

**Developing EGFR-Targeted Nanoliposomal Therapeutics in Head and Neck
Squamous Cell Carcinoma**
(Technical Report)

Music Streaming Services: The Soundtrack to our Future
(STS Research Paper)

An Undergraduate Thesis

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SocioTechnical Synthesis

Head and Neck Squamous Cell Carcinoma (HNSCC) is the 7th most common cancer worldwide. Despite its prevalence, Cetuximab is the only HNSCC-targeted therapy that exists to treat it, which has shown mixed outcomes in patients. This highlights the need to develop more effective treatment options for HNSCC patients. The ceramide nanoliposome (CNL) is a cancer cell death-inducing therapeutic currently in Phase I clinical trials for multiple cancers. The Kester Lab at the University of Virginia has identified a synergistic cell death effect between CNL and Erlotinib or Gefitinib, two FDA-approved drugs with the same molecular target as Cetuximab. The purpose of this study was to fully investigate the combination of CNL and Erlotinib, Gefitinib, or Cetuximab and prepare these combinations for use in living-organism HNSCC trials. Through successive cell viability experiments, synergy was confirmed between CNL and Erlotinib or Gefitinib, while no synergy was found between CNL and Cetuximab. To improve bloodstream retention time and host immune system shielding, Erlotinib and Gefitinib were successfully encapsulated inside their own lipid nanoparticle delivery vehicles. Optimization of the delivery vehicle compositions to deliver a maximal drug payload was in progress until this study was interrupted by the Covid-19 pandemic. Cetuximab was attempted to be attached to the CNL particle surface to serve as a molecular targeting mechanism, but success was never reached due to the institution of remote learning. This study characterized a novel combinatorial effect between CNL and Erlotinib or Gefitinib and laid the groundwork for future targeted delivery systems to combat HNSCC.

While the technical aspect of this thesis focused on preparing new therapeutics for HNSCC, the STS aspect of this thesis focused on the evolution of how individuals listen to music and how this impacts the music industry and the cultural norm of sharing. Over the past 20

years there has been a drastic shift in how individuals listen to and acquire music. This shift, also referred to as the evolution of music, is attributed to the technological progress that has occurred on music-listening devices that quickened in the 1970s and has yet to slow down. From the development of the Sony Walkman in 1979 to the creation of the first iPod in 2001, every improvement to music-listening devices has centered around making music more accessible, personal, and private. This shift from public to private music closely follows and connects with the societal shift in how music is perceived. Music is no longer perceived to be just a means for interactions with friends, family, and even strangers, but is now a way to express yourself and is even believed to contribute to individual's personal growth and development. Furthermore, the societal norm of sharing music contributes a great deal in determining how users will interact with a music-listening and music-storing device. Throughout the evolution of music, every technological improvement has caused a shift in a societal musical norm and every shift in a societal musical norm has caused a technological improvement. Therefore, to explore the evolution of music, the method of co-production was used, which allows for the exploration of both the technical and societal aspects in a non-linear fashion. A case study comparison was conducted between Spotify, Apple Music, Pandora, and SoundCloud to address how legal and free music streaming services are affecting the music industry and the societal norms surround music acquiring and sharing. Furthermore, a survey was conducted with 108 participants varying in age to determine how the societal norms surrounding music sharing have impacted the way individuals use legal and free music streaming services. Through all of this it is seen that by utilizing legal and free music streaming services, the societal norm surrounding how music is acquired and shared have greatly changed and the amount of conscious music sharing that occurs has decreased. Additionally, it is seen that the music streaming services have a negative effect on

the music industry as a whole. By sharing all of this, the hope is to help improve the relationship between legal and free music streaming services and the music industry to one that is positive for all parties involved. Additionally, by finding the flaws each service has with concern to sharing, the hope is to show the services aspects in need of improvement, which will then allow more self-expression and personal growth for the users.