# Increasing toxin production in *Clostridium tetani* using machine learning

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Tetanus is a global life-threating disease that affects both humans and animals. The disease is caused by the tetanus neurotoxin (TeNT), a protein produced by *C. tetani*. Fortunately, there is a toxoid vaccine, which requires the production of TeNT from *C. tetani* fermentation. However, the industrial process suffers batch to batch inconsistencies and occasional low yields, thus medium optimization is required. This study focuses on the prediction of the optimal concentration of five media metabolites, using a machine learning approach, based around neuro fuzzy networks (NFN). Construction of the NFN was conducted in Matlab using a subtractive clustering approach to interpret the input data. The NFN was trained using initial metabolite concentrations as the input and toxin production as the output. After training, the model was validated with an error of 0.4305 Lf/mL using leave one out cross validation and hold-out techniques. The inputs were optimised to give a maximum toxin concentration by using particle swarm optimisation. The resultant optimised input concentrations were tested experimentally and increased toxin production by 120% from control, with two metabolites identified as key compounds for toxin production.

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Research interests: I'm currently an undergraduate student at UQ aspring to learn more about metbolic engineering. This field is new to me and the opportunity to work using many different methods and organisms is an exciting prospect.