Young Career Focus: Professor Shuanhu Gao (East China Normal University (P. R. of China)

Background and Purpose. From time to time SYNFORM meets young up-and-coming researchers who are performing exceptionally well in the arena of organic chemistry and related fields of research, in order to introduce them to the readership. This Young Career Focus presents Professor Shuanhu Gao (East China Normal University, P. R. of China).

Biographical Sketch

Prof. S. Gao

Shuanhu Gao was born in Ningxia province, China. He obtained his BS degree from Lanzhou University (P. R. of China) in 2001. He then joined the group of Professor Yongqiang Tu at Lanzhou University to begin his doctoral study on natural product synthesis involving indole alkaloids and polyketides. After achieving his PhD in 2006, he began to work with Professor Chuo Chen at the UT Southwestern Medical Center at Dallas (USA) as a postdoctoral fellow. During this period, he worked on the total synthesis of nakiterpiosin and related chemical biology. He started his independent career in the Department of Chemistry at East China Normal University (P. R. of China) in October 2010. His current research interests are primarily focused on the total synthesis of natural products and medicinal chemistry.

INTERVIEW

SYNFORM *What is the focus of your current research activity?*

Prof. S. Guo My research interests are devoted to the total synthesis of natural products and related medicinal chemistry. The selected target molecules may have novel molecular structures, potent biological activities, and the potential for mechanistic studies. All the programs will begin with the synthesis of the corresponding natural products, and once the target molecules have been completed, we plan to carry out function-oriented synthesis of their analogues and derivatives to further study their potential medicinal functions and chemical biology through collaborations. We also try to develop some useful methodologies, especially photoreactions, to address issues of efficiency and diversity during the total synthesis.

SYNFORM *When did you get interested in synthesis?*

Prof. S. Guo I became interested in synthesis when I conducted undergraduate research in the laboratory of Professor Yongqiang Tu. During this period, I worked with Dr. Yanxing Jia on the total synthesis of madindolines. Professor Tu, an inspirational supervisor, taught me the science and research of synthesis, which had a significant influence on my academic career. I realized that creativity and innovation play key roles in the synthesis of molecules after five years of doctoral studies under the guidance of Professor Tu. My interest in synthesis grew after the experience of working with Professor Chuo Chen in UT Southwestern. Professor Chen broadened my horizon regarding the role of synthesis in both organic chemistry and related medical chemistry and chemical biology.

SYNFORM *What do you think about the modern role and prospects of organic synthesis?*

Prof. S. Guo I believe that organic synthesis of natural products and designed molecules serves, and will continue to serve, as the most effective tool for preparing target molecules, while dramatically facilitating the development of chemical biology, materials science as well as drug discovery. Clearly, organic synthesis is the indispensable driving force for developing new synthetic methods. The emergence of novel methodologies and strategies is also changing classical synthetic design. Therefore, organic synthesis is an important science in both academia and pharmaceutical areas. I also believe that the merging of chemical synthesis and biosynthesis will be an important research field and an unstoppable trend in the future.

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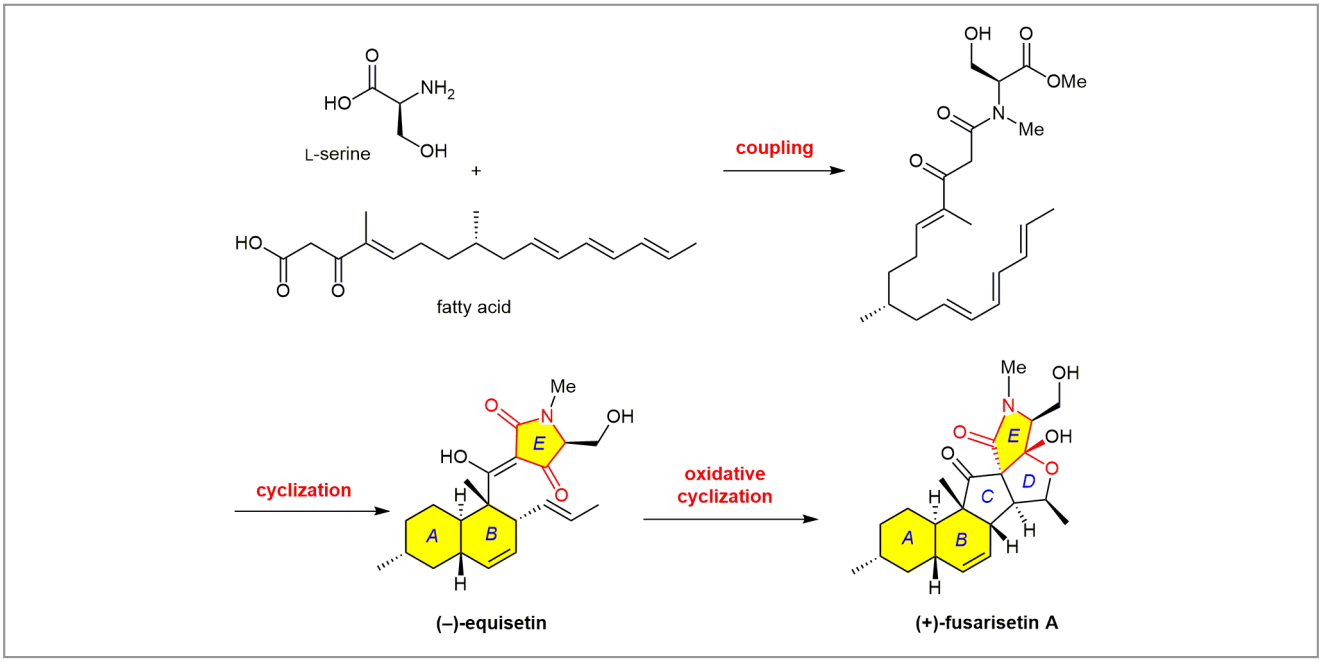
SYNFORM *Your research group is active in the areas of total synthesis and medicinal/biological chemistry. Could you tell us more about your research and its aims?*

Prof. S. Guo Currently, our research is focused on the synthesis of natural products, which include alkaloids, xanthones and terpenoids, among others. The target molecule always represents a family of natural products that are derived from the same biosynthetic pathway. We want to develop novel and efficient strategies to prepare the representative natural products, that will serve as common approaches for the synthesis of other biogenetically related natural molecules as well as their analogues and derivatives. In this way, we can provide the target molecules efficiently in adequate amounts. We believe this will be the foundation of further studies of the related medicinal chemistry and chemical biology. For instance, we developed an efficient strategy for the total synthesis of (+)-fusarisetin A, one of the most challenging naturally occurring tetramic acids with potential to be an anticancer agent, based on a biomimetic approach (Scheme 1).[1,2] We have already prepared a variety of related natural tetramic acids and derivatives of fusarisetin A by using a similar strategy. This facilitates the study of structure–activity relationships and further studies on medicinal chemistry.[3]

We also try to develop some useful synthetic methods to solve the problems encountered in classical chemical transformations. We found that photochemistry, promoted by either UV or visible light, provides unprecedented opportunities for the development of new reactions. In pursuing this idea, we have developed photoreactions, or strategies based on photochemistry, that have been used successfully in natural products synthesis.

SYNFORM *What is your most important scientific achievement to date and why?*

Prof. S. Guo My independent academic career started at the end of 2010, so our group is still very young. I hope the most important scientific achievements lie ahead of us. In the past four years, we have completed the total synthesis of four families of natural products, including tetramic acids, cyanthiwigins, hamigerans and hexahydrofluorenone-containing natural products. If I have to choose one contribution to organic chemistry, it should be the photo-Nazarov reaction and its application (Scheme 2).[4,5] After systematic studies of the photo-Nazarov cyclization of vinyl aryl ketones, we found this reaction proceeds under very mild conditions in neutral or basic solution and leads efficiently to the formation of hexahydrofluorenone. In contrast, the traditional Brønsted or Lewis acid promoted Nazarov cyclizations require much harsher conditions. We have also successfully applied this reaction in the total syntheses of taiwaniaquinol B and



Scheme 1 Biomimetic Synthesis of Tetramic Acids: Equisetin and Fusarisetin A

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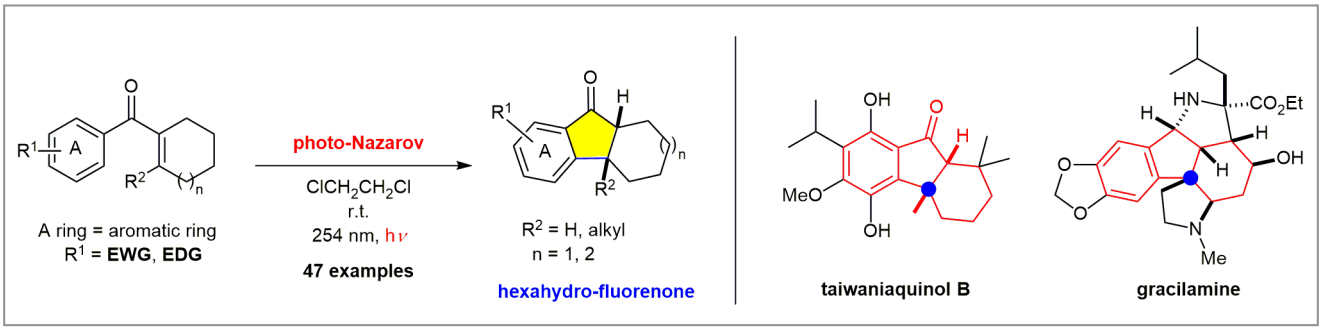

Scheme 2 Photo-Nazarov Reaction and Its Application in the Total Synthesis of Taiwaniaquinol B and Gracilamine

gracilamine. We firmly believe these photo-electrocyclized products may prove useful for synthesizing a variety of natural products and their derivatives.

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