

## Spicing up cancer treatment: adding curcumin to tiny chemotherapy beads

SN-38 is a strong cancer-fighting drug, but it is difficult to safely administer to patients

### WHAT IS THIS RESEARCH ABOUT?

SN-38 is good at fighting cancer, but if released directly into a patient's body it damages too much healthy tissue and is too toxic for human use. However, you can often make a drug safer by packaging it in a lipid or plastic container called a nanoparticle, so instead of travelling through the entire body it can travel directly to the cancer before being released. Also, you can sometimes make a drug work better by mixing it with other ingredients that affect how it acts and how well it interacts with the nanoparticles in which it is wrapped.

We pursued both these approaches by designing an integrated drug delivery strategy to find a “cocktail recipe” that would make SN-38 safe for injection.

### WHAT DID THE RESEARCHERS DO?

We first tried wrapping SN-38 by itself in plastic nanoparticles but that didn't work well. We then tried mixing SN-38 with different amounts of curcumin, and using slightly different approaches to making the nanoparticles to see if we could find better ways of getting SN-38 into them. With each new recipe, we tested the nanoparticles to find out their size, how much they varied in size, their shape, and how much drug they carried. Then, we picked the best recipes and tested how quickly the drug was released from the nanoparticles when heated to body temperature. We also tested our best recipes on cancer cells to see how much drug was enough to kill the cancer.

### WHAT DID THE RESEARCHERS FIND?

Mixing SN-38 with curcumin before wrapping it in nanoparticles makes it easier to wrap and allows more SN-38 into the nanoparticles. The more curcumin we added, the more SN-38 we could get into the nanoparticles, up to a limit.

When we tried to wrap SN-38 alone in nanoparticles, only about 5% of the SN-38 ended up in the nanoparticles. When we added 5 times as much curcumin as SN-38, we got 12% of the SN-38 into our nanoparticles. Also, adding curcumin made the nanoparticles more similar in size, which is good for patients. (Similar-sized nanoparticles give more predictable effects because they all behave in the same way.) We found that SN-38 and curcumin are released quite rapidly from the nanoparticles at body temperature, with the nanoparticles releasing half of the drug within an hour when tested in the lab.

We also found that adding curcumin didn't make SN-38 better at killing cancer cells but wrapping SN-38 in plastic nanoparticles sometimes made it better than unwrapped SN-38 at killing some types of cancer cells. While no experiments have yet been conducted on animals or humans to be certain of the safety of our formulation, the results we found suggest that this recipe is safer and better to use for patients than “unwrapped” SN-38.

## HOW CAN THESE RESEARCH RESULTS BE USED?

Our study brings us a step closer to using SN-38 in patients and gives scientists new ways to wrap other drugs like SN-38 in nanoparticles. Therefore, it is important research on improving the ways we tailor nanoparticles for delivering certain kinds of drugs to sites in the human body.

Our research provides scientists with new ways to make nanoparticles containing a cocktail of medications. This benefits patients and clinicians because we know that wrapping a cocktail of drugs together in a single nanoparticle has advantages since a “cocktail” of drugs is, in many cases, more effective than administering one drug alone, or even administering multiple drugs separately, and is often safer than using high doses of a single drug.

*Prepared by Dr. Liza Silverman, based on the article [“Improvements in Drug-Delivery Properties by Co-Encapsulating Curcumin in SN-38-Loaded Anticancer Polymeric Nanoparticles”](#) by L. Silverman et al, published June 2022 in Molecular Pharmaceutics.*