

September 1, 2017

Clayton Christian
Commissioner of Higher Education
Montana University System
2500 Broadway Street
P.O. Box 203201
Helena, MT 59620-3201

Dear Commissioner Christian:

This letter outlines the remarkable contributions of Dr. Patrik Callis who has brought recognition to Montana State University with his renowned contributions to the science of photophysics and his laudable integration of learning, discovery and engagement.

Professor Callis joined the faculty of Montana State University in 1968 as an assistant professor of chemistry. He earned the distinction of being recognized with numerous, major awards including the Charles and Norah L. Wiley Award for Meritorious Research and Creativity in 1990, the Cox Award for Teaching and Scholarship in 1992, the Phi Kappa Phi Anna Krueger Fridley Award for Distinguished Teaching in 1994, and the Letters and Science Research and Creativity Award in 2015. He has received the Outstanding Chemistry Teacher Award from MSU's Undergraduate Chemistry Society numerous times.

Professor Callis has established a lofty, international reputation as a leader in the field of photophysics. He has been engaged in experimental and theoretical studies of the electronic structure of dyes and biological chromophores for 50 years. The underlying motivation for his research is to explain the microscopic origin of complex molecular optical phenomena applied to biological processes. To be successful in this complex and demanding area of research, Dr. Callis has needed to understand and apply concepts from physical chemistry, mathematics, physics, and biology. His ability to successfully understand and combine topics from all of these disciplines is what has enabled Dr. Callis to be an internationally recognized expert in photophysics.

Dr. Callis is especially well known for his studies of the photophysics of indole ring systems (this is one of the "biological chromophores" mentioned above). This is important because in biology, the indole ring is an amino acid side chain in the amino acid tryptophan. (And tryptophan is much, much more important than whether you are tired or not after eating too much turkey at Thanksgiving dinner!) Tryptophan is present in nearly every protein. When proteins are correctly folded, biological functions happen smoothly. When proteins are misfolded, cellular machinery can break, and disease states can occur. Understanding what tryptophan's spectroscopic signature should look like in a

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wide variety of conditions enables scientists to determine whether biological processes and interactions are happening properly. When there are mis-steps caused by disease or another condition, spectroscopy can be used to study what is occurring because of Dr. Callis' research.

However, even after almost 50 highly productive years, the story for Dr. Callis is not finished, and he is still highly engaged in pushing forward the forefront of scientific knowledge. Dr. Callis understands better than just about anyone how changes in molecular dipole upon excitation serve as a measurement of the electric field in the protein. Recently, Dr. Callis has shifted his research focus from working more pointedly on tryptophan fluorescence to studying enzyme acceleration of reaction rates. Enzymes accelerate chemical reactions over the rates found in water by enormous amounts (10^8 to 10^{15} -fold), but the manner by which enzymes accomplish this is not well understood. Dr. Callis' studies on how the extreme and specific electrostatic environment at the site of reaction affects the rate of the process could have truly far-reaching significance. The work that he is currently doing to demonstrate that electrostatics are indeed at the root of enzyme action is timely and, for many people in the field, revolutionary.

Professor Callis has published 110 scientific papers, and he has a sustained track record of funding across the duration of his career, including many grants from the National Science Foundation and the National Institutes of Health for his research. He has presented his work in 167 seminars. His publications have appeared in the most prestigious journals, including the *Journal of the American Chemical Society*, *Biochemistry*, and *Angewandte Chemie International Edition*. The impact of his work, measured by citations by other scientists, is extraordinary: to date his work has been cited in over 3000 articles, with 221 citations in 2016 alone. These quantitative data give a strong sense of Professor Callis' luminosity in the scientific community.

In addition to leading the creation of knowledge in an exciting field, Professor Callis' career has substantial broader impacts. In the classroom, Dr. Callis is a gifted and versatile teacher. Across the lifespan of his career, Dr. Callis has influenced thousands of students and has taught a very wide variety of chemistry courses ranging from general chemistry to graduate level courses in electron transfer, kinetics, and application of bonding theory. In recent years, Dr. Callis has received some of the best teaching evaluations in the department for his junior level CHMY 361 "Elements of Physical Chemistry" course, which is taken by all of MSU's biochemistry majors. He also routinely teaches undergraduate physical chemistry laboratory courses (CHMY 374) and graduate level courses including "Advanced Quantum Chemistry" (CHMY 564).

Dr. Callis' impact on students is evident in the students' performance and in the student evaluations for the course. Annually, students in CHMY 361 take the American Chemical Society's standardized physical chemistry comprehensive exam. This 60-question exam is meant to be taken after a full year (two semester sequence of physical chemistry). Although this exam is meant to be given for 110

minutes, Dr. Callis' students are given 50 minutes (one course period), and they take the test on a voluntary basis (performance is not connected to their course grade). In 2014, for example, the average score for the MSU students was 49/60, while the national average for students receiving significantly more instruction and with twice as long to take the test is 52/60.

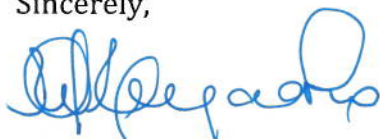
A few years ago, one of the students really struggled to master the content in CHMY 374 lab. Dr. Callis met every Friday afternoon for an entire semester with this student, often spending several hours, in order for this student to successfully learn the material needed to pass this course. I am confident that this student would have failed the course with any other instructor. This level of care for students is something that Dr. Callis has been willing to do routinely for the entirety of his career.

Dr. Callis has unquestionably contributed to every aspect of the Department of Chemistry and Biochemistry at Montana State University. He has chaired the Graduate Recruiting Committee, the Undergraduate Program Committee, and many Faculty Hiring Search Committees. He has repeatedly led the department during transitions, overseeing the process of electing new department heads. The bottom line is that he serves where he is needed. For MSU, his service includes serving on the search committee for Vice President of Research (when Bob Swenson was hired). He faithfully reviews grant proposals and papers for the wider scientific community and has chaired many sessions on fluorescence at the Biophysical Society Annual Meeting.

For the local community, Dr. Callis started the alpine component of Gallatin County Search and Rescue in the mid-1980s. He remains the patriarch of the group, and his philosophical foundations and presence continue to help make it successful. He still actively serves as a helicopter coordinator for Gallatin County Search and Rescue. His long-time commitment to this community service combines Dr. Callis' love for the outdoors with keeping others safe.

To close, Professor Patrik Callis has demonstrated substantial and sustained excellence in every aspect of his professional service at Montana State University. His contributions in scientific research, in teaching and mentoring, and in outreach are of the highest echelon. He has been a loyal and dedicated MSU employee. It is, therefore, without reservation that I recommend him to be named a Montana University System Board of Regents Professor.

Sincerely,



Waded Cruzado
President