

The Effects of Electromagnetic Waves Emitted by Cellular Devices on Germination, Root Growth, and Root Tip Cell Division

Read, annotate, and complete each section.

The environment is exposed to electromagnetic radiations as a result of widespread use of wireless communication. This yields a massive increase in electromagnetic pollution. There is a concern of possible adverse effects of cellular phone radiation as a result of the enormous increase in the use of these phones throughout the world. Some studies have been conducted on genetic and biological effects of cellular phones and the effects of these devices on plants. Plants are an imperative component of every ecosystem on earth because they produce organic compounds release oxygen.

1. (RST.9-10.4.) Explain the meaning of these words using context clues and prefixes/suffixes.

yields: _____
 adverse: _____
 imperative: _____

An experiment was conducted to explore the effects of electromagnetic radiation by cellular phones on the germination, root growth, and division of root tips of lentil seeds. 10 lentil seeds were each planted on filter paper in 3 separate petri dishes. Seed samples in the first petri dish, Sample 1, were exposed to electromagnetic waves in a dormant state for 48 hours, then germinated in a controlled laboratory environment at 22 C. Seed samples in the second petri dish, Sample 2, were germinated in a controlled laboratory environment at 22 C prior to application of electromagnetic waves for 48 hours. The third petri dish, Sample 3, was not subjected to electromagnetic waves beyond the natural background. Seed were harvested immediately after exposure and were stained and analyzed using a microscope.

2. (SIN 402) Draw and label the treatment applied to each petri dish below:



3. (SIN 402) According to the passage, what is the dependent variable in this experiment?

- a. type of laboratory and temperature
- b. germination, growth, and division
- c. type of seeds
- d. number of germinated seeds

4. (EMI 401) Which of the following conclusions is supported by the passage and Figure 1?

- a. The differences in growth suggest that electromagnetic waves have an adverse effect on seeds exposed in dormancy.
- b. The differences in root growth suggest that electromagnetic waves do not impact seeds.
- c. The differences in root growth suggest that electromagnetic waves have an adverse effect on seeds exposed after germination.
- d. The differences in data suggests that seeds exposed to electromagnetic waves in dormancy were positively affected.

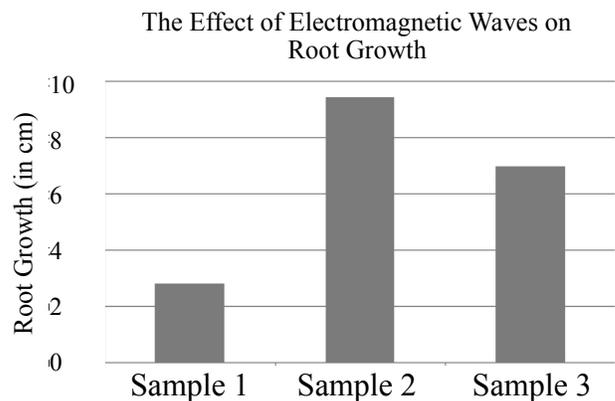


Figure 1

Experimental results of division in the root tip of lentil seeds are given in Table 1. The mitotic index is defined as the ratio between the number of cells in dividing compared to the total number of cells.

Experiment	Divided Cells		Mitotic Index (%)	Germination increase compared to control (%)	Abnormal division increase compared to control (%)
	Normal	Abnormal			
Electromagnetic waves applied to seeds during dormancy	177	12	8.85	-12.50	52.38
Electromagnetic waves applied to seeds during division	281	12	14.05	35.65	-1.71
Control	207	9	10.35	-	-

Table 1

5. (IOD 401) How many normally dividing cells were found in this experiment?
 - a. 177
 - b. 665
 - c. 698
 - d. 216

6. (EMI 401) Which of the following conclusions is supported by the data in Table 1?
 - a. Seeds exposed to electromagnetic waves during dormancy and division experienced a reduction in germination when compared to the control group.
 - b. Seeds exposed to electromagnetic waves during division experienced a reduction in germination when compared to the control group.
 - c. Seeds exposed to electromagnetic waves during dormancy experienced an increase in germination when compared to the control group.
 - d. Seeds exposed to electromagnetic waves during dormancy experienced a reduction in germination when compared to the control group.

Figure 3 illustrates three cells in a stage of division called anaphase. Figure 3.a illustrates normal anaphase and 3.b and 3.c illustrate abnormal anaphase. Use this information to answer Question 7.

7. (EMI 501) According to Table 1 and Figure 3, the cells in 3.b and 3.c were most likely in which experimental group?
 - a. electromagnetic waves applied to seeds during dormancy
 - b. electromagnetic waves applied to seeds during division
 - c. seeds in the control group
 - d. there is not enough information provided to answer the question

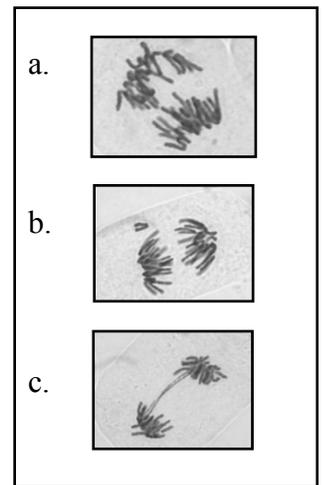


Figure 3

 Data Representations and Research Summary adapted from:
 Akbal, A. (2010). Effects of Electromagnetic Waves Emitted by Mobile Phones on Germination, Root Growth, and Root Tip Cell Mitotic Division of *Lens culinaris*. *Polish Journal of Environmental Studies*. Vol. 21, No.1, 23-29.