

HELICAL ARRANGEMENT OF RIBOSOMES
IN THE LEAF CELLS OF ETIOLATED BEAN
SEEDLINGS AFTER UV-IRRADIATION

Mit deutscher und kroatischer Zusammenfassung
Sa sadržajem na njemačkom i hrvatskom jeziku

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Introduction

Previous investigations have shown that ionizing radiation causes a retardation of thylakoid development and of chlorophyll synthesis in the plastids of etiolated plants when they are exposed to light (Devidé 1969). It has been possible to obtain a similar effect also by means of UV-light (Devidé 1967). During such experiments striking arrangements of ribosomes have been found in the cytoplasm of UV-irradiated leaf cells which should now be briefly described.

Materials and Methods

Primary leaves of 8—10 days old bean seedlings (*Phaseolus vulgaris* cv. Butterfisolé), grown in total darkness, were partially irradiated by ultraviolet light (UV) with 30.000, 60.000, 120.000 and 160.000 erg.mm⁻² (by means of a Philips TUV 30 W lamp). Partial irradiation was carried out by means of a 5 mm thick UV-absorbing glas plate containing holes of a diameter of 5—6 mm. The plants were irradiated in such a way that the lamina of folded leaves lied just under the hole as already described (Devidé 1967). The irradiated area was marked by Indian ink. During the irradiation, which lasted from about 15—80 minutes, the plants were kept in a moisture chamber to be normally supplied with water.

After irradiation the plants were exposed to white light of fluorescent tubes (4.500 lx). For electron microscopic investigations the material was fixed immediately after irradiation (in darkness) as well as after 2 and more hours illumination. Small pieces of leaf lamina were fixed in glutaraldehyde, postfixed in OsO_4 , dehydrated with ethanol and embedded in araldite. Ultrathin sections were prepared with an LKB Ultratome, double stained with uranylacetate and lead citrate (Reynolds 1963) and examined in a Siemens Elmiskop I.

Results

Besides the already described retardation of thylakoid formation and chlorophyll synthesis (Devidé 1967) the following peculiar phenomenon has been observed:

In the cytoplasm of the cells which were mostly exposed to the UV-light (outer layers of spongy parenchyma) frequently striking long helical (i. e. screw like) arrangements of ribosomes have been found. There are often more than 15 loops and probably more than 20 ribosomes in a single helix. In non-irradiated cells (of the same leaf or of other ones) such long helical arrangements of ribosomes have never been seen. After an illumination of 2 hours, or more, the helical arrangements of ribosomes have disappeared even in the most irradiated cells.

At the moment it seems to be difficult to explain the observed phenomenon. It is however possible that the occurrence of the helical arrangements of ribosomes is thoroughly accidental and has nothing to do with the UV-irradiation, but the following facts make this very improbable:

1. Helically arranged ribosomes have always been observed only in the UV-irradiated area of leaf lamina.
2. They appear most frequently in outer cell layers.
3. They have never been found in non-irradiated bean leaf tissue.
4. It has not been possible yet to induce a similar effect by means of other factors (as weak light, ionizing radiation etc.)
5. The experiments have always been reproducible.

Helical arrangement of ribosomes has been observed also by other authors, but only in a few quite different objects. Echlin (1956) observed e. g. such ribosomes in pollen mother cells of *Ipomoea purpurea*, Waddington and Perry (1963) in differentiating muscle cells, Bergquist and Horstmann (1967) in central nervous system of young chicken embryos etc.

Summary

In leaf tissue of etiolated bean seedlings a helical arrangement of ribosomes can be induced by means of UV-irradiation.

EXPLANATION OF FIGURES (PLATES)

Fig. 1 and 2. Helical arrangements of ribosomes in cells from the irradiated area of an etiolated bean leaf, fixed in darkness immediately after the irradiation (120.000 erg. mm⁻²). 50.000 : 1.





References

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ZUSAMMENFASSUNG

SCHRAUBIGE ANORDNUNG VON RIBOSOMEN IN BLATTZELLEN ETIOLIRTER BOHNENKEIMLINGE NACH UV-BESTRAHLUNG

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Gelegentlich der Untersuchungen über die Wirkung von UV-Licht auf die Chloroplastenentwicklung wurden im Cytoplasma der bestrahlten Zellen verlängerte, schraubig angeordnete Ansammlungen von Ribosomen festgestellt, die bisher nur selten beobachtet wurden. Die Reproduzierbarkeit der Experimente spricht dafür, dass es sich um keine zufälligen Bildungen handelt.

SADRŽAJ

ZAVOJITI RASPORED RIBOSOMA U STANICAMA LISTA ETIOLIRANIH KLICA GRAHA NAKON UV-ZRAČENJA

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Prigodom istraživanja djelovanja UV-svjetlosti na razvitak plastida pronađene su u citoplazmi ozračenih stanica produžene zavojite (helikalne) nakupine ribosoma, kakve su dosad bile samo rijetko opisane. Reproducibilnost eksperimenata govori u prilog mišljenju da opisane tvorevine nisu nastale slučajno.