# Dr. Thinzar M. Lwin: bringing tumor-specific fluorescence guidance technology to mainstream operating rooms

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## Editor's note

Fluorescence guidance technology was first introduced in the 1940s when fluorescein was primarily used in humans to enhance the imaging of brain tumors, cysts, edema and blood flow *in vivo* (1). This medical imaging technique aims to guide surgical procedures and provide real time visualization of the operating field for surgeons via detection of fluorescently labelled structures during surgery, and is gaining popularity these days.

As a rising star in the field of fluorescence-guided surgery (FGS), Dr. Thinzar M. Lwin from University of California San Diego has practiced for half decade studying the physiology of different combinations of fluorescent probes and using them for FGS with FDA-approved surgical devices. *Annals of Laparoscopic and Endoscopic Surgery* (*ALES*) has the honor to interview Dr. Lwin and will have a closer look at the research efforts made by her throughout these years.

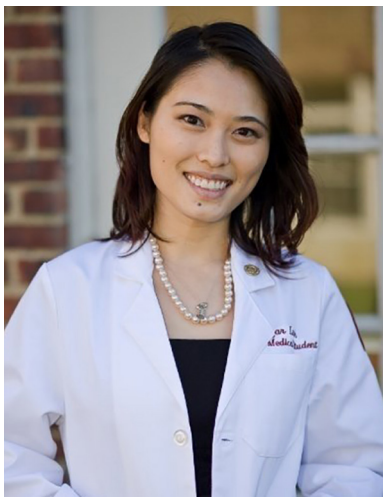

**Figure 1** Dr. Thinzar M. Lwin.

## Expert's introduction

Thinzar M. Lwin, MD, currently serves as a Resident Physician at the Department of Surgery, University of California San Diego, New York. She is a graduate of the University of California, San Diego BS/MS program in Human Biology. She finished her medical education at New York Medical College, Valhalla, NY and trained for 3 years at Mt Sinai Beth Israel Medical Center, NY. She will complete her surgical residency in 2020 and plans to pursue a surgical oncology fellowship with a focus on developing an academic practice treating hepatopancreatobiliary malignancies. Her scientific interests focus on the use of fluorescence technology to guide oncologic surgeries and developing tumor specific fluorophores for use in clinical practice. She received the NIH/NCI T32 training grant known as "Institutional National Research Service Award" for her development of novel combinations of antibody conjugated to fluorophores for tumor-specific image guidance (*Figure 1*).

## Interview

***ALES: We realize that you obtained an NIH/NCI Award T32CA121938. What were the qualifications to obtain it? What do you think is your advantage in obtaining it?***

**Dr. Lwin:** I received the NIH/NCI Award T32CA121938 through the Cancer Therapeutics Training (CT2) program at the University of California, San Diego.

The main qualification to obtain the research grant is that you were a promising post-graduate trainee (after earning MD or PhD) interested in developing therapeutic strategies in the field of cancer research. Applicants are required to have a faculty mentor's support and letters of recommendation from two other faulty members. My advantage in obtaining the grant was the great support from my faculty mentors—they saw that I was motivated and their enthusiastic support showed the selection committee that I was a trainee with potential to do well in the field.

***ALES: What was the grant about?***

**Dr. Lwin:** The primary goal of the grant was to develop novel combinations of antibody conjugated to fluorophores for tumor-specific image guidance. Existing fluorescence-guided technology is non-specific and does not give much physiologic information about the structures that are being defined by fluorescence. It is a drawback especially when using this technique for surgical oncology. I spent my time during the grant studying the physiology of different combinations of fluorescent probes and evaluating them for FGS using FDA-approved surgical devices.

***ALES: How does the fluorescence-guided surgical technique enhance tumor visualization? And what are the limitations of this technique?***

**Dr. Lwin:** Fluorescence-guidance allows surgeons to visualize tumors by enhancing the contrast between the lesion and the background normal tissue. Being able to directly see the tumor in-situ gives surgeons a better idea of the amount of tissue to remove. It also gives macroscopic reassurance that they have removed all the cancer that can possibly be removed. While microscopic pathologic confirmation is the gold standard, it is impossible to perform a pathologic survey of the entire surgical bed. Surgical judgment is used to ensure complete oncologic resection, but that is inadequate. This issue is especially important given that more and more surgeries are being performed with laparoscopic and robotic approaches where traditional tactile feedback is not present.

A critical limitation of the approach is in the availability of existing fluorophore probes that are FDA approved. Only non-specific fluorescent dyes such as indocyanine green and methylene blue are FDA approved at this time. These dyes rely on abnormal and disorganized vasculature that lead to enhanced permeability and retention of molecules. They do not give any tumor-specific information. Antibody-fluorophore conjugates that our lab and several others are in the process of developing give such information because they are based on antigen-antibody binding using targets that are commonly overexpressed in tumors. Tumor-targeting fluorescence technology for clinical use is still in its infancy, only a select few probes have progressed to phase I/II clinical trials.

***ALES: What has to be done further to optimize this technique?***

**Dr. Lwin:** Fluorescence-guided surgery and tumor-specific fluorescence is gaining popularity. There is an increasing number of device platforms to image fluorescence, but few probes. The resources and funding necessary to undertake clinical trials with these probes lead to a critical bottle-neck in advancing this technique. We need to get more candidate probes out for evaluation of safety and feasibility. We can then get to study the more interesting issues of efficacy and biophysical profile in a number of oncologic circumstances, such as neoadjuvant chemotherapy or radiation.

***ALES: What made you decide to specialize in surgery?***

**Dr. Lwin:** I have always enjoyed working with my hands. I am a very practical person, I enjoy helping others, and the field of human biology has always been interesting to me. Surgery struck me as a very directly applicable field that encompassed everything I enjoyed. The opportunity to use my hands to directly make a big difference in peoples' lives is so rewarding.

***ALES: What do you regard as the most challenging aspects of studying in this field? What are you studying at the moment?***

**Dr. Lwin:** The most challenging aspect of studying in this field is that there is so much to learn and do, and not enough time for it all. As physician-scientist in training, I work in the operating room, see patients in the hospital, the clinic and the emergency room, and somewhere in between, I continue to do research too. It is difficult to try to fit everything in, but everything is so interesting that it is hard to step away from any one thing.

I am currently studying the effect of dye positioning on biodistribution of fluorophore-antibody conjugates. If the dye molecule could be hidden within the antibody, will this allow the antibody to better penetrate tumors?

***ALES: What do you think are the most enticing aspects of research? What is the driving force that keeps you motivated in it?***

**Dr. Lwin:** The most enticing aspect of research is trying to obtain answers to the unknown. The driving force that keeps me motivated is that once you find the answer to a previous question, it leads to more and more questions and keeps drawing you back in!

 

***ALES: As a rising star, what is your aspiration as a surgeon/oncologist? What do you wish to contribute to the oncology world?***

**Dr. Lwin:** My aspiration as a future surgical oncologist is to bring tumor-specific fluorescence guidance technology to mainstream operating rooms. I envision that one day, there will be a library of tumor-specific probes and fluorophores that could be easily selected based on the patient's tumor biology. This will allow the surgeon to easily visualize the tumor, remove it entirely, leaving a completely clean surgical resection bed and improve patients' oncologic outcomes after surgery.

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*Ethical Statement:* The author is accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.



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1. Moore GE, Peyton WT, French LA, et al. The clinical use of fluorescein in neurosurgery; the localization of brain tumors. J Neurosurg 1948;5:392-8.

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