

Is the central channel of nuclear pore complex really the exclusive gateway for macromolecular transport?

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Examination of many nuclear pore complexes revealed in some of them very thin filaments presumably RNA with accompanying proteins, directing from inner nucleus to the edge of the complex. On one representative micrograph it is shown that this strand continues in the same direction through central part of the complex most probably through the peripheral channel. Next route of the strand is through the tunnel of a hollow rod – subunit of the cytoplasmic ring.

Key words: Nuclear pore complex, macromolecular transport, central channel, peripheral channels, transmission electron microscopy.

It is generally accepted, that all interphase cell macromolecular transport between nucleus and cytoplasm is realized through nuclear pore complexes (NPCs). These information highways are essential for normal function and life of interphase cell. Many observations and experiments have been done to show that different types of RNA and proteins are transported along the central axis of the NPC through the so called central channel. The transport factors with cargoes were always accessible to direct observation, because of big naturally occurred complexes, or artificially made large size cargoes has been the object of the observation using transmission electron microscopy (TEM). Transport model of the NPC has at present conception as follows: Macromolecules are transported through the central channel pathway of the NPC. In addition to the central channel pathway, inorganic ions can pass through NPC peripheral channels. There is cross talk between two pathways, although details are as yet unknown. Electrically silent macromolecule transport interferes with electrodiffusive ion transport [10]. In this sense all recent articles and reviews were published [9, 11, reviewed in 1, 2, 4, 7, 10, 12, 14, 16].

New approaches, which indirectly localized RNA export and some proteins, have undoubtedly shown that RNA, some proteins and transport factors enter the NPC apparently from the side, not through the nuclear basket [8]. This is in “so called contradiction“ with previously published and

well-documented results [13 and see reviews above]. Such approaches also undoubtedly revealed specialization of pores; it means that in certain time different classes of pores exist, transporting different cargoes.

Interpretation of the presented observation in comparison with results of others is that more independent transport pathways for macromolecules exist through NPC. One of them going along the central axis of NPC was many times well documented observing large size cargo. The other is localized at the edge of NPC and was also well morphologically defined as peripheral channels. This way was not supposed to be used by macromolecules, but the presented observation in combination with results of others [8] shows that long very thin filament, presumably RNA enter the peripheral channel at the NPC edge from the nuclear side using it to continue its route through the tunnel of hollow cytoplasmic rod.

Material and methods

Cell culture. Mouse leukemia cell line L1210 (purchased from the American Type Culture Collection, Rockville MD) was maintained in RPMI 1640 medium supplemented with 10% FBS. The cells were fixed in exponential phase of growth.