

# An investigation into the combined effect of static magnetic fields and different anticancer drugs on K562 cell membranes

Ying Liu<sup>1</sup>, Hao Qi<sup>1,2</sup>, Run-guang Sun<sup>1</sup>, and Wen-fang Chen<sup>1</sup>

<sup>1</sup>*Biophysics Laboratory, College of Physics and Information Technology, Shaanxi Normal University;*

<sup>2</sup>*College of Life Sciences, Shaanxi Normal University, Xi'an, China*

---

## ABSTRACT

---

**Aims and background.** Cell membranes were shown to be sensitive to and affected by static magnetic fields (SMF).

**Methods.** Cells were treated with four anticancer drugs followed by treatment with a combination of drugs and SMF. Individual cells were examined using atomic force microscopy (AFM). The drugs were taxol (alkaloid), doxorubicin (anthracycline), cisplatin (platinum compound) and cyclophosphamide (alkylating agent).

**Results.** Holes were observed in cells exposed to SMF but not in control groups. The number, size and shape of the holes were dependent on the drug type, SMF parameters and the duration of exposure.

**Conclusions.** The results suggest that the application of a SMF could alter membrane permeability, increasing the flow of the anticancer drugs. This may be one of the reasons why SMF can strengthen the effect of anticancer drugs. Observations were also made of the effect of using different anticancer drugs. For example, the effect of SMF combined with taxol or cyclophosphamide on the cells was additive while the effect of SMF combined with cisplatin or doxorubicin was synergistic. The target sites of cisplatin and doxorubicin are nucleic acids; continued research is required into this important area to ascertain the effect of SMF on nucleic acids.

---

**Key words:** anticancer drug, static magnetic field (SMF), K562 cells.

*Correspondence to:* Prof Hao Qi, College of Life Sciences, Shaanxi Normal University, 199 South Chang'an Road, Xi'an, Shaanxi, PR China 710062. e-mail qihao1846@sina.com

Received May 17, 2010;  
accepted February 2, 2011.