that has resonated with some is that we are creating a “liberal sciences” degree, which parallels the traditional “liberal arts” degree in its flexibility, and shares an outlook that it is not necessary “pre” anything, but rather which is an invaluable diverse education in its own right. It is notable that just as the value of a liberal arts degree is being questioned in this country, China is vigorously seeking to emulate it. A “liberal sciences” degree suggests a greater emphasis on scientific and mathematical thinking than a conventional liberal arts degree, but without as strong a link to one of the traditional disciplines as our traditional disciplinary majors, or, as we think of it, possessing a greater flexibility for the student to link areas of concentration.

Like many majors, despite not being exclusively “pre-anything” in particular, the expected set of interested students will include those with specific professional objectives, certainly (and designedly) including medical school, but also encompassing management (especially science- and technology-based management and entrepreneurship), law (especially environmental and intellectual-property law), journalism (especially science journalism). For each of these career trajectories, a wide scientific knowledge base — both wider and deeper than our general education requirements demand — will prove valuable preparation. We have met with the appropriate pre-professional advisers (Steve Scherger and Terri Mester) to ensure that the pathway through the major to the relevant post-graduate work is transparent and can be followed straightforwardly. We have included in our submission two pre-med educational plans for illustrative purposes, since that is by far the most constrained (and popular) of the pre-professional programs.

We emphasize our expectation that the audience for this major will include not just those students who are intentionally pre-professional, but also those who are just broadly curious. This will include those who enter CWRU intending one major, and discover the wider world of intellectual opportunities once they are here.

One could argue, and we do, that this broader knowledge base will also prove valuable for a career in scientific research in an environment where interdisciplinary and multidisciplinary thinking is often valuable and even essential. We anticipate that students recognize this even more than do our faculty, and that they will see connections that are not obvious to us from the outset. For this reason the requirements for the major will allow considerable flexibility, exercised within the context of faculty oversight of an educational plan. Nevertheless, the requirements insist on the need to gain more specific expertise through the Origins Focus. Recognizing that the target audience will also include those whose intentions evolve toward the pursuit of graduate work, almost by necessity rooted in a traditional discipline, the Origins major is designed to be compatible with BA programs in related scientific disciplines. At the same time, as a BA program with requirements comparable to other natural and mathematical science majors, an Origins course of study can be paired with arts, humanities, and social science majors.

Interdisciplinary majors exist at many institutions (see table below of sample 2012 majors with associated enrollments). It is hard to determine the appropriate comparison group, or to obtain accurate numbers for the number of majors. Some, such as the Biological Basis of Behavior major at Penn are longstanding (since 1978) and important presences on campus. Others no doubt languish. The sole other broad undergraduate Origins major – at McMaster University in Hamilton, Ontario, Canada – has graduated 35 majors in seven years, but is a secondary “research specialization” at a large second-tier foreign public university. The available incomplete un-normalized heterogeneous numerical data necessarily lacks any context. We can offer the following anecdotal data – each of the undergraduates to whom we have mentioned the major has responded with unsolicited reactions ranging from interest to excitement. The sample size is small – less than a dozen. The methodology for selection is unscientific – random undergraduates with whom we have happened to be thrown together, currently in a variety of science majors. An event in late October for undergraduates organized by the ISO may or may not be a better gauge of interest, but only among current undergraduates.



	(Majors( Biological( and( General( Interdisc	(Majors( Systems( Science( and( Theory((	(Majors( Mathematics( and( Computer( Science((	(Majors( Biology( hology((	(Majors( Gerontology( logy((	(Majors( Science( Society((	(Majors( Accounting( and( Computer( Natural( Sciences((	(Majors( Natural( Sciences((
Institution								
Brandeis	0	0	0	0	0	0	0	0
Brown	5	0	0	0	0	0	4	0
Caltech	0	0	0	0	0	0	0	0
CMU	0	0	79	0	23	0	0	0
Columbia	0	0	0	4	0	0	0	0
Cornell	0	0	0	0	0	0	8	0
Duke	0	0	0	0	0	0	0	0
Emory	0	0	0	2	0	0	0	0
Harvard	0	0	0	0	0	0	0	0
Johns(Hopkins	0	0	0	0	0	0	0	16
MIT	0	0	0	26	0	0	0	0
NYU	0	0	0	0	0	0	0	0
Northwestern	0	23	0	0	0	0	7	0
Princeton	0	0	0	0	0	0	0	0
Rice	0	0	0	0	0	0	0	0
Stanford	0	0	0	0	0	0	53	0
Syracuse	1	0	0	0	0	0	0	0
Tulane	0	0	0	0	0	0	0	0
Chicago	0	0	0	0	0	0	0	0
Penn	0	0	0	0	0	0	0	0
Rochester	0	0	0	0	0	0	0	0
USC	0	0	0	0	0	9	0	0
Vanderbilt	0	0	0	0	0	0	3	0
Wash(U	0	0	0	0	0	0	0	0
Yale	0	0	0	1	0	0	0	0
	6	23	79	33	23	9	75	0

Institution	(Majors( Nutrition( Sciences((	(Majors( Cognitive( Science((	(Majors( Human( Biology((	(Majors( Computational( Science((	(Majors( Human( Interaction( on((	(Majors( Marine( Sciences((	(Majors( Sustainability( ability( Studies((	(Majors( Multi/Int( erdiscipli( Other((
Brandeis	0	0	0	0	0	0	0	3
Brown	0	8	90	0	0	0	0	0
Caltech	0	0	0	0	0	0	0	1
CMU	0	4	0	0	0	0	0	0
Columbia	0	0	0	0	0	0	0	0
Cornell	46	0	0	0	0	0	52	0
Duke	0	0	0	0	0	0	26	0
Emory	0	0	0	0	0	0	26	0
Harvard	0	0	0	0	0	0	0	0
Johns(Hopkins	0	11	0	0	0	0	0	0
MIT	0	9	0	0	0	0	0	0
NYU	0	0	0	0	0	0	0	0
Northwestern	0	0	0	0	0	0	0	0
Princeton	0	0	0	0	0	0	0	3
Rice	0	27	0	0	0	0	0	1
Stanford	0	21	177	0	0	0	0	1
Syracuse	8	0	0	0	0	0	0	0
Tulane	0	0	0	0	0	0	56	0
Chicago	0	0	0	0	0	0	0	0
Penn	0	21	0	0	0	0	0	0
Rochester	0	0	0	0	0	0	0	7
USC	0	0	14	0	0	0	0	17
Vanderbilt	0	19	0	0	0	0	154	0
Wash(U	0	0	0	0	0	0	82	0
Yale	0	17	0	0	0	0	54	0
	54	137	281	0	0	0	485	



### The value to CWRU of this target audience

In an era when CWRU is no longer seeking to matriculate more students, the business argument for a new major cannot simply be that it will attract more applicants. A new major must enable us to attract more *desirable* students that we couldn't otherwise, to attract such students at a lower discount rate, or to continue to attract desirable students in the face of increasing competition by peer institutions.

One specific such opportunity identified above is provided by a subset of pre-medical students. Our current pre-medical offerings are excellent but standard, and thus difficult for prospective students (and their parents) to differentiate from similar offerings at other research universities. As training for medical school, a broader scientific education might well be of greater value for many future doctors than the level of specialization inherent in standard biology, (bio)chemistry or biomedical engineering majors. The new MCAT with its more diverse expectations is an affirmation of that viewpoint. The Origins Major will provide pre-meds with greater flexibility to avoid the usual pre-med tracks if they prefer. As described by the VP for Enrollment, such a program promises to give us something distinctive to offer in this very competitive segment of the market.

The Origins Science major will also provide an opportunity within the natural sciences to make more concrete our frequent ambition and oft-stated claim to make real connections for our students with other University Circle institutions. The Cleveland Museum of Natural History will be an active partner in the Origins Science major. CMNH curators will teach in the major on a regular basis. Significant segments of Origins courses will be taught at the CMNH. Further, research opportunities will be identified for Origins majors working with CMNH curators, both in the laboratory and in the field. Again, the VP for Enrollment expects this tangible connection to the CMNH to be an attractive point of distinction for the most competitive slice of the undergraduate market.

### Metrics and Goals

We provide the following metrics and associated goals by which we suggest the major be evaluated over a pilot period of approximately 5 years.

#### 1. Enrollment

- Year V Goal: The Origins major will enroll at least 10 majors per year.

#### 2. Attractiveness

- Year V Goal: At least 30 early-action applicants per year will indicate interest in the Origins major.
- Year V Goal: The Origins majors will include at least 10 per year who indicated interest in the major as matriculants, and:

- i. have higher total SAT (or equivalent) scores than the average for the 2014 incoming class; and/or
  - ii. have a lower tuition discount rate than the average for the 2014 incoming class; and/or
  - iii. are members of under-represented minorities or low-income groups.
- 3. Retention
  - Year V Goal: the four year graduation rate for Origins majors who indicated interest in the major as applicants, will not be less than that for other STEM majors .
- 4. Satisfaction
  - Year V Goal: the satisfaction rate for Origins majors who indicated interest in the major as applicants, will not be less than that for other STEM majors.

As supporting documentation we attach a letter from the VP for Enrollment endorsing the Origins major for the reasons given above.

**3. What are the projected costs necessary to mount the program? More specifically, what are the projected needed near- and long-term resources and estimated costs for:**

***NOTE: We have attached an excel spreadsheet to enable the CAS committees to better understand any questions they may have relating to the following.***

**a. Faculty?**

Faculty time will be required for three purposes:

- Teaching
- Advising/Mentoring
- Administration

**I. Teaching:**

The major will require the creation of the following new ORIG-designated courses, and the described teaching resources:

- **ORIG 101 Origins Prologue: Life, the Universe and Everything.** A one-credit course that introduces students to the research interests of Origins faculty, and thereby to some of the possibilities for student research or focused study. Taught every semester.

Because this consists of individual lectures, faculty will be asked to do this course as an overload. The Director of the Origins Major (see below) will coordinate.

**Estimated additional cost: \$0**

- **ORIG 201: Origins I: In the Beginning.** To be cross-listed with the existing EEPS 101 Earth and Planets. A three-credit quantitative introduction to cosmology, astrophysics, planetary science and geology. Taught every spring semester.



This course will continue to be taught principally by an EEPS faculty member. A physics or astronomy faculty member will serve as co-instructor, and will provide enriched cosmology content to a course that traditionally has included some such content. In line with the model of 300/400 level cross-listed courses, those students taking the course as ORIG 201 will complete enhanced/extended assignments with greater quantitative content. The co-instructor will have primary responsibility for these assignments.

The existing EEPS effort is shown as dual use of existing effort for a full course (10% effort) on the basis of a \$100K AY salary, \$5K salary plus \$3K fringe. For the co-instructor at the same rate 5% annualized effort (taken to be a ½ course), would compensate for replacement teaching to cover a half course in the co-instructor's home department, however this is shown as reallocation of existing effort.

**Estimated additional cost: \$0**

- **ORIG 202: Origins II. Life in all its diversity.** A three credit quantitative introduction to evolutionary biology, paleontology, physical anthropology and cognitive science. Taught every fall semester.

This will be a team-taught class. Two CWRU faculty will teach the class as part of their regular teaching duties; a CMNH curator will also co-teach the course. Cost estimates are provided on the basis of one CAS faculty member, one SOM faculty member and a CMNH curator. Costs for CAS faculty time (estimated as above for ORIG 201, for a net of \$6.5K) is taken to be a reallocation of existing effort. SOM faculty time is estimated at 5 weeks as lead instructor (12 hours per week), and 9 weeks as non-lead instructor (4.5 hours per week), for 100.5 hours out of a nominal 1560 hours of work in a 39-week academic year, or 0.064% effort. A salary of \$105k is assumed (per instructions of the Chair of Biochemistry). Net cost for SOM faculty: \$8.8k. Per CMNH head of science, net cost for half-course teaching by a CMNH curator: \$6.5k.

**Estimated additional cost: \$15.3k**

- **ORIG 301/MATH3xx: Mathematical Modeling Across the Sciences:** A three credit course on mathematical modeling, cross-listed with MAMS. Taught annually. Estimated at full cost of one CAS faculty (see above) but represents a dual use of (planned) faculty effort.

**Estimated additional cost: \$0**



- ORIG 351: Topics in Origins.** A three-credit special topics course in (an) Origins discipline(s). Taught at least once per academic year. Could be (co-)taught by a CWRU faculty member (CAS/SOM/other), or a CMNH curator. Currently estimated at the average of the nominal cost of a CAS faculty member or a CMNH curator (\$13k) and that of a SOM faculty member (168 hours, other assumptions as above, yielding an estimate of \$19.6k). We also allocate \$1k for course development. Since some 351 courses will be cross-lists of existing departmental courses, some savings will be realized; these are not reflected in the budget. The savings will be allocated for further course-development funding. For example, we would hope to develop courses in astrobiology, exo-planets, pre-biotic evolution, and linguistics, probably beginning life as an ORIG 351 offering and, demand permitting, evolve into a course with a departmental designation. In the meantime a number of courses exist that could be cross-listed as ORIG 351, examples include: ANTH 302 Darwinian Medicine, ANTH 327. Ancient Cultures of the Ohio Region, ANTH 331. The Most Ancient Near East, ANTH 375. Human Evolution: The Fossil Evidence, ANTH 378. Reproductive Health: An Evolutionary Perspective, BIOC 315. Nuclear Receptors in Health and Disease, BIOC 334. Structural Biology, BIOL 307. Evolutionary Biology of the Invertebrates, BIOL 326. Genetics, BIOL 328. Plant Genomics and Proteomics, BIOL 345. Mammal Diversity and Evolution, BIOL 352. Ecology and Evolution of Infectious Diseases, CHEM 329. Chemical Aspects of Living Systems, COGS 310. Cognitive Science of Religion, COGS 327. Gesture in Cognition and Communication, EEPS 301. Stratigraphy and Sedimentation, EEPS 307. Evolutionary Biology and Paleobiology of Invertebrates, EEPS 315. Structural Geology and Geodynamics, EEPS 340. Earth and Planetary Interiors, EEPS 345. Planetary Materials, EEPS 350. Geochemistry, EEPS 367. Topics in Evolutionary Biology, PHYS 365. General Relativity  
**Estimated additional cost: \$14.6k**

- ORIG 398: Independent Study in Origins.** A 1-3 credit offering available on an *ad hoc* basis to students wishing to pursue in depth study in an appropriate origins topic who can identify an appropriate Origins faculty member to supervise the activity on a *pro bono* basis.  
**Estimated additional cost: \$0**

**Subtotal estimated real additional costs for teaching: \$29.9k**

## II. Advising/Mentoring

Major advising costs scale directly with number of majors, and so are more difficult to project *ab initio*. We begin by projecting annual cohorts of 15 majors, suggesting that there will be 45 majors requiring advising. We project on the basis of half-hour meetings 8 times per year. This is high compared to most majors, however, given the interdisciplinary nature of the major, the need for students to draw up, submit and, inevitably, revise educational plans, and the need for faculty advisors to individually and collectively participate in that process, as well as in the collective review of the plans, perhaps this is not a gross overestimate. On that basis we would project a total of 180 advisor hours per academic year (3 cohorts x 15 students/cohort x 4 hours/student/year). This represents 11.6% of 39 forty-hour weeks. On a cost basis of \$100K for CAS and \$105K for SOM, and taking an average of 75% of those cost for CAS advisors and 25% for SOM advisors, we would arrive at an estimated additional cost for advising of \$15.4.

Such a "full-cost" accounting for advising time is an unfair cost burden to the proposed major. Most of that time spent would have been spent no matter what major the students had. Moreover, we expect that the Director of the Origins Major will assume some fraction of the advising burden, especially when the majors are newly declared and have yet to have an approved educational plan. Estimating that only 1/3 of this is "additional new costs" and that the CAS portion of that would be a reallocation of effort, we find

**Subtotal estimated additional cost for advising: \$3.9K**

## III. Administration

The ISO is not currently an administrative unit of the University. In order to administer the major, it will have to create appropriate administrative structures. These include a faculty member serving as Director of the Origins Major. This person would also provide advising to Origins majors who have not yet developed a plan for their Origins foci. We provide for a single course release for said faculty member. For CAS this is at an estimated cost of \$13K per year (see above). For SOM, assuming a Full Professor (~\$140K per year), and 7.5% effort, it is at an estimated cost of \$14K per year. We use the average of those two number as our:

**Subtotal estimated additional cost for administration: \$13.5k**



Note that this does not include costs for general ISO administration (ISO director).

**Subtotal estimated additional cost for faculty: \$47.3k**

**b. Staff**

We budget for a 20% part time staff position in support of the major, at \$30K full-time, plus fringe.

Subtotal estimated additional cost for staff: **\$7.8k**

**c. Graduate student support.**

No graduate student support is budgeted. If the enrollment in ORIG 201 or ORIG 202 reaches ~30 students, there will be a need to begin budgeting for a teaching assistant.

**d. Space (offices, research or instructional labs and/or equipment, if applicable) required for faculty or graduate students to carry out the program?**

The major will have the following short term space requirements:

I. Instructional Space

Classrooms will be required for 2 additional courses each fall (ORIG202, ORIG 351) and one each spring (ORIG 101), plus one other (ORIG301) in one or the other. CMNH has expressed interest in being the site for some of this teaching. There are several advantages for making that the case. We will advocate for teaching ORIG101 at CMNH, and at least half of ORIG202 there as well. ORIG 351 should be taught there when appropriate.

II. Administrative Space:

We will require a place for the part-time staff member to sit. This could also serve as a central administrative office for the major, where appropriate documents are kept, ... Because of associated FIRPA issues, it would be best if this was a lockable office, preferably on the Case Quad.

III. Other space

It may be difficult in the short term, but it would be useful to identify study and gathering space for the majors.

In the longer term, if the ISO is eventually "housed," the major would be well served by having appropriate space dedicated to it associated with the ISO space.

**e. Impact on university resources, such as increased library needs?**

None currently identified.

**f. Other costs:**

- Origins lecture series: We budget for an annual lecture series in Origins that ORIG 201 and 202 students will be expected to attend, and we anticipate that they will be incorporated in ORIG 101. We allow for 14 lectures at \$500 per lecture. CAS science departments generally have similar lecture series that are available to their upper level majors. Subtotal estimated cost: **\$7k**



- Program fund: Used to cover the costs normally covered by departments in support of their majors, including travel to conferences, discretionary spending by an associated student group, research support.  
Subtotal estimated cost: \$5k

Subtotal estimated other costs: \$12k

**Total estimated new costs (15 major/yr): 67k\$/yr**

**Additional new costs for increasing cohorts by 5 above 15:  
4k\$/yr**

**Estimated cost of five-year pilot: 286k\$**

#### **Ramp Down Contingency**

We have provided a budget for a four-year ramp down period in the event that the program does not meet its five-year metrics, and a decision is made to terminate the program.

These are: 29.1k in year VI, 27.8k in Year VII, 22.7k in year VIII and 14.9k in year VIII. Total: 94.5k. (Details are contained in the appropriate spreadsheet tab.) These would permit existing declared majors, including those who matriculate at the beginning of Year VI with the intention to major in Origins, to complete their degrees with the full academic experience originally advertised to them. Some savings compared with this projection might be realized depending on the context of the ramp down.

**4. What is the projected income associated with the new program? Identify likely sources and assess the near- and long-term likelihood of raising funds to support the program in such categories as external and internal grants, philanthropy and other non-grant external funding, and tuition.**

We discuss each of these categories in turn:

#### **I. Tuition:**

The most straightforward way to recoup the additional costs outlined above is through additional tuition income. As discussed, it is not realistic to imagine that we will add new students, therefore the relevant tuition income is however much additional tuition the average Origins major is willing to pay compared to the current average CWRU undergraduate. With an annual cohort of 15 and a nominal tuition of \$41.5K per student per year, collecting an additional 3% of tuition (about \$1250 per student per year), or in other words reducing the discount rate by about 6%, results in \$75K of additional annual income, fully offsetting the projected costs.

At this rate, each additional 5 students per cohort results in \$3K /year of additional costs, and 20 times \$1.25k per year (i.e. \$25K /year) in

additional revenue, netting out to \$22K /yr. A cohort of 20 is therefore cost neutral with a 2.2% (i.e \$900/year) improvement in the fraction of nominal tuition collected per student.

Similar income levels can be achieved with an annual cohort of 10 and a discount rate that is lower than the current level by 4%.

It should however be recognized that attracting a cohort of students with a lower average discount rate may not be our only metric of (financial) success. Two such possible metrics are attracting more under-represented minorities, and attracting a more selective cohort (as measured, for example, by higher average SAT or ACT scores). Greater diversity does not, in and of itself, translate into an improved bottom line, but is an institutional goal. School selectivity has a 12.5% weight in US News Rankings; improving the University's rankings is an institutional objective, and may well lead to improved financial outcomes in the long run — through an ability to reduce the discount rate and attract more philanthropy.

## II. Grants

There is some possibility of applying for an NSF grant through that agency's Directorate of Education and Human Resources (EHF), and it's Division of Undergraduate Education. Programs such as Improving Undergraduate STEM Education, Transforming Undergraduate Education in STEM (TUES) program, and Integrated NSF Support Promoting Interdisciplinary Research and Education (INSPIRE) program are promising if new solicitations are opened. These federal programs would of course not offer long-term funding of the program, but could provide valuable opportunities for seed funding. However, it will be difficult to solicit funds until approval of the major is secured.

## III. Philanthropy

There are both short-term and long-term opportunities for philanthropy. In the short term a truly innovative, indeed nationally unique, undergraduate program might be attractive to donors or foundations. This possibility has not yet been explored. In the long run alumni/ae of a unique and innovative program might be expected to exhibit particular loyalty to the program as a distinct community of CWRU graduates.

## **5. What are the national and international competitive programs and their resources?**

We have not identified a similar broad-based stand-alone undergraduate Origins major anywhere in the United States. Arizona State University's School of Earth and Space Exploration offers a B.S. in Earth and Space Exploration with a concentration in Astrobiology and Biogeosciences. Florida Institute of Technology advertises (apparently inaccurately) that it has the first and only undergraduate astrobiology



program in the country. Paleoanthropology can be studied as a concentration within anthropology in many places. Introductory and upper level courses in cosmology can be found at most major research universities. None of these programs are as broadly conceived as this one, though many institutions could easily mount one as a future response to innovation at CWRU.

The closest program extant is the Origins Research Specialization (ORP) offered by the Origins Institute (OI) at McMaster University in Hamilton, Ontario, Canada. It has a similar scope, though it is not itself a stand-alone major, but an add-on to other science majors. The McMaster Origins Institute is similar in scope and structure to the CWRU institute; it dates from 2004, and so is well established. The McMaster's Institute initially focused on an undergraduate pre-medical program, but appears to have recently added the ORP. McMaster is not a likely competitor to CWRU in most of our relevant markets. On the other hand its relative proximity offers opportunities for collaboration. ISO director Starkman and the OI director have a long acquaintance and have discussed opportunities for future collaborations.

## **6. How does the proposed program:**

- a. **move the college's strategic plan forward in regard to the goals for undergraduate and/or graduate education?**

Since these are among its leading metrics, the proposed program will, if successful, by definition do one or more of the following:

- reduce the undergraduate tuition discount rate (although not by "increase[ing] in the funded portion of the undergraduate discount rate;"
- "increase [the] quality of undergraduates enrolled, measured, e.g., by standardized test scores;"
- "increase [the] numbers and shares of undergraduate and graduate students who are women or underrepresented minorities."

The Origins major will also, if successful, increase the number of undergraduate applications that express interest in a specific major that is within the College, which may be regarded as similar to the stated goal of "increas[ing] the number of undergraduate applications that express interest in specific departments within the college (as compared to, say, "pre-med," or engineering)."

As suggested above, we anticipate that students applying to a specific program will be more likely to be retained through graduation, and will be more likely to remain engaged as alumni/ae, furthering two more of the "Measurable Outcomes" identified in the College's plan.

This is an undergraduate major and does not directly address issues in graduate education.



- b. strengthen the discipline through scholarship? And**
- c. foster collaboration across disciplines?**

This is an interdisciplinary undergraduate major, and so these are not the principal objectives of the proposal. Nevertheless, a desired, and expected, side-benefit of establishing the major will be to more tightly connect faculty across multiple departments of the College, as well as faculty from outside the College and scientists outside the University. The ISO's experience is that when we do this we increase collaborations across disciplines. This cross-disciplinary fertilization is itself an important vehicle for "strengthen[ing] the discipline[s]."

- d. increase attractiveness of the department and the college (to faculty, undergraduate students, graduate students, potential donors)?**

We have addressed the question of how the Origins major increases the attractiveness of the College/University to undergraduate students. We make no claim that it will do the same for graduate students, for whom it is likely to be mostly invisible in and of itself. However, we would imagine that it could lay the foundation either for a single interdisciplinary graduate program of similar scope, or for one or more such programs of more limited scope. For faculty, it seems likely to be of neutral effect for many faculty, but to be attractive to a subset of faculty who value the possibilities of interdisciplinary scholarship and teaching; thus on the whole the proposed Origins Major should be a net positive. Finally, as described above, as a nationally unique program it would seem likely to be attractive to potential donors.

**7. How does the proposed program relate to the university's strategic plan?  
Might the program:**

- a. involve alliance areas?**

The program is offered under the auspices of the ISO, which is the multi-institutional realization of the Origins Alliance.

- b. involve internationalization?**

There are, within the context of the major, multiple opportunities for international educational experiences. (One example is paleontology, (paleo-)anthropology, and geology field experiences in Africa and South America.) As a distinctive undergraduate major, it may well be marketable to foreign students, although that marketability may require a track record of post-graduation placement in graduate and professional programs or appropriate post-graduate employment.

- c. involve other units?**

The program involves faculty from SOM, and the CMNH. Faculty from other units, including WSOM and SODM are likely to participate.

**d. increase the university's impact by advancing our academic programs?**

As a nationally unique academic program, the proposed major has the potential to increase the University's impact.

**e. increase the diversity on our campus?**

Without specific research, it is difficult to assess whether the major would be differentially attractive to groups whose presence would increase campus diversity.

**f. strengthen institutional resources?**

Insofar as the major succeeds in various goals we have identified -- attracting a desirable cohort of students, attracting philanthropy, increasing interdisciplinary collaborations, strengthening collaborations with partner institutions — it will strengthen institutional resources.

**g. foster collaborations/partnerships with other institutions?**

The major involves the CMNH. We will also work to involve ideastream in the major activities.

**8. How will the program contribute to CWRU's reputation regionally, nationally, and internationally?**

This is a distinctive undergraduate major. More than that it represents a different take on undergraduate STEM education at a private or public research university. That has many positive possibilities (as described above) for reputation building, certainly regionally and nationally, but perhaps even internationally.

**9. To what extent does the new program reflect a change of departmental priorities and subsequent reallocation of resources?**

The question is not directly applicable, however, perhaps a relevant point to make is that the program may allow redistribution of effort among CAS (and other CWRU) departments in a way that is beneficial to each of them. In particular, certain departments (BME, Biology, Chemistry) currently have a heavy burden of teaching and advising due to the popularity of their major programs among pre-med students. To the extent that the Origins major allows these pre-med students to

move away from traditional pre-med majors it may allow a shifting of the teaching and advising burden away from those traditional department-based pre-medical courses of study.



**EXPENSES**  
assume 15 per cohort

Item	new costs (K\$)	total (K\$)
Teaching	29.9	29.9
Advising	3.9	3.9
Administration	21.1	21.1
Program Funds	12.0	12.0

total **67** 66.9

**additional costs for 5 additional students per cohort**

Advising	<b>1.3</b>	<b>0.0</b>	1.3
Program Funds	<b>1.7</b>	<b>0</b>	1.7
total	<b>3.0</b>	0.0	3.0

**INCOME**

	students cohorts /cohort	Origins majors	nominal tuition	additional %	additional \$/student	additional income (K\$)	revenue	
10/cohort	10	4	40	41.5	4.05	1.68075	67 10 @ 4.05%	0.3
	10	4	40	41.5	4.5	1.8675	75 10 @ 4.5%	7.8
	10	4	40	41.5	5	2.075	83 10@ 5%	16.1
15/cohort	<b>15</b>	4	60	41.5	<b>2.85</b>	1.18275	71 15@2.85%	1.06
	15	4	60	41.5	3	1.245	75 15@4%	4.80
	15	4	60	41.5	4	1.66	100 15@4%	29.70
	15	4	60	41.5	5	2.075	124.5 15@5%	54.60
20/cohort	<b>20</b>	4	80	41.5	<b>2.2</b>	0.913	73.04 20@3%	0.16
	20	4	80	41.5	3	1.245	100 20@3%	26.72
	20	4	80	41.5	4	1.66	132.8 20@4%	59.92
	20	4	80	41.5	5	2.075	166 20@5%	93.12

## Origins Major BA

Sample Educational Plan Template non Pre-Med

### Key:

Open Elective

SAGES requirements of the CAS

Science Core

Origins Core

Origins Focus

(courses fulfilling multiple purposes shown in all appropriate colors)

- <sup>1</sup> Fulfills Social Sciences requirement
- <sup>2</sup> Fulfills Natural and Mathematical Sciences requirement
- <sup>3</sup> Fulfills Arts and Humanities requirement
- <sup>4</sup> Fulfills Quantitative Reasoning Requirement
- <sup>5</sup> Fulfills Global and Cultural Diversity requirement
- <sup>6</sup> Fulfills PHED requirement
- <sup>7</sup> Fulfills Departmental seminar requirement
- <sup>8</sup> 300 level or above

## Year I

### **Fall**

Course	Credits
Freshman Seminar	3
PHED I <sup>6</sup>	0
Quantitative Reasoning <sup>4</sup>	4
Natural/Math. Sciences I <sup>2</sup>	4
CHEM 105	3
Semester Credits	14

### **Spring**

Course	Credits
Natural/Mathematical Sciences II <sup>2</sup>	4
BIOL 214	4
MATH 122	4
Open Elective I	3
Semester Credits	15

## Year II

### **Fall**

Arts and Humanities I	3
University Seminar I	3
CHEM 106	4
ORIG 202      Origins II. Life in all its diversity	3
Open Elective II	3
Semester Credits	16

### **Spring**

University Seminary II	3
PHED II <sup>6</sup>	0
BIOL 225      Evolution	3
ORIG 201      Origins I. From the Beginning	3
Open Elective III	3
Open Elective IV	3
Semester Credits	15

**Summer suggestion:** work in CWRU lab



### **Year III**

#### **Fall**

Social Sciences I	3
ORIG 351 <sup>8</sup> Topics in Origins	3
Prereq to Origins Focus course	3
Open Elective V	3
Open Elective VI	3

Semester Credits 15  
Credits at 300 level or above 3

#### **Spring**

Social Sciences II	3
Departmental Seminar <sup>7,8</sup>	3
ORIG 301/MATH 3xx <sup>8</sup> Mathematical Modeling	3
Origins Focus I <sup>8</sup>	3
Open Elective VII	3

Semester Credits 15  
Credits at 300 level or above 9

**Summer suggestion:** NSF REU

### **Year IV**

#### **Fall**

Global and Cultural Diversity <sup>5</sup>	3
ORIG 351 <sup>8</sup> Topics in Origins	3
Origins Focus II <sup>8</sup>	3
Open Elective VIII <sup>8</sup>	3
Open Elective IX	3

Semester Credits 15  
Credits at 300 level or above 9

#### **Spring**

Arts and Humanities II	3
Senior Capstone <sup>8</sup>	3
Origins Focus III <sup>8</sup>	3
Open Elective X <sup>8</sup>	3
Open Elective XI	3

Semester Credits 15  
Credits at 300 level or above 9

**Total Credits 120**  
**Total Credits at 300 level or above 30**

## Origins Major BA

Sample Educational Plan for Pre-Med (Mathematical/Physical Sciences Track)

### Key:

Open Elective

SAGES requirements of the CAS

Science Core

Origins Core

Origins Focus

Pre-Health Requirement

(courses fulfilling multiple purposes shown in all appropriate colors)

- <sup>1</sup> Fulfills Social Sciences requirement
- <sup>2</sup> Fulfills Natural and Mathematical Sciences requirement
- <sup>3</sup> Fulfills Arts and Humanities requirement
- <sup>4</sup> Fulfills Quantitative Reasoning Requirement
- <sup>5</sup> Fulfills Global and Cultural Diversity requirement
- <sup>6</sup> Fulfills PHED requirement
- <sup>7</sup> Fulfills Departmental seminar requirement
- <sup>8</sup> 300 level or above

## Year I

### Fall

Course	Credits
First Seminar	4
PHED I <sup>6</sup>	0
Quantitative Reasoning <sup>4</sup> Calculus for Sci/Eng I. MATH 121	4
Natural/Math Sciences I Intro. Physics I. PHYS 121 (or 115) <sup>2</sup>	4
Natural/Math Sciences I Principles of Chemistry I CHEM 105 <sup>2</sup>	3
Open Elective I e.g. ORIG 101	1

Semester Credits 16

### Spring

Course	Credits
Principles of Chemistry II CHEM 106	3
Principles of Chemistry Lab CHEM 113	2
Calculus for Science & Engineering II MATH 122	4
Intro. Physics II. PHYS 122 (or 116)	4
Open Elective II	3

Semester Credits 16

## Year II

### Fall

University Seminar I	3
Social Sciences I <sup>1</sup> Sociology (eg SOCI 101)	3
Genes, Evolution and Ecology (with Lab) BIOL 214 <sup>2</sup>	4
Introductory Organic Chemistry I CHEM 223 <sup>2</sup>	3
Introductory Organic Chemistry Lab I CHEM 233 <sup>2</sup>	2

Semester Credits 15

### Spring

University Seminar II	3
PHED II <sup>6</sup>	0
Introductory Organic Chemistry II CHEM 224 <sup>2</sup>	3
Introductory Organic Chemistry Lab II CHEM 234 <sup>2</sup>	2
Cells and Proteins BIOL 215 (with lab)	4
Origins I. From the Beginning ORIG 201	3

Semester Credits 15

**Summer suggestion:** work in CWRU lab



### Year III

#### **Fall**

Development and Physiology (with Lab) BIOL 216 <sup>2</sup>	4	
Biochemistry BIOC 307 <sup>8</sup>	Origins Focus I	4
ORIG 202	Origins II. Life in all its diversity	3
Open Elective III		3
Open Elective IV <sup>#</sup>		0-3
Semester Credits		14-17
Credits at 300 level or above		6

#### **Spring**

Social Sciences II <sup>1</sup>	Psychology (eg PSCL 101)	3	
Departmental Seminar <sup>7,8</sup>		3	
ORIG 301/MATH 3xx <sup>8</sup>	Mathematical Modeling	3	
ORIG 360 <sup>8</sup>	Independent Study in Origins	3	
Open Elective IV <sup>#</sup>		0-3	
Semester Credits		12-15	
Credits at 300 level or above		6	
<sup>#</sup> Students may choose to do Open Elective IV in Fall of Year III to free up time for MCAT studying in Spring.			

**Summer suggestion:** NSF REU

### Year IV

#### **Fall**

Arts and Humanities I <sup>3</sup>	3	
Global and Cultural Diversity <sup>5</sup>	3	
ORIG 351 <sup>8</sup>	Topics in Origins	3
Origins Focus II (eg. ANTH 302 Darwinian Medicine) <sup>9</sup>	3	
Open Elective VI <sup>8</sup>	3	
Semester Credits		15
Credits at 300 level or above		9

#### **Spring**

Arts and Humanities II <sup>3</sup>	3	
Senior Capstone <sup>8</sup>	3	
Origins Focus III (eg. EEPS 345 Planetary Materials) <sup>9</sup>	3	
Open Elective VII <sup>8</sup>	3	
Open Elective VIII <sup>8</sup>	3	
Semester Credits		15
Credits at 300 level or above		9

**Total Credits**

**120**

**Total Credits at 300 level or above**

**30**

## Origins Major BA

Sample Educational Plan for Pre-Med (Biological/Chemical Sciences Track)

### Key:

Open Elective

SAGES requirements of the CAS

Science Core

Origins Core

Origins Focus

Pre-Health Requirement

(courses fulfilling multiple purposes shown in all appropriate colors)

- <sup>1</sup> Fulfills Social Sciences requirement
- <sup>2</sup> Fulfills Natural and Mathematical Sciences requirement
- <sup>3</sup> Fulfills Arts and Humanities requirement
- <sup>4</sup> Fulfills Quantitative Reasoning Requirement
- <sup>5</sup> Fulfills Global and Cultural Diversity requirement
- <sup>6</sup> Fulfills PHED requirement
- <sup>7</sup> Fulfills Departmental seminar requirement
- <sup>8</sup> 300 level or above



## Year I

### Fall

Course		Credits
First Seminar		4
PHED I <sup>6</sup>		0
Quantitative Reasoning <sup>4</sup>	MATH 121	4
Genes, Evolution and Ecology (with Lab)	BIOL 214 <sup>2</sup>	4
Natural/Math Sciences I Principles of Chemistry I	CHEM 105 <sup>2</sup>	3
Open Elective I	e.g. ORIG 101	1

Semester Credits

16

### Spring

Course		Credits
Principles of Chemistry II	CHEM 106	3
Principles of Chemistry Lab	CHEM 113	2
Cells and Proteins	BIOL 215 (with lab)	4
MATH 122		4
Open Elective II		3

Semester Credits

17

## Year II

### Fall

University Seminar I		3
Introductory Organic Chemistry I	CHEM 223	3
Introductory Organic Chemistry Lab I	CHEM 233	2
Development and Physiology (with Lab)	BIOL 216	4
Open Elective III		3

Semester Credits

15

### Spring

University Seminar II		3
PHED II <sup>6</sup>		0
Introductory Organic Chemistry II	CHEM 224	3
Introductory Organic Chemistry Lab II	CHEM 234	2
Introductory Physics I. PHYS 121		4
Origins I. From the Beginning	ORIG 201	3

Semester Credits

15

**Summer suggestion:** work in CWRU lab

### Year III

#### **Fall**

Social Sciences I <sup>1</sup>	Sociology (eg SOCI 101)	3
Biochemistry BIOC 307 <sup>8</sup>	Origins Focus I	4
ORIG 202	Origins II. Life in all its diversity	3
ORIG 351 <sup>8</sup>	Topics in Origins	3
Open Elective IV		3
Semester Credits		16
Credits at 300 level or above		6

#### **Spring**

Social Sciences II <sup>1</sup>	Psychology (eg PSCL 101)	3
Departmental Seminar <sup>7,8</sup>		3
ORIG 301/MATH 3xx <sup>8</sup>	Mathematical Modeling	3
PHYS 116 or 122		4
Open Elective V		0-3
(time to study for MCATs)		
Semester Credits		13-16
Credits at 300 level or above		6

**Summer suggestion:** NSF REU

### Year IV

#### **Fall**

Arts and Humanities I <sup>3</sup>		3
Global and Cultural Diversity <sup>5</sup>		3
ORIG 351 <sup>8</sup>	Topics in Origins	3
Origins Focus II (eg. ANTH 302 Darwinian Medicine) <sup>8</sup>		3
Open Elective VI <sup>8</sup>		3

Semester Credits	16
Credits at 300 level or above	9

#### **Spring**

Arts and Humanities II <sup>3</sup>		3
Senior Capstone <sup>8</sup>		3
Origins Focus III (eg. EEPS 345 Planetary Materials) <sup>8</sup>		3
Open Elective VII <sup>8</sup>		3

Semester Credits	12
Credits at 300 level or above	9

<b>Total Credits</b>	<b>120</b>
<b>Total Credits at 300 level or above</b>	<b>30</b>