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A Nonlinear Logistic Regression Model for the Measurement of Drug Potency in Photodynamic Therapy

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Medical physics has revolutionized how cancer is diagnosed and treated. From imaging to therapy, the principles of physics have shown the inseparable relationship with biological systems. One such example is Photodynamic Therapy (PDT), a therapeutic modality that uses light to kill cancer by means of a photochemical reaction that is initiated when a photosensitizer (PS) molecule absorbs a photon of light to become phototoxic. Like all other therapies, the potency of PDT has to be determined before confirming its usage. Many PSs are available, some are being investigated and yet more will emerge in future. To measure the therapeutic potency of these PSs in PDT therefore, a good model and technique for the accurate measurement of potency is indispensable. Unlike most therapies, where a single drug causes effect, in PDT there are two input variables to produce a response, the PS and the light. A design for accurate estimation of PDT potency was therefore developed in this present investigation, using regression analysis of the proliferation of cells treated with PDT. A cancer cell line, SiHa cells, was cultured and treated with serially diluted PS concentrations for treatment at two different laser fluences. Using nonlinear regression, the dose response curve was fitted and the half growth inhibition (GI50) value was calculated using an adjusted Four Parameter Logistic (4PL) Model. This work has since provided guiding principles for the accurate estimation of PDT potency for early stage PDT investigations, and includes theoretical considerations for the accurate estimation of the GI50 value.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

PhD

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