Homework #4

Lupașcu Marian
Syntactic Modeling of Biological Systems
University of Bucharest

March 23, 2020

Organelle-specific targeting of polymersomes into the cell nucleus

Christina Zelmer, Ludovit P. Zweifel, Larisa E. Kapinos, Ioana Craciun, Zekiye P. Güven, View ORCID ProfileCornelia G. Palivan, and View ORCID ProfileRoderick Y. H. Lim

Context

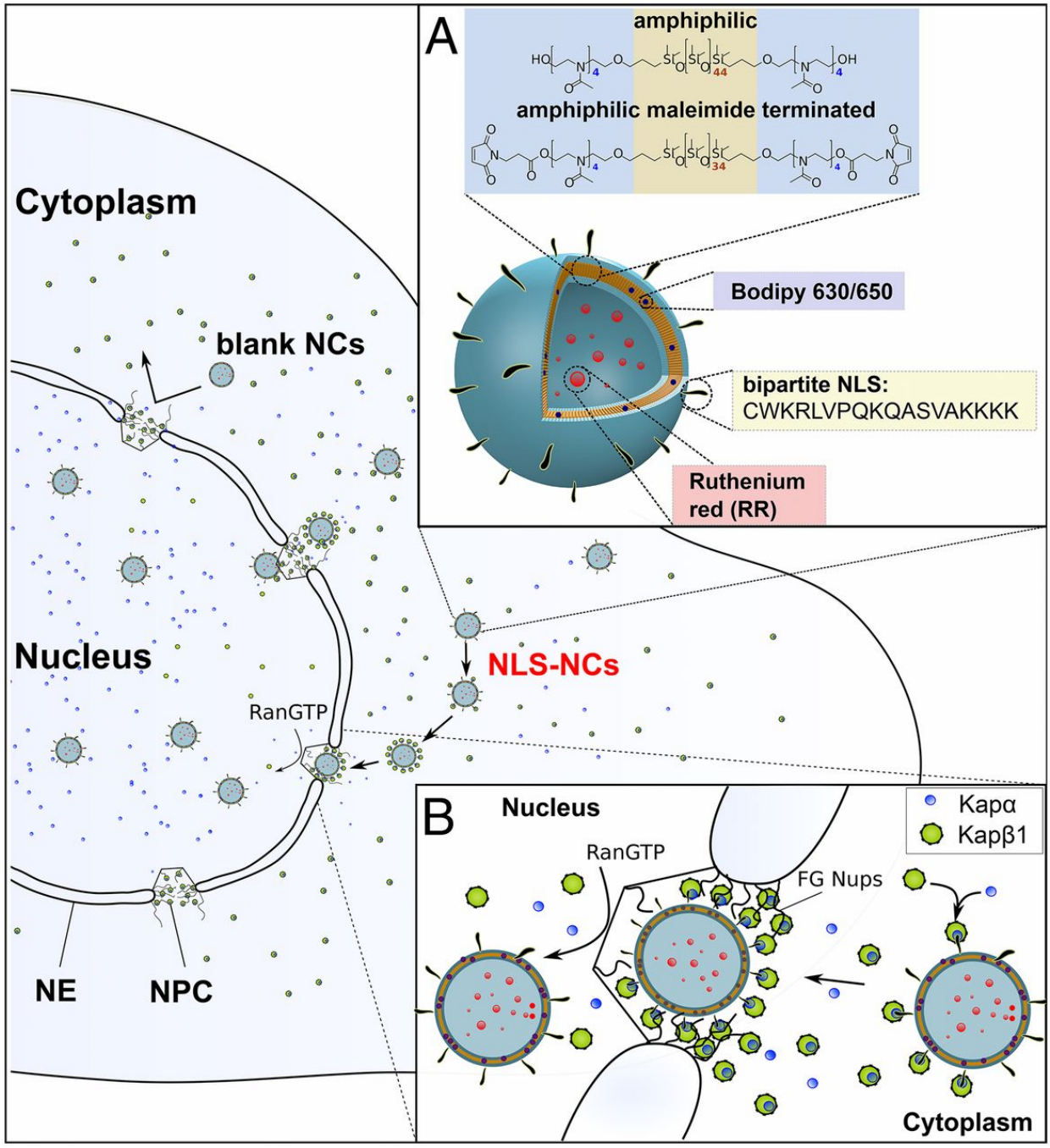
In the paper published on January 27, 2020, in the PNAS (Proceedings of the National Academy of Sciences), a team of researchers at Basel University in Switzerland managed to introduce external material (nanocontainers) into the cell nucleus, in vitro and in vivo. This was demonstrated using a contrast colored substance and electron microscope.

This is very important from the point of view of nanomedicine because using the techniques in this paper, a drug can be transported directly to the cell nucleus (more efficient chemotherapy), or gene therapy can be performed.

Mode of penetration of nanocontainers into the nucleus

The way nano-containers enter the nucleus is inspired by nature. Nanocontainers have a number of free radicals (NLS). A series of soluble cytoplasmic transport receptors that must be transported from the nucleus are attached to these free radicals. Thus nanocontainers (60nm in diameter) are disguised as these substances and manage to pass through the pores of the nucleus. Naturally - some viruses do this to get into the nucleus.

Of course, after this discovery, a lot of challenges are involved: such as: biocompatibility, encapsulation efficiency, biological stability, detection and precision of nanocontainers.



NE = cell membrane
NPC = pore in the cell membrane (max. 60 nm, the only aqueous portions to the genome) has barrier functionality (which is selective) that is made by a series of proteins: phenylalanine and glycine (FG)
NLS = free radicals that interact with soluble transport receptors (Kapα or Kapβ1)
GTPase Ran = mechanism by which Kapα and Kapβ1 are released into the nucleus