

Task 5 for obtaining credits for B130P16E (Practical basics of scientific work)

Task:

Write a short manuscript of the scientific article with following title:

"Carrier-driven auxin transport drives plant phototropic reactions"

Structure of the manuscript:

First page:

Title, authors, affiliations – use your imagination

Abstract:

Try to briefly summarize the introduction into the topic, description of methods and results achieved and summarization of the relevance of the message that could be taken from this report (2-4 sentences).

Key words:

Find the most relevant terms according to which readers will find our article in the database

Introduction:

Put the reader into the true picture of these days knowledge in the field of auxin research. Mention briefly what is auxin and how important is its transport. The information could be found in the attached file (info_auxin_for_task5.ppt).

Material and methods:

Describe the design of the experiments, you can find technical details below, do it briefly.

Results:

Assemble a consistent text describing results of your experiments, use appropriate subheadings, and refer to the respective image.

Discussion:

Discuss your results in the context of general knowledge and also try to make your own interpretations. Suggest some additional experiments if needed.

Acknowledgments:

Here you can specify grant support as well as mention colleagues or donators of the experimental material.

Reference list:

Make the reference list for all the papers that are mentioned in your article, they can be found in the file (info_auxin_for_task5.ppt). Use Pubmed, WOS, or Scopus and Mendeley.

Figure captions:

A concise description of what is presented in the respective image. It should be self-explaining and easy to understand.

Figures: Always 1 figure per one page.

Here is the explanation of two sets of experiments that you performed in the laboratory, including their description, rationale, data obtained, and techniques used:

Experiment 1:

Aim:

To determine whether plant hormone auxin could, in theory, enter the cell by carrier-mediated transport.

Background, description of the experiment and rationale:

Two synthetic auxins, 2,4-D and NAA, enter the plant cell through the plasma membrane by two different mechanisms. The first utilizes specific membrane carrier (energy-dependent); the second is diffusion-based transport across plasma membrane.

The accumulation of radioactively-labelled auxins [³H]2,4-D and [³H]NAA inside 2-day-old tobacco cells BY-2 (Bright Yellow) was measured. For the assay, cells were transferred to the buffer of pH 5.8. After 2h of the equilibration in this buffer, radioactively labeled auxin ([³H]2,4-D or [³H]NAA) was added, and during a subsequent 30 min period, sampling of small aliquots was performed and the radioactivity determined in them using a scintillation counter. Control cells and cells treated with the inhibitor of the active transport inside cells 1-NOA (1-naphtoxyacetic acid) were used. An inhibitor was added 1 minute after the radioactivity.

The following values of radioactivity inside cells were obtained (data could also be downloaded as an excel file from the web page):

For 2,4-D:

Time (min)	Sample number	[³ H]2,4-D (dpm)	[³ H]2,4-D plus 1-NOA (dpm)	
0	1	4063		
	2	4635		
	3	5008		
	4	5309		
3	5	13830	29	9881
	6	14303	30	10046
	7	12719	31	9792
	8	14703	32	9715
5	9	16039	33	9175
	10	15901	34	9389
	11	15757	35	8727
	12	16555	36	10175
11	13	16112	37	8722
	14	16750	38	8486
	15	16574	39	8787
	16	16799	40	8834
17	17	14524	41	9106
	18	15943	42	10500
	19	16290	43	8674
	20	16694	44	8843
25	21	15952	45	8128

	22	15438	46	8509
	23	15519	47	8444
	24	16738	48	8744
32	25	15688	49	8357
	26	15763	50	8789
	27	15593	51	8281
	28	16029	52	8278

For NAA:

Time (min)	Sample number	[³ H]NAA (dpm)	[³ H]NAA plus 1-NOA	
0	1	4827		
	2	5363		
	3	5586		
	4	5883		
3	5	7360	29	7591
	6	8076	30	8064
	7	7898	31	8211
	8	8269	32	8348
5	9	7164	33	7904
	10	7446	34	7994
	11	7822	35	8380
	12	7260	36	8461
11	13	8187	37	8304
	14	7279	38	8505
	15	7682	39	8113
	16	7734	40	7987
17	17	7308	41	8040
	18	7432	42	8134
	19	8279	43	8446
	20	7765	44	8168
25	21	7669	45	8192
	22	7516	46	8198
	23	7416	47	8376
	24	7812	48	8588
32	25	7710	49	8316
	26	8581	50	8610
	27	8301	51	8860
	28	8064	52	8931

Make plots from these values representing how the radioactive auxin accumulates inside cells. Based on the data, try to conclude which of these two auxins enter the cell passively and which actively. Results of this experiment also clearly show that at least one of these two synthetic auxins enters plant cells by active carrier-mediated transport across the plasma membrane.

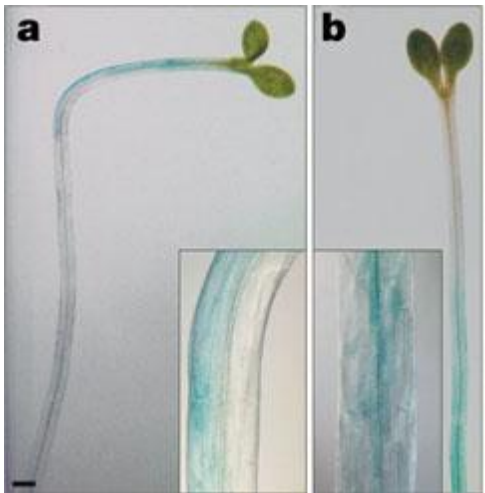
Experiment 2:

Aim:

To determine whether carrier-mediated transport could have some role in the bending reactions of plants towards light.

Background, description of the experiment and rationale:

This experiment tested the importance of carrier-mediated transport in plants. We were interested in what would be the consequence of the inhibition of active auxin efflux carrier for the reaction of plants to the light (phototropism).



From this image (take it as the result of your work for the purpose of this trial manuscript) it is obvious that the inhibitor of auxin efflux carrier NPA (1-N-naphthylphthalamic acid) disturbed the reaction of *Arabidopsis thaliana* seedlings stems on the directional illumination from the right side. Under standard conditions **(a)** the stem is bending towards the light. After NPA treatment **(b)** the stem is not bending at all. This image is also demonstrating how the auxin is distributed in this plant. The blue color indicates sites where the gene expression provoked by auxin takes place. Clearly, it is enhanced at the shaded side of the stem, which is elongating more than the illuminated side. After the application of NPA, this gradient cannot be formed. We ask the question on the importance of this process for the elongation of cells at both sides of the stem. For the purpose of this experiment, plants were transformed with the gene coding for β -glucuronidase enzyme under the promoter sensitive to auxin. The expression of this enzyme takes place only when there is a sufficient amount of auxin around. Its activity subsequently creates a blue precipitate after the addition of chromogenic substrate to the fixed plants, X-gluc (5-bromo-4-chloro-3-indolyl β – D glucuronide).

From this experiment, you can conclude (at least indirectly), what is the role of active auxin transport during the bending of the stem of *Arabidopsis thaliana* seedling. Describe the experiment in your words.