



## PhD Program between the Freie Universität Berlin (FUB) and the China Scholarship Council (CSC)

### Open PhD position for CSC scholarship candidates 2015

The PhD position is only offered to Chinese PhD candidates for application in the framework of the FU-CSC Program.

<b><u>Department/Institute:</u></b>	Institute of Pharmacy
<b><u>Subject area:</u></b>	Pharmaceutics, Pharmaceutical Nanotechnology & NutriCosmetics
<b><u>Name of Supervisor:</u></b>	Prof. Rainer H. Müller
<b><u>Number of open positions:</u></b>	3
<b><u>Project title:</u></b>	smartPearls® - novel dermal delivery system based on amorphous cosmetic actives & drugs

#### **Project description:**

Liposomes revolutionized the dermal delivery when they were introduced to the market by the cosmetic company Dior in 1986, later on pharmaceutical products followed. The next, second generation in dermal delivery, developed in the 1990ies and around 2000, are the solid lipid nanoparticles (SLN®) and nanostructured lipid carriers (NLC®), and the dermal nanocrystals (smartCrystals®). These 3 delivery systems were invented by our work group and are meanwhile investigated world-wide in many labs. Cosmetic products entered the market, e.g. by Juvena Switzerland and la prairie (e.g. exclusive product platinum rare, 50 ml for 1000 €). However, now it is time to develop the 3rd generation technology for dermal delivery!

This 3rd generation is currently being developed in our laboratory. It is based on amorphous cosmetic actives. Drug nanocrystals increase the penetration into the skin, because they have an increased saturation solubility (supersaturation) due to their small size in the nanodimension (higher concentration gradient between dermal formulation with nanocrystals and the skin). Amorphous drugs have an increased saturation solubility (supersaturation) due to their lack of crystallinity (= disordered state). In the newly developed delivery system smartPearls both properties are unified – amorphous active is transferred to the small size of the nanodimension. Both supersaturation effects are now synergistic! This leads to penetration into the skin being very much superior to the previous delivery systems of the first generation (liposomes) and also the second generation (SLN, NLC, nanocrystals).

Within the research project you will be involved in developing optimized production methods for smartPearls, will investigate the academic basic mechanisms of how they work, and also prepare final dermal formulations with smartPearls (gels, creams, lotions) and test their skin penetration (e.g. using pig skin model). The research involves basic academic research, but also developments with industrial focus to generate products for the market.

It is a new technology, the principles were not yet published. Therefore you cannot write up

a research program. The research program will be provided by Prof. Rainer Müller. But you are invited to suggest lipophilic or poorly soluble compounds or plant extracts from traditional Chinese medicine for incorporation into the smartPearls® for dermal delivery.

**Language requirements:**

Writing of thesis and oral defense in English, no German required. The working language in our international research group is English, you will meet colleagues from your country China, but also Brazil, Syria etc. Please have a look at our web site, click Research Team. Good English is essential, because all our work is published in English.

**Academic requirements:**

Subject areas: Pharmacy, chemistry, crystallography, physics, process engineers, physicians.  
Master degree is required.

**Link to professor and further information:**

For more information about the research group, please visit our web site: [www.muller-berlin.com](http://www.muller-berlin.com).

If you want to access our publication list, please go to the web site, go to the area Research/Science and click publications.

Please send your application directly to the Beijing office of the Free University (FU) Berlin, not to the professor.

It is expected that the thesis including defense is completed within 4 years (standard time), for this a grant of 4 years is the pre-requisite. In general, we try to publish an article for each piece of the work when it is completed. At the end of your PhD time, all these articles are compiled for the thesis (so called "cumulative" thesis).

**Please note:**

In a first step the complete application should submit to the Beijing Office for evaluation by January 4<sup>th</sup>. Please don't contact the professor before. He will get in contact with you after having received the complete application in January.