Developing a Procedure for Radiolabeling Chemotherapy Drugs

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BACKGROUND/OBJECTIVES:
Fluorine-18 fluorodeoxyglucose (FDG) is commonly employed for cancer detection as it accumulates in tumors, allowing them to be observed using PET imaging. However, this approach does not reveal appropriate cancer treatments as each cancer is different, needing targeted chemotherapy. After an initial treatment, a drug's efficacy is investigated to see its effect on the cancer; if no improvement is observed, a new drug is chosen and the process repeats. An objective of this project is to radio-fluorinate chemotherapeutic drugs. A patient will receive a drug and a PET scan can be performed. If the cancer is visible on the PET scan, then the drug has reached its target and will most likely be effective, eliminating the trial-and-error in patient treatment. Fluorine-18 has a half-life of 110 minutes so hot synthesis and purification must be performed quickly. Solid phase synthesis of F-18 radiolabelled compounds is being investigated to accelerate this process with filtration being the only necessary purification step.

METHOD/RESULTS:
The fluorination of alcohols using a literature Mitsunobu procedure was attempted with limited success. The procedure was successful when adding a pre-fluorinated chain with an alcohol to a free alcohol on a molecule (dehydration). The proposed solid-phase synthesis was performed using a sulphonyl chloride resin and attaching it to an alcohol as a leaving group. This reaction was successful using different fluorine sources; however, the reaction produced side-products that need to be eliminated or prevented altogether.

CONCLUSION/IMPLICATION:
Current cancer drug choice is time-consuming due to a trial-and-error process. This research attempts to remove guesswork from chemotherapy choice as well as proposing a synthetic pathway that is rapid, requiring little purification. Future research includes improving resin reactions and applying the fluorination of an alcohol to pre-existing cancer drugs to enhance their therapeutic use.