International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)
'A Bridge Between Laboratory and Reader'

www.ijbpas.com

APPLICATION OF DIFFUSION EQUATION IN LIFE SCIENCE

KUMAR B

P G Department of Mathematics, TMBU, Bhagalpur, Bihar, India

*Corresponding Author: Bikram Kumar: E-Mail: bikramforever@rediffmail.com; Mobile No.
+91 9472109525

ABSTRACT

By the help of diffusion equation we can verify the trends of tumor growth in Brain and we can minimize the cause growth process of tumor. By using Partial differential equation aided by del we can define the functional existence of growth of brain tumors.

Keywords: Diffusion equation, brain tumors, cancer, differential equation, life science

1. INTRODUCTION

The Gliomas are highly invasive brain tumors. They account for about 50% of all brain tumors [1]. The prognosis process of patients with gliomas depends upon some factors like including like histologic type and grade, malignancy, the patient's age and neurological functioning [2]. The grade of malignancy includes at most two factors: the rate of net proliferations, invasiveness that are found out by using diffusion equations. These equations are mathematical models of the experimental overview of the test for tumor growth. Gliomas consists of motile cells that can migrate as well proliferate. The invasiveness makes it impossible to define the growth rate of these tumors, as Blankenberg [3] showed even in the ideal case where at least two scans (CT, MRI) are analyzed at different times without treatment intervening. The boundary between tumor and normal tissue is not determined. Hence, new mathematical formulation is necessary for investigation of this boundary.

2. Mathematical Formulation of this boundary

Mathematical Modeling is been very useful since it was invented in solving many Biological problems. A sound

understanding and appreciation of biological problems is achieved by it. A realistic and practical representation of the biological problem is indicated by using this tool is been achieved. The cancer research has been futile field for the use Mathematical Modeling. Beginning with exponential growth of cells, usually, benign tumors doubling at rate of: 1 cell, 2 cells, 4 cells etc. as found by the Collins [4], which can be applied malignant human tumors, metastases studied by X-ray. Kusama of Deisboeck [6], states these tumors behave like complex dynamic and self- organizing bio systems. After that work by Steel [7]. The mathematical model equation for interaction of migration and net proliferations. The model is,

The rate of change of tumor cell population = the diffusion (the motility) of tumor cells + the net proliferations of tumor cells.

It can be better defined by,

1) $\delta c/\delta t = \blacktriangledown(D(x)\blacktriangledown c) + f(c)$.

Where,

$\blacktriangledown$ **= operator called Del,** $(D(x)\blacktriangledown c)=$
gradient driven by Fickian diffusion and net proliferation rate $= f(c)$

The diffusion tensor isotropic, i.e., proportional to the identity matrix. But inhomogeneous, which varies from point to point.

3. How this model works

In the case of drug delivery there are two domains: one contains the brain tissue and another one an internal space (the resection space in which then tumor has been surgically removed.), in which there is an antitumoral drug, described by different diffusions. In the case of cancer growth there is unique domain instead in which we use diffusion equation. With exponential proliferations term (which makes PDE Linear). By using this fact we can work with model. By doing case study taking consideration of RMN images, then by taking values and implementing them for stimulations which requires 4 GB and 64 Bit work station in order to handle the large number of degrees of freedom of the model and the complexity of the interpolating function.

4. CONCLUSIONS

Comsol Multiphysics can be used for modeling diffusion process in biological real geometries.

REFERENCES

[1] Alvord, Jr. E. C., Shaw C. M. (1991): Neoplasms affecting the nervous system of the elderly: In: Duckett S, Editor. The Pathology of the aging human nervous system; Philadelphia: Lea and Fabiger; p. 210-86.

[2] Silbergeld, D. L, Rostomily R. C, Alvord, Jr. E. C. (1991): The cause of death in patients with glioblastoma is

multifactorial: clinical factors and autopsy findings in 117 of supratentorial glioblastoma in adults. J. Neurol. Oncol., 10: 179 – 85.

[3] Blankenberg, F. G.; Teplitz, R. L.; Ellis, W.; Salamat, M. S.; Min, B. H., Hall, L. (1995): The influence of volumetric tumor doubling time. DMA ploidy, and histologic grade on the survival of patients with intracranial astrocytomas. AJNR Am J. Neuo. Rad, 16: 1001-12.

[4] Collins, V. P; Loeffler, R. K. and Tivey, H. (1956): Observations on growth rates of human tumors. Am J. Roetgenol Radium Ther. Nucl. Med., 76: 988 -1000.

[5] Kusuma, S., Spratt, Jr. J. S.; Doegan, W.L.; Watson, F. R. and Cunninghm, C. (1972): The gross rates of growth of human mammary cancer. Cancer; 30: 594-9.

[6] Deisboeck, T.: Pattern of self – organization in tumor systems: complex growth dynamics in a novel brain tumor spheroid model. Cell Prolif., 34: 115 – 35.

[7] Steel, G. G. (1977): Growth kinetics of tumors. Cell population kinetics in relation to the growth and treatment of cancer. Oxford: Clarendon Press.