

Analytic expression of total quasi steady state approximation in competitive target-mediated drug disposition

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ABSTRACT

Competitive target-mediated drug disposition (competitive TMDD) models describe the behavior of drugs that bind with high affinity to target receptors while competing with endogenous ligands for a common receptor. Due to the complexity of these systems, several reduction methods using quasi-steady-state approximations (QSSA) have been introduced, such as competitive mTMDD and competitive qTMDD. While competitive mTMDD, which yields linear equations, has an explicit analytic solution, solving the competitive qTMDD model is more challenging due to the cubic equations involved, making its analytic solution largely unknown. In this work, we derive an explicit real solution for competitive qTMDD by leveraging the properties of complex numbers and cubic equations. These explicit real solutions provide an efficient and accurate approximation for competitive TMDD, with potential applications in a range of competitive interaction scenarios.

REFERENCES

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