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MATHEMATICAL ANALYSIS OF THE MODEL DESCRIBING CHEMOTHERAPY OF BRAIN TUMOURS.

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ABSTRACT

In this paper we discuss mathematical properties of a model formulated in Bogdańska *et al.*, *Math Biosci* (2017) that describes evolution of a type of brain tumours, namely low grade gliomas. The proposed model, consisting of ordinary differential equations, reflects the basic phenomena concerning the growth and response to chemotherapy of these tumours. Here we study the long-term behaviour of the model solutions, when the chemotherapy is described by asymptotically periodic or constant function.

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REFERENCES

- [1] M. Bodnar, U. Foryś, and M. J. Piotrowska: *Logistic type equations with discrete delay and quasi-periodic suppression rate*, *Appl Math Lett* **26** (2013), 607–11.
- [2] M. U. Bogdańska, M. Bodnar, J. Belmonte-Beitia, M. Murek, P. Schucht, J. Beck, and V. M. Pérez-García: *A mathematical model of low grade gliomas treated with temozolomide and its therapeutical implications*, *Math Biosci* **288** (2017), 1–13.
- [3] H. Dulac: *Recherche des cycles limites*, *C.R. Acad. Sci. Paris* **204** (1937), 1703–6.
- [4] L. Hammond, J. Eckardt, S. Baker, S. Eckhardt, M. Dugan, K. Forral, P. Reidenberg, G. Weiss, D. Rinaldi, D. Von Hoff, and E. Rowinsky: *Phase I and pharmacokinetic study of temozolomide on a daily for 5 days schedule in patients with advanced solid malignancies*, *J Clin Oncol* **17** (1999), 2604–13.
- [5] G. Keles, K. Lamborn, and M. Berger: *Low-grade hemispheric gliomas in adults: a critical review of extent of resection as a factor influencing outcome*, *J Neurosurg* **95** (2011), 735–45.
- [6] P. Mazzocco, C. Barthelemy, G. Kaloshi, M. Lavielle, D. Ricard, D. Ricard, A. Idbaih, D. Psimaras, M. A. Renard, A. Alentorn, J. Honnorat, J. Delattre, F. Ducray, and B. Ribba: *Prediction of Response to Temozolomide in Low-Grade Glioma Patients Based on Tumor Size Dynamics and Genetic Characteristics*, *CPT Pharmacometrics Syst. Pharmacol.* **4** (2015), 728–37.
- [7] J. Portnow, B. Badie, M. Chen, A. Liu, S. Blanchard, and T. Synold: *The neuropharmacokinetics of temozolomide in patients with resectable brain tumors: potential implications for the current approach to chemoradiation*, *Clin Cancer Res* **15** (2009), 7092–8.
- [8] N. Pouratian and D. Schiff: *Management of low-grade glioma*, *Curr Neurol Neurosci Rep* **10** (2010), 224–31.

- [9] B. Ribba, G. Kaloshi, M. Peyre, D. Ricard, V. Calvez, M. Tod, B. Cajavec-Bernard, A. Idbaih, D. Psimaras, L. Dainese, J. Pallud, S. Cartalat-Carel, J. Delattre, J. Honnorat, E. Grenier, and F. Ducray: *A tumor growth inhibition model for low-grade glioma treated with chemotherapy or radiotherapy*, Clin Cancer Res **18** (2012), 5071-80.
- [10] D. Ricard, G. Kaloshi, A. Amiel-Benouaich, J. Lejeune, Y. Marie, E. Mandonnet, M. Kujas, S. Mokhtari, S. Taillibert, F. Laigle-Donadey, A. Carpentier, A. Omuro, L. Capelle, H. Duffau, P. Cornu, R. Guillevin, M. Sanson, K. Hoang-Xuan, and J. Delattre: *Dynamic history of low-grade gliomas before and after temozolomide treatment*, Ann Neurol **61** (2007), 484–90.

