Natural Science

2020 COMPREHENSIVE
PROGRAM/UNIT REVIEW
AY 17-18, AY 18-19, AY 19-20
1. Program or Unit Description

Program/Unit Description from the catalog or Unit Mission or Purpose Statement

The Associate in Science in Natural Science (NSCI) Degree program prepares students to transfer to 4-year institutions in STEM (Science, Technology, Engineering and Mathematics) related fields. Hawai‘i Community College offers two NSCI tracks: Biological Science (NSCI-BSC) and Physical Science (NSCI-PSC).

What is the target student or service population?
The NSCI-BSC and NSCI-PSC are designed to provide a transferable degree to students interested in life and physical sciences. Students who graduate from the NSCI Program transfer within the University of Hawai‘i system as juniors ready to take more specialized 300- and 400-level courses. It is targeted towards high school students with an interest in science. For West Hawai‘i residents, this program provides the opportunity to stay locally while completing the first two years of courses necessary for a four-year science degree.

2. Analysis of the Program/Unit

The NSCI Program at Hawai‘iCC is still new; at the start of this review period, it had been in existence for only three years at the Manono campus. The Pālamanui campus began offering the Program to its first cohort in 2017 and graduated its first students in 2019.

Overall, the NSCI Program was considered Cautionary in 2017-18 (referred to as 2018 for the remainder of the document), Cautionary in 2018-19 (referred to as 2019 for the remainder of this document), and Unhealthy in 2019-20 (referred to as 2020 for the remainder of this document). However, the ARPD data do not often reflect the data we have collected on students, and small, annual fluctuations have outsized impacts on the data.

Demand for the program ranged from Cautionary (2018) to Unhealthy (2019, 2020). This is due to a decline in the number of majors over the three-year review period from 53 (2018) to 46 (2020), a change of only seven students. This drop in majors is reflective of the overall drop in higher education enrollment across the U.S. during a period of high economic output and low unemployment. The overall enrollment at Hawai‘iCC dropped at a similar rate over the same period, and the enrollment in the NSCI Program is closely correlated with the overall drop. For example, from 2018-2019, NSCI enrollment dropped by seven students, which was an 8% drop. Enrollment at HawCC in the Liberal Arts AA (the largest major at the campus) also dropped 8%. Although there is little we can do about the changes in demand due to economic factors, our program has been focused on increasing efficiency. The number of Student Semester Hours (SSH) for Program Majors has been steadily increasing over the three-year period covered by this review, from 187 in 2018 to 283 in 2020; an over 51% increase. In the same period, we excelled at attracting non-majors to our courses and increased our total SSH in program classes by over 82% (from 341 to 622 over the three-year period).
Efficiency Health was Cautionary in all three years included in this Comprehensive Review. Efficiency is determined by two factors: Class Fill Rate and Students to BOR Faculty. The Majors:BOR Faculty ratio has been healthy across the time period of this report, ranging from 15-17 students per faculty. The fill rate over the three years has ranged from Cautionary to Unhealthy (a low of 46.2% and a high of 60.1%). Since the NSCI at Hawai‘iCC is still a new program on the Manono campus and had just begun on the Pālamanui campus at the beginning of the review period, the courses on that campus were likely low enrolled. Additionally, we are still developing the resources to offer the full program and subsequently, offer lower-enrolled courses in order to develop interest in the major and grow knowledge of it in the local high schools. In order to reduce low-enrolled courses, we also offer some of our classes via Vidcon between the two campuses. We were dismayed to discover that the ARPD reports these classes as two low-enrolled sections, even though they are taught by the same instructor for the normal TEs of teaching a single section. We have not had the opportunity to calculate our own efficiency measures using the combined enrollment in these classes, but we know that it would dramatically change the overall fill rate for the NSCI classes.

Average class size increased by 10% over the period from 2018-2020, indicating that we are heading in a positive direction in our efforts to attract students to the program and to consolidate classes. In addition, the calculated number of low-enrolled classes (<10 students) has increased over the period covered by this review from seven (2018) to 10 (2019) to 11 (2020). We are actually quite pleased with this increase because many of these courses are the result of an agreement we have made with UH Hilo (UHH) whereby they hold seats in courses that we cannot provide (such as physics) and we create ‘shadow sections’ on our campus that hold only one or two seats. We place tight instructor approval holds on the classes to ensure that only Hawai‘iCC NSCI students enroll (at Community College tuition rates), and although they may be listed as the only student in the course, as seen by Hawai‘iCC, they are actually one of a full section of students offered at UHH. For example, in Fall 2019, we had four students enrolled in three CRNs that were UHH-taught lectures and labs.

Effectiveness was Unhealthy (2018), Cautionary (2019) and Unhealthy (2020). The effectiveness health call is based on persistence from Fall to Spring. The NSCI persistence ranges from a low of 53% (2020) to a high of 62% (2019). The low persistence in 2020 may be the beginning of Covid-19 related drops that occurred in the Spring 2020 semester, but may also be from more typical changes in student enrollment. Additionally, we do not have the facilities to offer the full range of required courses at our campuses. Because of this, students have to either take courses from UHH while still enrolled with us (see above) or, many students will take the courses they can from us then transfer to UHH prior to receiving their AS degree where they will take the courses we cannot offer. These numbers fluctuate over time but have ranged from zero NSCI degrees and seven transfers within UH in 2018 to six degrees and nine transfers in 2019 and four degrees and nine transfers in 2020. In addition, we have had students transfer outside of the UH-system, particularly for science degrees that they cannot obtain on the Big Island. The number of STEM degrees and certificates granted is typically double the number of degrees conferred: one in 2018 (no degrees conferred), 12 in 2019 (six degrees conferred), eight in 2020 (four degrees conferred).
Significant Program Actions

From 2017-2019 the NSCI Program, which was until then a provisional program, applied and was granted permanent program status by the BOR, along with the NSCI degrees from HonCC, WinCC, KauCC, and UHMC.

From 2017-2018, Hawai‘iCC worked with representatives from all UHCC campuses to align science curriculum. We made changes to the name, alpha, number, and/or credits of 31 of our science course offerings, including the NSCI Program and many Natural Science courses for Liberal Arts (several of which are elective credits for the NSCI degree). In 2018, we re-designed the required curriculum for both the NSCI-BSC and NSCI-PSC tracks in order to further align the courses with Foundations and Diversifications requirements and made further revisions in 2019. BIOL171/171L and CHEM 161/161L were submitted and approved for Diversifications in Fall 2019. We also created a number of courses designed for NSCI and science-focused Liberal Arts students at Hawai‘iCC.

We proposed and received curricular approval for seven classes during the period of this review:

- PHYS 151L (Fall 2018)
- PHYS 152L (Fall 2018)
- BIOL 275 (Fall 2019)
- BIOL 275L (Fall 2019)
- BIOL 265L (Fall 2019)
- SCI 190V (Fall 2020)
- SCI 292V (Fall 2020)

These courses increased the number of physics labs we will be able to offer once lab space is developed. They create a venue for internship credit in science and/or research-based projects, create a science-based study abroad course, and create a diversity of 200-level courses for our students.

To support student enrollment and reduce educational costs in NSCI courses, we began using Open Educational Resources (OER) textbooks in BIOL 171 and CHEM 161 in Fall 2019. BIOL 275 lecture will also use an OER textbook. In Summer 2020, we developed an OER lab manual for BIOL 171L. Additionally, an OER lab manual was also created for BIOL 275L. However, due to COVID-19, we will likely be unable to run the course because purchasing of new lab equipment and materials will be required.

Faculty in our program have focused on professional development through AVID and other training designed to improve student engagement and success. Building on our capacity to support students and to further the goals of Hawai‘iCC as an indigenous-serving institution through Hawai‘i Papa O Ke Ao, in AY2018-2019, two NSCI faculty members (one in Science and one in Mathematics) began and completed a graduate certificate in Ethnomathematics at UH Mānoa. Ethnomathematics is a form of teaching and learning in STEM that uses real-world problem-solving to empower students to be locally-minded, global citizens through a sense of purpose, a sense of place, and focused challenges that are relevant and contextualized in the environment and culture of Hawai‘i.
Through the NSF Bridges to Baccalaureate grant (B2B) we have been able to support students from both the West and East Hawaii campuses to train as peer mentors to other science students, to participate in URE (Undergraduate Research Experiences), and to attend national conferences through travel support. During the period of this comprehensive review we provided travel funding for seven students and three faculty to attend the Society for the Advancement of Chicano and Native Americans in Science (SACNAS) Conference in Honolulu in Fall 2019, travel for two students accompanied by one faculty to the Annual Sigma Xi conference, stipends for ten peer mentors and stipends for three student URE projects. All of these activities help to equip, empower, and energize students in their academic and professional paths in STEM.

Discussion of 2013-2016 Comprehensive Report Action Goals:

**Action Goal 1: Advocate for the development of infrastructure to support science instruction, including a physics lab at both Manono and Pālamanui and a laboratory prep room for the Manono biology laboratory.**

We have been working on improving and developing infrastructure for both the Manono and Pālamanui campuses since the inception of the NSCI Program. At Pālamanui, we have received a donation to purchase physics lab equipment. The physics lab construction is scheduled to start Fall 2020, and we have made an agreement with the Humanities Department to share their lab space until a dedicated space can be built. In Hilo, we still have not obtained funding for a physics lab and continue to collaborate with UHH to offer our physics courses. Funding for a laboratory prep room has been obtained, and designs have been submitted.

**Action Goal 2: Advocate for increased faculty support and personnel, including the permanent confirmation of a chemistry instructor.**

In collaboration with the Math & Natural Science department, NSCI was able to move a math faculty position to chemistry and hire a chemistry instructor at the Manono campus in 2018. In 2019, based on advocacy from NSCI program faculty, the Hawai‘iCC Administration reallocated a position from Business Education to physical science at the Pālamanui campus and a second chemistry faculty member was hired.

**Action Goal 3: Increase funding for lab supplies and equipment.**

We continue to work toward providing sufficient funding for science lab supplies and equipment through external funding and through collaboration with Hawai‘iCC Administrators. This has included working with the UH Foundation to find donors to help cover science laboratory costs. In Fall 2019, we received a $35,000 donation for physics lab equipment from Rotary Club of Kailua-Kona.

Faculty from ASNS and Hawaii Life Styles (HLS), in collaboration with the Dean of Liberal Arts are in discussion to apply for a NSF-TCUP (Tribal Colleges and Universities Program). In 2019, we decided to apply for the Preparing for TCUP Implementation (Pre-TI) grant, which supports
development-level activities such as an institutional assessment of current STEM instructional capacity. Discussion and proposal writing are on-going.

Instructional programs must include a discussion of ARPD health indicators with benchmarks to provide a quick view on the overall condition of the program for the period of this Review; CTE programs must include an analysis of Perkins Core indicators for which the program did not meet the performance level in the last year of this Review period.

[If applicable, provide attachment(s) or URLs for ARPD data tables from the previous three years or from the full period of this Review if more than three years; if applicable, provide attachment(s) or URLs for unit or program specific data discussed above in this Review.]

https://uhcc.Hawai‘i.edu/varpd/ (ARPD for 2018 & 2019)

ARPD for 2020.

3. Program Learning Outcomes or Unit/Service Outcomes

a) List of the Program Learning Outcomes or Unit/Service Outcomes

The program-level Student Learning Outcomes (PLO) are:

1. Analyze data effectively using current technology
2. Communicate scientific ideas and principles clearly and effectively
3. Analyze and apply fundamental mathematical, physical, and chemical concepts and techniques to scientific issues
4. Apply fundamental concepts and techniques in their chosen concentration

b) List the Program Learning Outcomes or Unit/Service Outcomes that have been assessed in the period of this Comprehensive Review.

c) Discuss the assessment results from the period of this Comprehensive Review.

d) Discuss changes that have been made as a result of the assessment results.

All four Program Learning Outcomes were assessed during this period as well as two Institutional Learning Outcomes. Note that there are only ten classes and ten labs within the ASNS. The remainder of the science courses that students take are under the Liberal Arts. Of the twenty classes, four 200-level courses are new to the program and have not yet been offered, eight are physics courses which the majority of our students take though a collaboration with UH Hilo (i.e., they are not taught by our faculty), and only eight are offered regularly. Half of those (four) were scheduled to be assessed during the period of this review, but due to Covid-19, Spring 2020 Assessment was
moved back by a year. Thus, BIOL 171 and 171L were the only courses to be assessed. They were assessed at both the original and the Closing the Loop (CTL) levels.

AY2018-2019:

- BIOL 171 and BIOL 171L.

AY2018-2019:

- BIOL 171 and BIOL 171L (Closing the Loop).

### Natural Science

#### Academic Year 2018-19

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<thead>
<tr>
<th>Term</th>
<th>Overview</th>
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<tbody>
<tr>
<td>NSCI_PLO1</td>
<td><img src="#" alt="Green" /> <img src="#" alt="Yellow" /> <img src="#" alt="Red" /></td>
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<tr>
<td>NSCI_PLO1</td>
<td><em>NSCI_PLO1: Analyze data effectively using current technology.</em></td>
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<td>NSCI_PLO2</td>
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<tr>
<td>NSCI_PLO2</td>
<td><em>NSCI_PLO2: Communicate scientific ideas and principles clearly and effectively.</em></td>
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<tr>
<td>NSCI_PLO3</td>
<td><em>NSCI_PLO3: Analyze and apply fundamental mathematical, physical, and chemical concepts and techniques to scientific issues.</em></td>
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<tr>
<td>NSCI_PLO4</td>
<td><em>NSCI_PLO4: Apply fundamental concepts and techniques in their chosen concentration.</em></td>
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<td>ILO1</td>
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<tr>
<td>Communication - Ho'oka'a'iike</td>
<td>Communicate effectively in a variety of situations. Ho'oka'a'iike pono i nā manawa 'ike 'ole. Requested By: Hawai'i Community College</td>
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<td>ILO2</td>
<td><img src="#" alt="Green" /> <img src="#" alt="Red" /> <img src="#" alt="Yellow" /></td>
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<td>Critical Thinking - No'ono'o lo'i</td>
<td>Utilize critical thinking to solve problems and make informed decisions. No'ono'o lo'i ma ka hulilani i ka hulilani me ka hulilani. Requested By: Hawai'i Community College</td>
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</table>
For this review period, assessment of PLOs came exclusively from two sections of BIOL 171 and BIOL 171L where a total of 80 students were assessed. Instructors assessed all students enrolled in these courses using a common set of rubrics.

During AY2018-2019 assessment results, we discovered that the number of students meeting the learning outcomes was lower than expected. At the time of the AY2018-2019 assessment, there were no English prerequisites for these courses. English prerequisites were added to both courses for Fall 2019 to ensure that students would have necessary preparation in basic communication skills. Additionally, faculty members also adopted AVID techniques to strengthen students’ WICOR (Writing, Inquiry, Collaboration, Organization, and Reading) skills and incorporated these into both lecture and lab curriculum.

The Closing the Loop assessments were done in Fall 2019. Although we still did not meet the desired 70% of students meeting or exceeding the learning outcomes, we noticed that the number of students that “exceeded” (dark green bar in Campus Labs) in achieving the learning outcomes increased from the previous assessment. This is particularly obvious in the PLO2 (“Communicate scientific ideas and principles clearly and effectively”). We attribute this to the changes made to these courses, in particular adding English prerequisites and incorporating AVID WICOR strategies.

We recognize that there is still room for improvement in these courses to decrease the number of students in the “partially met” and “not met” metric categories. The challenges identified by our
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Program: A.S. in Natural Science (NSCI/ASNS)

assessments have led us to focus our efforts on scaffolding more preparatory activities leading up to culminating assignments, and to work to encourage students who did not turn in the final assignments, as this may have skewed results towards increasing the “not met” metric. Action plans to address these challenges include working with The Learning Center so that students can get help on their writing skills, especially in scientific writing, and improving students’ academic study habits and understanding of the importance of adhering to assignment due dates.

4. Action Plan

Based on findings in Parts 1-3, develop an action plan for your program or unit from now until your next Comprehensive Review date. Be sure to focus on areas to improve identified in ARPD data, comparable unit-developed measures or program-developed metrics, assessments of student learning or unit/service outcomes, results of survey data, and other data used to assess your program or unit. This plan should guide your program/unit through to the next Comprehensive Program/Unit Review cycle and must detail measurable outcomes, benchmarks and timelines. Include an analysis of progress in achieving planned improvements.

* CTE programs must include specific action plans for any Perkins Core Indicator for which the program did not meet the performance level in the last year of this Review.

Specify how the action plan aligns with the College’s Mission and Strategic Plan:
HawCC Strategic Directions 2015-2021.

Discuss how these recommendations for improvement or actions will guide your program or unit until the next Comprehensive Review. Be sure to list resources that will be required, if any, in section 5 below.

*The action plan may be amended based on new initiatives, updated data, or unforeseen external factors.

Action Goal 1:
Advocate for the development of infrastructure to support science instruction, including a physics lab at both Manono and Pālamanui and a laboratory prep room at the Manono biology laboratory. This action goal is a continuation of the goal from our 2016 Comprehensive Report and we will continue to work towards it until it is completed.

Action Goal 2:
Advocate for increased faculty support and personnel, including the permanent confirmation of a laboratory coordinators for both Pālamanui and Hilo campuses and a faculty position in physics. We recognize that additional time will be required to achieve this due to financial constraints and hiring freeze related to the Covid-19 pandemic.
Action Goal 3:
Increase funding for lab supplies and equipment, including pursuit of external funding.

Action Goal 4:
Increase funding for professional development of science faculty within their fields of study.

Action Goal 5:
Work with the College to provide clean and accurate data on program measures.

Action Goal 5:
Create a First Year Experience (FYE) course specifically for NSCI majors.

Action Goal 6:
Collaborate with UH Hilo to create an articulation pathway with the Marine Science degree and NSCI.

Action Goal 7:
Advocate for Increased faculty office space on the Pālamanui and Manono campuses.

Action Goal 8:
Improve teaching spaces on the Pālamanui and Manono campuses through access to larger classrooms at Pālamanui and increased videoconferencing equipment at Manono.

Action Goal 9:
Recruit science-specific tutoring and peer mentors at both Pālamanui and Manono campuses.

Action Goal 10:
Provide supplies such as laptops and software for faculty to excel in their positions.

Action items for the NSCI Program in the next review period align with the College’s Mission and Strategic Directions as follows:

The Hawaii Community College Mission: To promote lifelong learning, Hawai‘i Community College will emphasize the knowledge and experience necessary for Kauhale members to pursue academic achievement and workforce readiness. Aligned with the mission of the UH Community Colleges, we are committed to serving all segments of our Hawai‘i Island community.
Through taking laboratory courses, through supporting the professional development of our faculty, and through encouraging students to bring their learning outside the classroom we will support this mission. Students have the opportunity to use current technology, write lab reports on their experiences, analyze data and apply concepts and techniques. Through subject-matter excellence and current equipment and supplies in the laboratories, the ASNS degree helps students to develop the knowledge and curiosity needed to support their goals of lifelong learning and will allow them to gain the specific knowledge needed in their science program, leading to academic achievement and workforce readiness.

**Hawai‘i Graduation Initiative (HGI) Goal:** Increase the educational capital of the state by increasing the participation and completion of students, particularly Native Hawai‘ians, low-income students, and those from underserved regions and populations, and preparing them for success in the workforce and their communities.

We hope to broaden awareness of the NSCI program at the high-school level more effectively, working with the College outreach counselors to attract a larger cohort of high school students to the Program.

To better support incoming students and promote persistence to attain their degrees in a timely manner, we would like to develop a FYE specifically for NSCI students that includes skill topics such as data analysis and presentation, scientific writing and other science-specific skills. This will build a stronger foundation in skills required for success in science, as well as create a community of learners who could support each other throughout their academic journeys.

We will continue to expand and improve the program curriculum by collaborating with STEM organizations and employers. Currently, as a part of course curricula, we introduce the students to local STEM job opportunities through field trips and participation in service learning projects and community workdays. The newly-created SCI 190V internship course will allow students to gain credit for internship projects in science. Hawai‘i Island is uniquely positioned to train and retain students in STEM jobs, such as positions in conservation, ocean engineering, aquaculture, and astronomy. STEM majors that understand the unique environment here, such as those graduating from the NSCI program, are needed to sustain the workforce on this island and in Hawai‘i.

**High Performance Mission-Driven System (HPMS) Goal:** Through cost-effective, transparent, and accountable practices, ensure financial viability and sustainability to ensure UH’s ability to provide a diverse student body throughout Hawai‘i with affordable access to a superb higher education experience in support of the institutional mission of the university, which includes commitments to being a foremost indigenous-serving university and advancing sustainability.

We are actively collaborating with the Hawai‘i Life Styles program to develop additional placed-based lessons in natural science and mathematics courses on both campuses. We hope to continue these collaborations in order to increase student success for Native Hawaiian and all students, and to support Hawai‘i Papa O Ke Ao, UH’s plan for a model indigenous-serving university.
We will work to create an articulation agreement with UHH’s Marine Science degree. Ideally, it will allow BIOL 171/172 to be credited for MARE 171/172 at UHH. This will increase interest from new students and provide additional students the opportunity to transfer directly into the Marine Science program. This has precedent at KauCC through their NSCI degree.

The Natural Science program will continue to discuss and advocate for laboratory and prep spaces on the Manono campus and funding from the Administration. Physics labs are required for our majors but cannot be offered through Hawai‘iCC until lab space is created. Additionally, we are limited in the number of labs we can offer by the lack of a prep space for science courses. This means that all preparation for upcoming labs is done in the same space in which the labs are held requiring a reduction in the number of labs that can be scheduled.

Additionally, in order to offer the full range of courses required by the major (e.g., physics, cell biology, etc.), we plan to purchase additional laboratory equipment and supplies on both campuses.

In order to reduce low-enrolled sections, we would like to combine more classes between Pālamanui and Hilo. However, the Hilo campuses are limited in the number of video conferencing-equipped rooms available. NSCI shares a single Manono vidcon room with all courses taught in the Math & Natural Sciences department. There is heavy scheduling pressure on the room, and it is often not possible to combine classes because of lack of space. In addition, classroom space in general is limited at both campuses. The STEM Center redesign at the Manono campus (requested on a previous Program Review) is scheduled for the 2020-21 year and should help to alleviate this issue on the Hilo-campuses. Redesign of the Pālamanui campus (also scheduled for 2020-21) will create a physics lab that will allow for improved course offerings on that campus. More classroom space is still very much needed at Pālamanui, and we will continue to advocate for increased and larger teaching spaces on that campus. Spaces to hold tutors and peer mentors are also needed on both campuses.

Faculty office space should also be close to the classes they teach. Having classes and offices located on the two Hilo-side campuses complicates the ability for faculty to get to and from classes easily. We currently ‘borrow’ office space from other departments to temporarily house science faculty at the Manono campus. Redesign of the Manono STEM Center will increase faculty offices that are close to the classrooms where science is offered and will place faculty closer to the students they are teaching. This will lead to increased faculty-student communication and to student retention.

Every faculty member should be assigned a laptop with up-to-date components that allows continued work from off-campus. Software should be provided that allows and encourages faculty to teach with modern tools.
In order to increase student retention in the program, we will continue to advocate for funding to hire and house science tutors and peer mentors on both campuses. Although we have access to online tutoring services, many students prefer meeting with a tutor face-to-face to discuss difficult-to-comprehend scientific subjects, and our ability to have stable tutoring services in science is critical to supporting student success in this program.

5. Resource Implications

Detail any resource requests, including reallocation of existing resources (physical, human, financial)

☐ I am NOT requesting additional resources for my program/unit.

- Physics lab at both Manono and Pālamanui campuses. [approx. $1,000,000]
- Prep room for the biology lab at the Manono campus. [approx. $200,000]
- Permanent positions for a lab coordinator on both campuses. [approx. $85,000 per year]
- Faculty position in physics [approx. $60,000 per year]
- Lab equipment and supplies for new and existing courses (physics, cell biology, etc.) [approx. $40,000 initial plus $8,000 annual replacement of supplies and consumables]
- Bi-annual conference registration and travel for faculty [approx. $25,000/year]
- Computer and software licenses for faculty [approx. $10,000 per year]