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CHECK BACK REGULARLY FOR COSMOS HANDBOOK UPDATES
WELCOME
Congratulations! We are pleased to welcome you to the COSMOS community and look forward to your arrival on July 9th. The faculty and staff have been busy preparing an exciting curriculum designed to sharpen your interest in science and mathematics and residential program to foster a comfortable and fun transition to your month away from home.

Over the course of the four weeks, we will open doors to a whole spectrum of research areas in math and science. We hope that you find many different subjects that intrigue you, as well as the specific area that you’ve chosen to explore in-depth. Take advantage of the chance to look at the stars with an astronomer, learn about cutting edge research from our distinguished lecturers, learn about science fairs and visit some industrial uses for math and science on your academic field trips.

COSMOS also has exciting social events and activities for you to engage in. Embrace this opportunity by becoming an active participant in your residential and academic communities.

We hope that this handbook answers most questions you have about life at COSMOS. Please feel free to direct any further inquiries to the office and we will be happy to assist you.

Sincerely,
Abigail Thompson
Program Director
Professor of Mathematics

COSMOS CONTACTS
We do our best to be available to families whenever possible. Please feel free to contact us via phone or email at any time. Voicemail messages left after 4:00 p.m. will be returned the following morning.

COSMOS OFFICE
Monday – Friday, 9:00 a.m. – 4:00 p.m.
1204 Mathematical Sciences Building
Phone: (530) 754-7326 – message only
Fax: (530) 754-7327
Email: cosmos@ucdavis.edu
Web: www.cosmos.ucdavis.edu

STAFF
Johnny Chavez
Program Manager
Phone: (530) 754-7325
Cell: (530) 551-3128
Email: jnychavez@ucdavis.edu

Abigail Thompson
Program Director & Mathematics Professor
Phone: (530) 754-7326 – message only
Email: cosmos@ucdavis.edu

RESIDENCE HALL
Tercero (do NOT send mail to this address)
TDB
Davis, CA 95616

Stefanie Smart, Program Coordinator/Resident Dean
Cell: (530) 551-3122
Fax: (530) 754-7327
Email: slsmart@ucdavis.edu

AFTER HOURS EMERGENCY
If you are not able to reach the Resident Dean, please call Johnny Chavez.

UC DAVIS CAMPUS CONTACTS
There are many other campus resources that will assist COSMOS if needed. A few include:
Student Health Center: (530) 752-2300
Police Department: (530) 752-1230
Fire Department: (530) 752-1236

This Handbook is designed for BOTH parents/guardians and students. We encourage you to review it together.
CHECK-IN & CHECK-OUT SCHEDULES

CHECK-IN DAY, SUNDAY, JULY 9, 2017
9:00 a.m. - 11:30 a.m.  Registration and residence hall check-in*  Parking Lot 47

9:00 - 9:45 a.m.  Check-in: Last names beginning with A - H
9:45 - 10:30 a.m.  Check-in: Last names beginning with I - Q
10:30 - 11:15 a.m.  Check-in: Last names beginning with R - Z

*Please note: there is no early check-in or dormitory access.

1. *First, find a parking place. Leave your things in the car until you’ve checked-in and received your room key and COSMOS materials.*

2. *Next, proceed to check-in at the Summer Conference Housing table located in front of the residence hall to receive your room key and meal card.*

3. *Then, register at the COSMOS table located next to the Summer Conference Housing table to pick-up your COSMOS specific materials.*

4. *Move your belongings in to your room.*

5. *Finally, proceed to the SEGUNDO Dining Commons (DC) where lunch is available. Students will use their meal card and will receive two additional meal tickets for parents/guests to dine in the DC. Additional meals for family members may be purchased at the DC for $13.00 per person.*

11:30 - 1:30 p.m.  Lunch  Segundo Dining Commons

- *This is when you say goodbye to your children, as they will be elsewhere during the parent/guardian orientation! Parents will not be allowed entrance into the dorms for the remainder of the program beginning at 12 noon.*

1:30 - 2:30 p.m.  Parent/Guardian Orientation  Activities & Recreation Center

This is a mandatory meeting for parents/guardians who attend Opening Day. During this meeting we will introduce faculty and staff, review important information, rules, procedures, and answer any questions you may have. Parents and families must depart campus by 3:00 p.m. so students may prepare for their first cluster meeting.

1:30 – 2:30 p.m.  Student Ice Breakers (Students Only)

This is a mandatory session for students. It is an opportunity to get to know other COSMOS students and Resident Assistants.

4:00 - 5:00 p.m.  COSMOS Town Hall Meeting (Students Only)

The town hall meeting is for students and Resident Assistants. We will go over COSMOS conduct policies, games, and skits.
CHECK-OUT DAY, SATURDAY, AUGUST 5, 2017

8:30 - 9:30 a.m.  Student Move-Out        Residence Hall
     Students must return their key to the Conference Housing desk PRIOR to the project viewing and buffet breakfast. If the key is not returned, students will be responsible for the cost of replacing the key.

9:30 - 10:45 a.m.  Project Viewing & Buffet Brunch    Mondavi Center
     Enjoy brunch while viewing displays and demonstrations of the students’ final projects.
     *Please do not plan to arrive earlier than 9:30.

10:45 a.m. - 11:45 a.m.  Closing Ceremony       Mondavi Center
     This special celebration will include presentation of certificates, cluster photos and slideshow. There is limited seating so we ask families to limit their guests to two people.
ARRIVAL & DEPARTURE INFORMATION

ARRIVING BY CAR

Driving Directions and Parking
From Sacramento:
- Travel West on Interstate 80 toward San Francisco.
- Take CA-113 North.
- Take Exit 27 and turn right onto Hutchison Dr.
- Turn right onto La Rue Rd.
- Lot 47 will be on your left (corner of La Rue Rd. and Bioletti Wy.)

From Bay Area:
- Travel East on Interstate 80 toward Sacramento.
- Take CA-113 North.
- Take Exit 27 and turn right onto Hutchison Dr.
- Turn right onto La Rue Rd.
- Lot 47 will be on your left (corner of La Rue Rd. and Bioletti Wy.)

Visitor Information
If you plan to spend a day or a night in Davis there are many places to stay, things to do, attractions to see, places to eat, etc. Please note that COSMOS does not endorse nor maintain any websites listed below. Links are provided solely for your convenience.

Yolo County Visitors Bureau: www.yolocvb.net/davis/
City of Davis: www.cityofdavis.org/visitors
UC Davis: Visiting UC Davis

ARRIVING BY AIR

Airport Shuttle
Some participants may need to fly into the Sacramento International Airport on Opening Day. In this case, COSMOS staff will either pick-up students from the airport or will arrange for a free shuttle for the student on July 9th. We will not make shuttle arrangements if you fly in to any other airport. We encourage you to make flight arrangements so that you arrive in the morning in time to check-in and participate in opening activities. Feel free to check with our office about appropriate arrival times. In order to secure a shuttle flight itineraries must be emailed to cosmos@ucdavis.edu NOT LATER THAN 5:00 p.m. JUNE 23. You will receive additional information the following week confirming the scheduled shuttle transportation.

We will also coordinate shuttles to the Sacramento International Airport for students to catch return flights home on August 5th. Please do not schedule a flight to leave from Sacramento prior to 2:00 p.m. on August 5th. If you have any questions please call and discuss your situation with us in advance.

Public Transportation Resources

Amtrak
1-800-872-7245
www.amtrak.com
840 2nd Street, Davis, CA 95616

Greyhound Bus Lines
1-800-229-9424
www.greyhound.com
840 2nd Street, Davis, CA 95616

We will also provide a shuttle from the Amtrak or Greyhound Bus stations on both opening and closing days. Please see the directions for the Airport Shuttle and follow the same steps to arrange for this transportation.
RESIDENTIAL LIVING

RESIDENTIAL STAFF
The residential staff consists of a Resident Dean, two Senior Resident Assistants, twelve Resident Advisors and an office assistant. All residential staff have completed a background check and gone through extensive training including First Aid and CPR and are able to respond to emergency situations, answer questions about college life and address student concerns.

RESIDENT DEAN
The Resident Dean (RD) has extensive experience with residential programs and campus resources. The RD supervises the senior resident assistant staff and works closely with COSMOS administration to ensure a supportive and safe residential experience. The RD is also the primary contact for all conduct issues. Our Resident Dean during COSMOS 2017 is Stefanie Smart. This is Stefanie’s third year serving as Resident Dean, but sixth year with the COSMOS program. She spent two years as Resident Assistant for Cluster 6: Mathematics and one year as Senior Resident Assistant. She is also a UC Davis graduate, having earned her bachelor’s degree in Spanish with minors in Mathematics and Education.

SENIOR RESIDENT ASSISTANTS
The Senior Resident Assistants (SRAs) have extensive experience with residential programs and are very familiar with campus resources. The SRAs supervise the resident assistant staff and work closely with the RD and COSMOS administration to ensure a supportive, safe, and enjoyable experience. COSMOS 2017 Senior Resident Assistants are Pavel Kuzkin and Gloria Marin. Pavel and Gloria both worked as Resident Assistants for COSMOS in 2016. They are both very excited for the program to start and look forward to providing one of the best experiences of your life.

RESIDENT ASSISTANTS
The Resident Assistants (RAs) are undergraduate students who have experience working with students and are familiar with campus resources; many have a science or math backgrounds. RAs will live with students in the residence hall, plan programs and activities, and accompany students to class and on all field trips and social outings. They will also help students feel comfortable living in the dorms by ensuring that COSMOS rules and procedures are followed and that issues are addressed right away. RAs are assigned to work closely with each cluster and will remain with those clusters throughout the program.
**Contacting Students**

**Mail**
Students love to receive mail and “care packages”! Family and friends should consider sending mail early in order for it to be received during the beginning of the program. Since all campus mail is sent to the same location, then distributed on particular days to the different departments, it may take more than a week for mail to reach the student. Keep this in mind when sending mail to students, especially if sending food. Please send all student mail to the following address:

*Student’s Name, Cluster Number*
COSMOS, UC Davis
1204 MSB
One Shields Avenue
Davis, CA 95616

**Email**
If you are unable to reach your student by email or phone parents are welcome to email the COSMOS office at cosmos@ucdavis.edu. We will relay critical information or a simple message to call home.

**Visiting Students**
COSMOS offers an intense academic and social experience. Not only will students be participating in classes and labs, but will also enjoy weekend and other recreational activities. In order for students to fully experience all educational and interpersonal opportunities, we have found it best to limit guest visits and short-term departures from the program.

Should you wish to visit your student, please understand family/guardians will NOT be allowed in to the residence halls. Our staff takes the safety and security of students VERY SERIOUSLY.

In order to accommodate visits, we allow parents and guardians to sign out their students between 10am and 4pm on Sundays. More information will be available during the Parent/Guardian Orientation on Opening Day.

**Family Leave Weekend**
July 21-23

Students may not leave the UC Davis campus during the program, except for COSMOS field trips/activities, and only on Family Leave Weekend if prearranged no less than 72 hours in advance. Students will only be released to parents or legal guardians, with advance written notice. Furthermore, participants may only leave campus between 6:00 and 8:00 p.m. on Friday and may only return on Sunday between 6:00 and 8:00 p.m.

Family Weekend is an optional activity and COSMOS staff will be on campus to supervise and provide programs for those students who will be staying on campus during the weekend.

In order to facilitate this process we have developed a procedure for checking students out and returning them to the program. The Permission for Family Leave Weekend form must be fully completed. This form may be found in the participant forms area.
We would prefer Family Leave Weekend be arranged prior to the students arrival on Sunday, July 9th; however, we will accept completed forms as long as they arrive prior to 72 hours before pick up. Understanding and coordinating the special circumstances for our students is an important ingredient to providing an appropriate level of supervision.

WHAT TO BRING
Being prepared for your month-long stay will lend to a positive experience away from home. Below is a list of items we suggest you pack or require for your participation. But first, things you need to know:

YOU NEED TO KNOW...

- If your medication requires refrigeration, you must arrange to bring a small refrigerator. Call the COSMOS office for more information.
- Photo IDs are REQUIRED for most academic outings. You may be denied admission without it. A secure safe to store passports or birth certificates will be available upon request.
- Computer lab and laptops will be available in the residence hall during evening and weekend lab hours to do your class work and take a few minutes to check email.
- Summer weather in Davis is typically hot with temperatures in the high 90’s or low 100’s. Bring clothing that will work for you in the heat.
- Laundry facilities are available in the residence hall.
- Prescription and over-the-counter medications must be in their original containers.
- Miscellaneous items such as apparel, sundries, school supplies and over-the-counter medications may be purchased at a local shopping center.
- COSMOS will provide a binder with dividers, paper, a pen and pencil. Students in Cluster 6 will be provided with calculators. Calculators are not required for other clusters.
- Bikes are STRONGLY RECOMMENDED. If you choose to bring a bike be sure to bring a sturdy lock such as a U-lock and a helmet.
- Bike rental information is below. COSMOS does not endorse or recommend any particular company nor maintain listed websites. Information is provided solely for participant and parent convenience. Advance reservations are strongly advised. Bike availability is extremely limited during the month of July. Some rentals will include a bike lock, license and delivery.

Davis Bike Rentals – davisbikerentals.com
UC Davis Bike Barn – bikebarn.ucdavis.edu
B & L Bike – bblbikeshop.com
Ken’s Bike & Ski – kensbikeski.com
ESSENTIALS

- Photo identification (REQUIRED), i.e. driver’s license, Passport, CA issued identification card or high school student ID.
- Medical Insurance card (REQUIRED)
- Walking shorts
- Jeans, slacks, pants, skirts
- T-shirts, blouses, button-down shirts
- Athletic clothing
- Sunglasses and Sunscreen
- Light jacket and/or sweatshirt
- Closed toe shoes (REQUIRED for labs and academic outings)
- Sandals and comfortable walking shoes
- Dressy clothes (for Closing Ceremony)
- Sleeping clothes
- Toiletries, i.e. toothbrush/paste, deodorant, shampoo/conditioner, razor, soap, etc.
- Laundry detergent
- Shower shoes, i.e. flip-flops
- Pool towel
- Prescription medication (REQUIRED to be in original bottle)
- Water bottle (preferably refillable)
- Padlock (RECOMMENDED for the Dining Commons)
- Backpack, notebook, pens/pencils
- Flashlight/headlamp/bike light

OPTIONAL OR RECOMMENDED ITEMS

- Bike or other non-motorized form of transportation (STRONGLY RECOMMENDED)
- U-lock bike lock (STRONGLY RECOMMENDED)
- Bike helmet (REQUIRED for bikes, skateboards, and scooters)
- Swimsuit / beach towel (room towels may not be used at the pool)
- Sun hat
- Extra blanket or comforter
- Pillow
- Musical instrument
- Books for reading pleasure
- Camera and batteries
- Laptop computer with lock/long Ethernet cable
- Cell phone or pre-paid phone card
- Small fan for your room
- Alarm clock
- Extra clothing hangers (some provided)
- Spending money (for laundry, vending machines, snacks, souvenirs, bookstore, etc.)
- Non-perishable snacks (candy, chips, granola bars, etc.)
- Sports equipment, i.e. basketball, football, goggles
- First Aid Kit (item ideas)
  - Aspirin / Ibuprofen
  - Band Aids
  - Hand sanitizer
  - Tweezers
  - Benadryl
  - Ace bandage
  - Cortisone cream
  - Triple antibiotic ointment

DO NOT BRING

- Low-cut or revealing clothing
- Clothing with inappropriate language or artwork
- Cars
- Pets
- Valuables
- Weapons, fireworks, explosives, candles or incense
- Illegal drugs, alcohol or tobacco

NOTE: The University and COSMOS will not be responsible for lost or stolen items in the residence halls!
RESIDENCE HALL
During the four weeks at COSMOS, students will be staying the Tercero Housing Area. Males and females will be housed on separate resident floors. Students are roomed by age and information provided on student’s Residential Questionnaire, and typically housed with a student from a different cluster.

All rooms are air conditioned and carpeted. Visit UC Davis Tercero housing area.

UC Davis is a large sprawling campus. Classes and activities will be spread throughout campus and the surrounding Davis Area. For this reason we strongly recommend a non-motorized transportation (see Bicycles and other non-motorized transportation on this page).

NOTE: electric cooking appliances are prohibited in the residence halls.

MEALS
All student meals will be provided in the Segundo Dining Commons (DC.) The dining commons provide a wide range of choices for meals including a variety of entrees, a salad bar, fresh fruits, desserts, and assorted beverage options. Vegetarian and vegan options are available at every meal. Contact the COSMOS staff to arrange for special dietary needs. Visit Segundo Dining Services for the weekly menu.

When you arrive at COSMOS, you will be issued a meal card. You must have this card with you in order to enter the dining room. A $10 fee will be charged if you lose your meal card. You must wear appropriate attire in the dining room. Backpacks and other large containers are permitted inside the DC, however you can bring a padlock to secure items in lockers outside of the DC.

ROOM KEYS
Students will be issued a key upon check-in on July 9th. Sharing or lending keys with anyone other than the person to whom it was assigned is prohibited. A $50 fee will be charged to any student who loses or neglects to return their key upon check-out. If you lose your key during the program you will have

LAUNDRY
Card-operated washing machines and dryers are available in the residence hall. Students will be provided with a laundry card at check-in, pre-loaded to allow you one use of a washer and dryer. Money may be added to laundry cards in the Cuarto Area Service Desk in Thoreau. Washers cost $1.00 and dryers cost $0.75. Detergent is available for purchase in the laundry room, but we recommend students bring their own. A few irons are available for use at no cost. A limited number of clothes hangers are also available. We recommend you bring some of your own.

LINENS
Linens will be provided during your stay. Towels and sheets will be in your room when you arrive and you may exchange your linens once a week. Towels and sheets may only be exchanged once weekly unless there is an emergency. For your comfort you may want to bring an extra towel, blanket and pillow cases along with a comforter for your bed.

CLEANING
Every student is responsible for keeping their room clean. Cleaning supplies and a vacuum cleaner are available to check out from the Resident Halls Staff Office.

BICYCLES AND OTHER NON-MOTORIZED TRANSPORTATION
COSMOS highly recommends that students bring some sort of non-motorized transportation. Designated as the home of the US Bicycling Hall of Fame in 2009, Davis has hundreds of miles of bike paths, and bicycles are UCD students’ primary choice of transportation. COSMOS students will be housed off-campus, and the Davis campus is a large sprawling campus. Students will visit all areas.

If students bring a bike, you have it licensed (your city/county license is acceptable on campus) and all students must bring and wear a helmet. Bicycle licenses will be available for purchase on opening day or the next day. In addition, a strong U-style bike lock is recommended.

If students prefer to rent a bike while at COSMOS
to pay Conference Housing directly to be issued a replacement key. Keys must be returned to Conference Housing on the last day of the program BEFORE proceeding to the Activities and Recreation Center for the Closing event.

**SAFETY & SECURITY**

Every resident is issued a key to the building. The key will open the outside entrance doors of the residence hall. **If you lose your key to the building, you must contact your Resident Assistant. You will have to pay a $50 fee to get a replacement key.** Exterior doors of the residence hall are locked at all times. Your key is needed to enter the building. Students should carry their keys at all times. **Do not allow anyone you don’t know to enter your building at any time.**

Should you wish to visit your student, please understand family/guardians will NOT be allowed in the residence hall. Any exception must be arranged with COSMOS staff in advance. Our staff take the safety and security of students VERY SERIOUSLY.

We encourage you to leave valuables such as expensive jewelry or substantial amounts of cash at home. You will not need money for anything other than souvenirs and incidentals. If you have a credit card or bank card, it is recommended that you bring one, as opposed to large amounts of cash. There are several ATM’s on campus a list can be found here: [cashier.ucdavis.edu/services/atm.cfm](http://cashier.ucdavis.edu/services/atm.cfm). While residence hall security is rarely a problem, it is always better to be safe than sorry!

As provided by the [Jeanne Clery Disclosure of Campus Security Policy and Campus Crime Statistics Act of 1998](https://www.ncsclery.org/), you are entitled to request and receive a copy of the Security Report for the University of California, Davis campus. The report includes statistics for the past three years concerning crimes and incidents reported to campus security authorities and is available at [UC Davis Clery Statistics](https://www.ucdavis.edu/security/clery STATISTICS). You may also obtain the above information by submitting a written request to the UC Davis Information Practices Officer, University of California, Davis, One Shields Avenue, Davis,

refer to one of the businesses below. COSMOS does not endorse or recommend any particular company nor maintain listed websites. Information is provided solely for participant and parent convenience. Advance reservations are strongly advised by or before June 1. Bike availability is extremely limited during the month of July. Some rentals will include a bike lock, license and delivery.

- Davis Bike Rentals – [davisbikerentals.com](http://davisbikerentals.com)
- UC Davis Bike Barn – [bikebarn.ucdavis.edu](http://bikebarn.ucdavis.edu)
- B & L Bike – [blbikeshop.com/rentals](http://blbikeshop.com/rentals)
- Ken’s Bike & Ski – [kensbikeski.com/rentals](http://kensbikeski.com/rentals)

**COMPUTER ACCESS**

Computers are not required at COSMOS, but you may bring a laptop if you wish. A wireless computer lab with a limited number of computers will be available in the residence hall. There are hard wire internet connections in the dorm rooms. So, bring appropriate cables if you bring your own laptop.

Each student must register on the campus network in order to access the internet and wireless connections. A brief workshop will be held in the resident hall to provide direction and assistance.

Students will also be assigned a UC Davis computing account. Instructions on how to do so will be made available prior to the start of the program. Additionally, each student and parent must read and sign an [Acceptable Use Policy](https://www.ucdavis.edu/security/clery STATISTICS) before a student is granted access.

The COSMOS computer lab will have limited open-lab hours. However, additional computer labs are available around campus for student use. Locations and hours of operation will be available in each student’s binder.

**MUSIC ROOM**

Students who would like to bring a musical instrument to campus may arrange for a room to practice. Please let your RA know if you need to practice, so we can help assign a time and location.
California 95616. The report also provides campus policies and practices concerning security - how to report sexual assault and other crimes, crime prevention efforts, policies/laws governing alcohol and drugs, victims’ assistance programs, student discipline, campus resources, and other matters.

**Quiet and Courtesy Hours**
Quiet hours will be in place from 9 p.m. to 7 a.m. every day. All other times will be courtesy hours; this means you will be expected to make sure you are not disturbing others. Courtesy and quiet hours will be discussed in more detail at the Town Hall meeting.

**Curfews, Signing In & Out, and Name Tags**
Students are required to wear a COSMOS nametag at all times. You will be expected to sign in and out of the residence halls if you have to leave for any reason. We will expect you to use a buddy system or have an RA accompany you when you leave the hall. In all cases, you will be expected to be in the residence hall and on your assigned floor no later than 9:00 p.m. every night, unless other arrangements have been made with staff. Specific details about these procedures will be discussed at your first residence hall meeting.

**Student Health**
COSMOS staff promote and encourage healthy habits and behaviors of students. Students are reminded daily to eat well, get plenty of sleep, stay hydrated and wear sunscreen.

However, should a student become injured or experience an illness COSMOS staff will take quick action. Although an attempt to contact parents/guardians before any treatment is sought, all students must have a Confidential Health History and Authorization to Treat form on file with COSMOS. Monday thru Friday during regular business hours students will be taken the UC Davis Cowell Student Health Center. If it is after hours or on a weekend students will be taken the nearest Emergency Room or Urgent Care.

Students are asked to maintain their personal health insurance during the program. Accident Only Statewide Camper’s Insurance is secured for

**Religious Services**
Students who would like to attend religious services will be provided a shuttle by COSMOS staff to local places of worship. Please let your RA know if you require this service.

**Recreation**
If you like to swim, we encourage you to bring a swimsuit. UCD has a beautiful [recreational swimming pool](#) with lap lanes available to COSMOS students as part of their housing package. We expect that the swimsuit you bring will be appropriate for an academic community.

COSMOS students have the privilege of using UC Davis’ Outdoor basketball and tennis courts which are also available for you to use.

**Homesickness**
For many students attending COSMOS this may be their first time away from home. Students will experience everything from a new town and dorm life to new people and different food to a structured schedule and unfamiliar academic demands. It is normal for students to feel homesick. Our trained residential staff will watch for behaviors and symptoms that may indicate a student is homesick, and will use strategies to help them get through it.

While it can be extremely difficult, please do not respond to your student’s "rescue call" by coming to campus to talk them into staying. Once a student sees a ride home, there is rarely any turning back. If you are concerned about your student's homesickness, please call a COSMOS staff member so that we can discuss different options. While it may be best for the student to go home in the end, we prefer to try other strategies first.
all COSMOS students should they become ill or injured during the program. Families will be billed for visits to any medical facility on-or-off campus. This coverage will reimburse out-of-pocket medical expenses not paid by your insurance.

**Evening Activities**
Every evening, the Residential Advising staff will organize activities intended to give students a chance to get to know other students, get some exercise, and have some fun! Watch for the signs in the residence hall announcing Hip Hop dancing, Downtown Davis Farmer’s Market, Music on the Quad, Talent Show, Scavenger Hunts, COSMOS Jeopardy and the Closing Social.

**Saturday Outings**
During the COSMOS program, we have planned three weekend all-cluster outings. Admission and meals for weekend activities are included for all students.

Saturday, July 15th
UC Davis Recreation Pool

Saturday, July 22th
San Francisco, Pier 39 and Bay Cruise
www.pier39.com
Red and White Fleet

Saturday, July 29th
California State Fair

**Academics**

**Overview**

**Mission**
The mission of COSMOS is to motivate the most creative minds of the new generation of prospective scientists, engineers, and mathematicians who will become leaders for California, the nation, and the world. The program aims to create a community of students who participate in and contribute to an intensive academic experience delivered by distinguished educators and scholars.

**Academic Outings**
Most clusters schedule weekly outings that complement classroom learning. The UC Davis region is rich with resources and access to leaders in industry, internationally recognized research facilities and laboratories, and science centers. Outings expose students to how math and science are applied in these settings. Generally, academic outings are scheduled on Tuesdays and Thursdays. Past outings have included JGI, Affymetrix,
**History**
The State of California Education Code requests the Regents of the University of California to provide an opportunity for students who wish to learn advanced mathematics and science and to prepare for careers in these areas. The California State Summer School for Mathematics & Science is modeled after the California State Summer School for the Arts. COSMOS is made possible by the California Assembly Bill 2536 (Statutes of 1998). No exams, grades or credit are given. UC Davis's inaugural program was held summer 2001.

**Curriculum**
COSMOS curriculum is dependent upon faculty involvement and availability, and therefore may vary from year to year. Each cluster consists of a pair of related science, math or engineering courses and a third course in writing and communication. On average, each cluster admits 20 students with the exception of the Biomedical Sciences course which admits 40 students. All students will engage in interactive, hands-on curriculum in university laboratories and research facilities. Distinguished faculty, researchers and industry leaders are often invited as guest lecturers.

**Writing and Communication Course**
It is important that students who pursue STEM fields are proficient in technical reading and writing as well as able to speak academic language. It is vital to their success. At COSMOS a Writing and Communication course is taught twice-weekly by Teacher Fellows. Students will learn how to articulate concepts and vocabulary relevant to their cluster topic. They will also develop skill in writing succinct technical abstracts.

**Final Project**
All COSMOS students are expected to complete a final research project assigned by the core course instructor which will be displayed at the COSMOS closing event.

**Saturday Field Trips**
Students who stay on campus during weekends will attend an off-campus field trip on Saturdays. There is no additional fee although students may want to bring spending money for souvenirs. Saturday field trips scheduled for COSMOS 2017 are the Recreation Pool on the UC Davis campus, San Francisco bay cruise and Pier 39, and the California State Fair.

**Study Time and Homework**
Sunday through Friday evenings, time is set aside for independent study. Students may study in small groups or on their own. While students may have the option of going to the library during this time, computer labs and laptops are available for students to do class work in the residence halls.

**Computer Access**
Computers are not required at COSMOS, but you may bring a laptop if you wish. A computer lab with a limited number of computers will be available in the residence hall. There are hard wire internet connections in the dorm rooms. So, bring appropriate cables if you bring your own laptop.

Each student must register on the campus network in order to access the internet and wireless connections. Instructions on how to do so will be made available prior to the start of the program. Additionally, each student and parent must read and sign an Acceptable Use Policy before a student is granted access.

The COSMOS computer lab will have limited open-lab hours. However, additional computer labs are available around campus for student use. Locations and hours of operation will be available in each student’s binder.

**Distinguished Lecture Series**
The Distinguished Lecture Series (DLS) is designed to introduce students to outstanding scientific and mathematical research by inviting leading researchers to speak to the COSMOS community. More information about the 2016 DLS will be posted at [www.cosmos.ucdavis.edu/Academics.html](http://www.cosmos.ucdavis.edu/Academics.html).
Students will work in pairs or small groups to produce an inquiry-based final project. Final projects are often presented in the form of a poster which displays the project description, hypothesis, methods used, results and recommendations. Students will articulate their findings to faculty and peers during the last week of the program. Final projects must be completed by the last Thursday of the program to receive a certificate of completion.

**Library Access**
Students will have access to campus libraries and will learn more about how to access it when they meet with their Teacher Fellow.

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**Weekly Schedule**
Each cluster has unique plans for its students, so this schedule may vary. Students will receive a schedule specifically designed for their cluster in their student binder upon arrival. Faculty will, however, provide specific information about laboratory work, field trips, and other special activities. Meals will be arranged through campus food service when students are on a field trip away from campus.

In addition to cluster activities, there will also be guest speakers and three weekend outings for all COSMOS participants. A schedule of weekend activities can be found on page 22.

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Clusters and Courses

Cluster 1: Quantum Mechanics and Applications to Nanotechnology

Courses (4 weeks)

Is it a particle? Is it a wave? It’s both – when we talk about either an electron or light. Electrons can behave like waves when they are scattered by an ordered array of atoms in a crystal. The photoelectric effect can only be explained if light can also behave like particles, called photons. Quantum mechanics explains these phenomena and is the fundamental description of how matter behaves at very short distances. Hence, it contains the principles needed to understand fields from solid state physics to electronics and biology. It explains many properties of atoms, such as chemical bonds and how the periodic table of elements works. In the first course of the cluster, students will learn some of the basic principles behind the experiments in the second course.

Computations of Quantum Phenomena

The basic equations of quantum mechanics involve quite sophisticated mathematics. Fortunately, they can also be solved with some fairly simple computer programs. This portion of the cluster will begin with an introduction to the elements of programming in C which are needed to do quantum mechanics on a computer. (No previous programming experience will be assumed.) Along the way we will also learn the Linux operating system. By the end of the month, each student will write programs that illustrate how an electron’s location involves a probability of being at a range of positions, rather than a precise value. Using the computer, students will calculate the spreading of the range of positions as time passes. They will also be able to compute the energy levels of some simple quantum mechanical systems.

Core Course: Quantum Physics Experiments and Applications to Nanotechnology

Each student will learn basic electronics to do quantum physics experiments. Students will use modern scientific instruments to measure the speed of electromagnetic pulses on a cable and also the energies corresponding to the band gaps for light-emitting diodes (LEDs) of different colors. (The inventors of blue LEDs recently won the 2014 Nobel Prize in Physics.) For the final project, small groups of students will work together to construct several scanning tunneling microscopes (STMs). An STM is an instrument that uses quantum mechanical tunneling to make images of individual atoms on the surface of a conducting solid. Students will use a small computer programmed in C to control their experimental apparatus in real-time. In addition, quantum mechanical ideas will be used to explain phenomena such as properties of crystalline solids, how lasers work, and how to detect single photons. Several distinguished faculty will give guest lectures connecting quantum mechanical ideas to their current research on nanotechnology and nanomaterials.

Instructors

Shirley Chiang and Richard Scalettar

Dr. Scalettar received his B.S. from the University of California, Irvine and his Ph.D. from the University of California, Santa Barbara. After a post-doctoral position in the Chemistry department at the University of Illinois, he joined the Physics faculty as a Professor at UC Davis in 1989. Professor Scalettar’s primary research interests are in the magnetic and super conducting properties of solids, which he studies using quantum Monte Carlo simulations. He is the chairman of the Steering Committee of a campus program involving students in research and has been a mentor in the Office of Naval Research High School Apprenticeship Program.
Cluster 2: Physics & Engineering: From the scientific method to technological applications

Core Course

The Foundation of Modern Science
This section will explore the evolution of man's understanding of the rational world, from the ancient Greeks to Newton's equations of motion. We illuminate how simple observations can produce remarkable revelations of the world around us, and how theoretical abstractions can be combined with observations to provide reliable and important explanations and predictions that can be used in science and technology. We will investigate the foundations of western scientific techniques in physical science; explore how and why we have come to develop the "scientific method" of proving and disproving hypotheses; what it means to do basic and applied research; and how the principles of Newtonian mechanics, quantum mechanics, and special relativity are directly linked to the centerpiece of the Cluster: The relationships between observation/experiment, physics models, and technology.

Nuclear Materials and their Applications
As an important application of the interplay between science and technology, we review the workings and technological opportunities of nuclear materials. Based on high-school curriculum in mathematics and physics, students are presented with a straightforward understanding of important concepts, such as fission and fusion as well as critical mass and enrichment of fissile materials that lead to applications, e.g., in nuclear power on both very long and very short time scales. Through this, we also discuss the necessities of a multiple of physical principles, from classical to quantum and relativistic mechanics, and the inevitability of the different theories is clarified through direct calculations and physical reasoning. We anticipate visiting relevant locations, including McClellan Nuclear Reactor facility in Sacramento.

Electro-optics and Optical Communications
Electro-optics, the branch of science dedicated to the study of the effect of electric fields on light and on the optical properties of substances, has enabled unparalleled speed and reliability for every day communications. As its name implies the discipline combines the utilization of optics and electronics. In this cluster, we will investigate the theory and practice that enable the transmission of information through a fiber-optic communication link. Lecture time will examine the fundamentals of propagation of electromagnetic waves, reflection, refraction, waveguides, interferometry and lasers. In addition, lectures will provide a review of the fundamentals of analog and digital circuits.

Instructors
Niels Gronbech Jensen and Diego Yankelevich

Dr. Jensen is a Professor in the Department of Applied Science at UC Davis and a faculty scientist at Lawrence Berkeley National Laboratory. Prior to his current appointments, he worked in the Theoretical Division at Los Alamos National Laboratory. He earned a Ph.D. in Physics from The Technical University of Denmark in 1991. His research interests include dynamical and statistical systems, molecular and atomic scale modeling of materials, soft materials and biomolecules, complex fluids, vortex systems, and any other system that may show how important the discrete molecular scale is to macroscopic observables.

Dr. Yankelevich is an Adjunct Professor in the Department of Electrical and Computing Engineering at UC Davis. Prior to his current appointment, he was a Professor in the Applied Optics Department at CICESE in Ensenada, Mexico. He earned his Ph.D. in electrical engineering from UC Davis. During the last nineteen years he has worked in the photonics field. His research includes nonlinear optical polymers, optical fiber RF modulators, ultrashort-pulse second-harmonic microscopy and sum-frequency spectroscopy of biological molecules.
Cluster 3: Introduction to Engineering Mechanics
What Makes Airplanes Fly?
This section will cover airplane configuration and properties of air as well as characteristics of wing selection, lift generation and dependence on angle of attack. Three dimensional effects in terms of Aspect Ratios, compressibility effects in terms of Mach numbers, viscous effects in terms of Reynolds numbers, and stability of airplanes will also be discussed. In addition to discussions and computer assignments, planned activities include smoke and water tunnel experiments to demonstrate tip vortex, flying airplane models, and visiting the United Airlines Engine Center in San Francisco and McClellan Airforce Museum in Sacramento.

Satellites & Rocket Science
This section will introduce students to Orbital Mechanics and the two-body problem. Trajectories of satellites in terms of conic sections, thrust generation, and derivation of the Rocket Equation as well as Launch Vehicle Dynamics will be covered. This course will also discuss flow through convergent-divergent nozzles, transfer of internal energy to kinetic energy, and both solid and liquid propellant rocket engines. Planned activities include experiments using a water table to demonstrate wave patterns analogous to shock waves in supersonic flows, flying model rockets, and planned outings to Space Camp at NASA AMES Research Center in Moffett Field.

Sensors, Actuators, & Smart Machinery
As a result of the computing revolution, we are surrounded by microprocessors: in cars, aircraft, hospitals – even in our washing machines. For these microprocessors to perform a useful task in a real-world application, they must be connected to sensors that allow them to collect information, and actuators that allow them to act on their surroundings. Sensors perform the vital task of taking physical information and converting it into an electrical signal that can be recorded or processed. Actuators convert electrical signals into physical actions, such as opening a valve or rotating a control rudder. Sensors and computer control systems help to keep our houses temperature controlled and make sure that the air-bag deploys at precisely the right moment (and not when we drive over a pot hole).

This course will cover the technology used to make sensors and actuators. Students will learn how these devices work and how they are constructed. Students will experiment with sensors for basic parameters such as temperature, pressure, acceleration, and position. Fundamental concepts such as sensitivity, resolution, and accuracy will be introduced. Finally, the methods used to design computer controlled machinery will be described.

Future Cars
This section will cover car components (body, engine and fluids), including basic statics, strength of 10 materials, car dynamics, vibrations, stability, and control. A study of the various types of vehicles will also be conducted including vehicles powered by internal combustion, fuel cells, hydrogen, electrical, and hybrid engines. Activities include racing remote control cars and visiting the Mercedes Center in Sacramento.

Instructors
Mohammed Hafez
Dr. Hafez holds a B.S. in Aeronautical Engineering from Cairo University; he earned a M.S. in Aerospace Engineering from the University of Southern California, a Ph.D. in Aerospace Engineering from the University of Southern California and a M.S. in Mathematics from the University of Southern California. Dr. Hafez is a Professor of Aeronautical Engineering in the department of Mechanical and Aeronautical Engineering at UC Davis.
Cluster 4: Introduction to Astrophysics

This cluster consists of three interrelated core courses that will be taught throughout the duration of the cluster. The courses are: “Foundations of Astronomy”, “Star and Planet Formation and Evolution”, and "Intro to Cosmology". These courses are intended to provide students with a good background in some of the most important aspects of astrophysics, and then to apply this knowledge to some of the most interesting recent discoveries in the field. In addition, the students will work on research projects in astrophysics.

Courses

Foundations of Astronomy
There are some key ideas that every astronomer needs to know, and this course will cover those core concepts. We will discuss the basics of how telescopes work and why different kinds of telescopes are important for different applications. We'll also talk about how astronomers use various types of detectors to measure different frequencies of light, from radio waves all the way up to gamma rays. Students will also learn important astronomy terminology and basic measurement concepts, such as the magnitude system. We will talk about how the sky moves, how astronomers find particular objects in the sky, and the basic methods used to determine the distance to different astronomical objects, a fundamental measurement in astronomy and cosmology. This course will give students a solid grasp of the practical steps necessary to turn light from the sky into a meaningful measurement that tells us about the Universe.

Star and Planet Formation and Evolution
We will examine aspects of the formation and evolution of stars and associated planetary systems from the initial collapse of interstellar gas to the likely consequences as stars no longer fuse hydrogen in their cores. We will discuss methods for detecting and studying pre-stellar material, disks around stars, and planets around stars. This will include discussion of what we know about the chemical makeup of stars and planets of various types.

Introduction to Cosmology
How did the Universe begin? Will it ever end? Are there other universes out there? In this class we will discuss the evidence for the expansion of the Universe, the Big Bang, Dark Matter and Dark Energy, and explore what our current understanding of those implies for the ultimate fate of the Universe.

Topics in Contemporary Astronomy
This course will feature lectures in selected areas of contemporary astronomy, focusing on the cutting edge of modern science. Topics will include the search for extra-solar planets, the astrophysics of active galactic nuclei, theory and observation of gamma ray bursters, and the evolution of galaxies in the universe. These topics will build upon the concepts introduced in the Light, Gravity, and Cosmology courses.

Instructors
Chris Fassnacht, Stefano Valenti, Matt Richter, and Tucker Jones
Cluster 5: Computers in Biophysics and Robotics

Random Walks From Physics to Biology
We know that everything, living or nonliving, is made out of molecules. Molecules are random walkers with very little memory that keep bumping into each other and changing their trajectory, shape and even their chemical identity. Their behavior is subject to the most fundamental law of nature known as the 'Second Law of Thermodynamics', which precludes them from having the magical ability to move in one special direction as opposed to another. How, then, does a collection of such random walkers assemble into incredibly organized and precise molecular machines that make a living system function? In this course we will learn how to describe random walkers. We will learn how their behavior can be influenced by other structures, such as obstacles or mountains and valleys. We will learn how a large collection of random walkers can collectively act in deterministic ways and accomplish precise tasks. We will introduce basic ideas of probability theory and computer programming to set up the concepts and apply them to problems from cell biology.

Computer Science - Intro to Robotics
This course is an informal introduction to computer science using Lego Mindstorm™ robots. The course teaches the basics of a first semester college computer science course, using NXC, a variant of the C programming language, developed for the Lego robots by Dave Baum. Standard programming concepts covered include: variables, loops, arithmetic functions, function calls, data/file manipulation, and random number generation. In addition, mechanical aspects of the robot such as the building bumpers and feelers, playing sounds, locomotion, gears, pulleys, and communication will be covered. Since programs for the robot are written on a personal computer (and then downloaded to the robot via an infra-red port), students will also learn the basics of the Unix operating system (either Linux or OS X) running on the personal computers. Each student in the course will be assigned their own robot for the duration of the course. This course will focus on the basics of designing, building, and programming the robots.

Instructors
Ali Dad-del and Rajiv Singh

Dr. Dad-del received his Ph.D. in Mathematics from the University of California, Davis. Dr. Dad-del’s primary research interests are covering and tiling of n-dimensional spaces with star-shape objects called crosses and semi-crosses. He is also interested in teaching, in particular, in utilizing technology and history in teaching mathematics. He is a Lecturer and Assistant for undergraduate mathematics majors in the Department of Mathematics.

Dr. Singh received his Ph.D. from State University of New York, Stony Brook in 1986. His research interests include theoretical condensed matter physics, statistical mechanics, biophysics; magnetism; superconductivity; phase transitions and critical phenomena; Prion diseases; DNA damage and repair; gene expression; Bioinformatics. Dr. Singh was a Gordon Godfrey Visiting Fellow at the University of New South Wales, Sydney in 1995, 1998 and 2002. He is currently a Professor in the Physics Department at UC Davis.
Cluster 6: Mathematics

This cluster is designed to introduce students with a strong interest in mathematics to several different advanced topics. Many of these topics would ordinarily only be seen at the advanced undergraduate level, but all lend themselves to an introductory course at the high school level. No prior experience in any of these topics is expected, but enthusiasm for and interest in mathematics is essential.

**Combinatorics**
Enumerative combinatorics provides a way to count in complicated mathematical settings, and we will learn several important counting techniques in this course. In addition, we will learn some related ideas in elementary probability and number theory. The following is an example of a combinatorics problem that we will encounter in our four-week journey through this interesting area of mathematics:

If a teacher returns a test to her class of 10 students at random, what is the probability that no student gets his or her own test?

**Symmetry**
One can analyse images and shapes in terms of their symmetrically repeating patterns. A symmetry of a geometric figure is a motion which does not change the figure's appearance. These motions form a group in the mathematical sense, because if one such motion is followed by another, the combined motion also does not change the figure's appearance. We will study point groups of motions which keep a figure's center fixed. For example, the symmetry group of a square has 8 motions: the rotations of 0, 90, 180, and 270 degrees about the center (the first of these does not actually move anything), and the reflections in the horizontal line, the vertical line, and the two diagonal lines through the center. We will also look at point groups for 3D figures, for example, of a soccer ball sewn from twelve black pentagons and twenty white hexagons, or a baseball cover sewn from two leather pieces along a curved line.

We will study frieze groups for repeating patterns along a strip, "wallpaper" groups for patterns repeating along two directions in a plane, and space groups for repeating patterns in space, which appear in crystals. Along the way, we will study regular and semi-regular polyhedra (3D shapes bounded by flat regular polygon faces), kaleidoscopic patterns generated by mirrors, and tilings which fill a plane by regular polygons, or by identically shaped tiles.

**Introduction to Graph Theory**
A graph is a collection of points, called vertices, connected by edges. Using graphs to describe information has applications from scheduling tournaments to cryptography. We’ll look some of the at the basics of graph theory, including graph coloring problems, Euler’s formula for graphs on surfaces, and graph planarity. Klein bottles will make a guest appearance when we look at graphs on non-orientable surfaces.

**Instructors**

*Abigail Thompson, Lawrence Marx, Nelson Max, and Bradley Ballinger*

Dr. Marx received his Ph.D. in Mathematics from the University of Minnesota in the field of commutative algebra. He was an instructor for five years at LSU, and since 1984 he has been teaching undergraduate mathematics at UC Davis. I

Nelson Max received his Ph.D. in Mathematics from Harvard University in 1967. Professor Max's research interests are in the areas of scientific visualization, computer animation, realistic computer graphics rendering, and multi-view stereo reconstruction. In visualization he works on molecular graphics, and volume and flow visualization, particularly on irregular finite element meshes.
Cluster 7: Biomedical Sciences

Medical & Veterinary Responses to Infectious Diseases
Bacteria, viruses, fungi, and parasites far outnumber the human and animal inhabitants of planet earth. Most of these microbes are innocent grazers and bystanders and generally do us no harm. Some are even beneficial like those used in making bread, yogurt, cheese, etc. Those that cause disease, although in the minority, occupy a large part of a physician’s or a veterinarian’s professional career. This course will provide hands-on experience in identifying and characterizing disease-causing agents of humans and animals. Students will play the role of doctor, veterinarian, or research scientist in learning the diagnosis and treatment of selected infectious agents. Students will read X-rays, study anatomy and pathology specimens, observe surgical procedures, and learn how antibiotics work and observe their effect on pathogens. Typical field trips include visits and tours of the UC Davis Veterinary Medicine Teaching Hospital, the UC Davis Medical Hospital, the Primate Center, Raptor Center, Equine Center, the Center for Companion Animal Health, and the Center for Comparative Medicine. Guest speakers representing the broad diversity of specialty careers within these professions will present talks and answer questions.

Veterinary Medicine
Infectious diseases of importance in veterinary medicine will be investigated. Students will participate in diagnosing, identifying, and determining the proper management and treatment of these pathogens. In addition, students will demonstrate microbiology techniques used in clinical laboratory diagnostics with hands on participation. Students will tackle actual clinical case projects combining radiology, and infectious diseases.

Human Medicine
This course will focus on infectious disease agents of the human host. Students will utilize and refine the techniques described in supplementary course B1 with exposure to differences and similarities used in human medicine diagnostics and treatment regimes for pathogens. Students will create a life size human subject determined by measuring a single bone from the human body. The students will also draw to scale the circulatory system, digestive tract, and vital organs.

Instructor
Rance LeFebvre

Dr. LeFebvre is a Professor in the School of Veterinary Medicine in the Department of Pathology, Microbiology, and Immunology. His research interests are the study of infectious disease agents of humans and animals with a focus on spirochetal pathogens such as the agent that causes Lyme disease, and leptospirosis. Preventing and diagnosing these diseases is difficult at best and his laboratory is using molecular and biochemical tools to address these issues. He is responsible for the instruction of an undergraduate Medical Microbiology class, which emphasizes infectious diseases of humans. He is also the instructor of record for the Veterinary Microbiology course taught to the second year veterinary students here at UC Davis. Dr. LeFebvre was just named Associate Dean for Student Programs within the School of Veterinary Medicine.
Cluster 8: Chemistry of Everyday Life

A Molecular-level Understanding of Nanomaterials, Biomolecules and Drug Design
In this cluster we will introduce the origins of bonding and the interactions between molecules that give rise to particular physical properties of everyday and novel materials, biomolecules and for the design of pharmaceutical agents for improved health. An introduction to physical, organic, biological and inorganic chemistry will be followed by hands-on experience in computer modeling and laboratory experiments, as well as projects within and across the areas outlined below.

Organic Molecules: Nature’s Building Blocks and Drug Design
Organic molecules – proteins, carbohydrates, fats, etc – are the basic construction materials for all life forms. Organic chemists spend their careers making, breaking, analyzing, and thinking about them. We will introduce how chemists interact with nature's building blocks in the lab, with molecular models, and on paper, to show how chemistry is applied to solve real-world problems in the fields of pharmaceuticals, energy, and materials science. An emphasis will be placed the importance of the three-dimensional shape of molecules and how this property influences biological activity and the ability to treat diseases. We will discuss the organic chemistry of pharmaceutical molecules and specific drug-protein interactions that help us understand their mechanisms of action. Labs will involve chemical synthesis, renewable chemistry, and the application of computer modeling techniques to the design of new medicinal compounds.

What Is the Nano Hype and Why?
You must have heard of nanorobots that would one day enter your body and detect and fix all the problems. These machineries are being investigated, although the delivery date is still highly uncertain. We will discuss a few fundamental building blocks of these nanomachineries. They are nanoparticles, nanotubes, and nanowires, all of which are being used in less sophisticated but nonetheless important applications such as next generation energy sources, drug delivery vehicles, and cell and tissue imaging. Typical labs include synthesis of nanoparticles of different types and sizes, characterization, and data analysis.

An Atomic-Level View of the Proteins that Make Us Tick
We will cover the fundamental principles of molecular interactions that will enable us understand the physical properties of chemical and biological systems. Computational modeling will be used to offer an atomic-level view for a range of important proteins. For example, we will investigate ion channels that are tiny biological transistors that make us living, thinking creatures. Labs will involve building and simulating the movements of various biomolecules on desktops and in 3D visualization facilities. We seek a deeper understanding of how a protein’s structure relates to its function for future medical discoveries.

Instructors
Mark Mascal, Jesus Velasquez, & Alexander Dudnik
Cluster 9: Mathematical Modeling of Biological Systems

*Dynamics of Biological Systems: Patterns in Time and Space*
Most biological systems are dynamic, producing fascinating patterns in both time and space. Examples include outbreaks of epidemics, the development of spots on a leopard, the synchronization of flashing fireflies, and pathological rhythms in the heart. Identifying the mechanisms that underlie the “spatio-temporal” dynamics of biological systems can not only lead to better understanding of natural phenomena but also help us to design more effective interventions when necessary. Mathematical modeling plays a fundamental role in identifying these mechanisms. In this course, students will use computer simulation and mathematical analysis to explore the dynamics in models of a variety of biological processes and to gain insight into the mechanisms that produce complex temporal and spatial patterns.

*Networks and Games in Biology*
Biological systems often involve many interacting components that form complex networks. These networks occur at all biological scales ranging from genes to ecosystems. Network theory provides a collection of mathematical and computational methods to understand the structure and function of these networks. When networks consist of interacting individuals, individuals within these networks may play different strategies to increase their reproductive success. Strategies exhibiting greater reproductive success are more likely to spread through the population. Evolutionary game theory examines the long-term outcomes of these interactions and has provided important insights into the evolution of cooperation, social learning, animal conflicts, and language. In this course, students will learn the fundamentals of network theory and evolutionary game theory. Computational methods will be applied to biological data sets to examine the structure and function of ecological or metabolic networks, and will be used to identify how the structure of social networks facilitate or inhibit the evolution of cooperation.

*Morphometry and Allometry: Relationships of shape and Size in Biological Organisms*
Allometry, also referred to as biological scaling, is the study of the relationship between body size and the properties of an organism. For example, as the body size of mammals increases, brains get bigger and life spans increase. Morphometrics is the quantitative analysis of the size and shape of organisms. Allometry and morphometrics can be used to address important questions in physiology, developmental biology, evolution and ecology. In this course, students will learn the basic concepts of allometry and morphometrics, and discuss examples that include modeling the shape and size of the mammalian brain (a research project being carried out at the Center for Neuroscience at UC Davis). As a hands-on example, students will compare the geometry of the eggs of various birds. Students will collect data and perform statistical analysis to compare the shapes of the eggs and look for underlying scaling laws.

**Instructors**
*Tim Lewis, Bob Guy, Sebastian Schreiber, and Andrew Sornborger*
Teacher Fellows
Funded through private gift donations, the Teacher Fellows program provides opportunities primarily for outstanding high school teachers to participate in COSMOS. During the four weeks that the program is in session, Fellows serve as a liaison between students and university faculty by providing pedagogical guidance as needed. Fellows participate in cluster course delivery, laboratory work, and field trips. Fellows are also called upon to provide supplemental instruction, mentor individual students, and supervise course projects.

Expectations
In order for everyone to have a successful COSMOS experience, it is important that the rules and procedures established for COSMOS be followed. The most critical rules were shared with you in the Participant Agreement and will be provided to you when you arrive at the program as a reminder. We expect everyone to adhere to all of the rules and procedures established for COSMOS. If you are unable to adhere to the rules, COSMOS staff may contact your parents/guardians to discuss your behavior and whether you should remain in the program.

- **Curfew**: No later than 10 p.m., students must be in the residence hall and on their assigned floor.
- **Signing in & out**: Students are expected to sign in and out of the residence hall when they leave or return, for any reason. We will expect you to use a buddy system or have an RA accompany you when you leave the hall.
- **Name tags**: Students are REQUIRED to wear a COSMOS name tag at all times.
- **Conduct on campus**: Faculty, staff, and students conduct important business and teaching on campus throughout the summer. COSMOS students are expected to be quiet and courteous when walking through buildings and hallways.
- **Quiet and courtesy hours**: Quiet hours will be in place from 9 p.m. to 7 a.m. every day. All other times will be courtesy hours; this means you will be expected to make sure you are not disturbing others. Courtesy and quiet hours will be discussed in more detail at the residence hall meeting.
- **Visiting other students**: There will be no co-ed visitation (i.e. men on women’s floors and vice versa). COSMOS students are not permitted in non-COSMOS buildings.
- **Hosting visitors and friends while you are at COSMOS**: Many of you have friends and family in the Davis area. However, you may not host a non-COSMOS visitor during the program.
- **Fire and Safety Procedures**: The residence halls are equipped with excellent smoke detectors and other fire protection devices. The procedure for exiting the building if the fire alarm sounds, along with other safety measures will be covered at your first residence hall meeting. Tampering with the fire protection system results in a $125 fine and may result in your being asked to leave the program.
- **Leaving campus on weekends**: In general, you will not be allowed to leave campus for any reason without a 48 hour advance written request and a Short-term Leave form on file from your parent/guardian. We expect that you will return to campus between 6:00 - 8:00 p.m. on Sunday evenings, unless prior arrangements have been made with COSMOS staff. You must be checked in and out from the residence halls only — departures from any other location will not be permitted.
• **Attendance**: You are expected to attend class daily, academic outings, and all COSMOS related events. If you become ill and cannot attend class for any reason, you must contact your RA immediately.

• **Behavior during field trips and COSMOS outings**: You will be expected to be completely ready for departure on-time, follow all procedures during the outings, and display mature conduct while off campus. COSMOS students will be required to wear a COSMOS T-shirt and carry photo identification on all off-campus outings, and on academic outings, wear close toed shoes.

• **Classroom conduct**: Gum chewing, eating, drinking, and other distracting behaviors are not allowed in the classroom. You will be expected to keep all classroom and lab areas clean and safe at all times and must wear appropriate clothing in all classes and labs (i.e. closed toed shoes, pants, etc.). Personal equipment such as cell phones, iPods, CD players, stereos, and other electronic devices that could be disruptive in classes are to be left in your room.
## ACKNOWLEDGMENTS

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<td>Daniel G. Aldrich III, Ph.D.</td>
<td>California Department of Education</td>
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<td>California State Legislature</td>
<td>COSMOS Statewide Advisory Board</td>
<td>College Access Foundation of California</td>
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<td>UC Office of the President</td>
<td>Mrs. Gayle Wilson</td>
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## THANKS AND APPRECIATION

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