Nano World: 150 nanodrugs on horizon

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While only two kinds of nanoparticle therapies against cancer are now clinically available in the United States, roughly 150 more lie in various stages of development, experts told UPI's Nano World.

"The National Cancer Institute's goal to the nation is to eliminate the suffering and death from cancer by 2015. Now getting rid of cancer is a ridiculous notion, but the hope is to turn cancer into something we can live with and treat, much like how diabetes was a death sentence 50 years ago and now is not. And these nanodrugs may help lead the way," said Mauro Ferrari, who led the development of the National Cancer Institute's nanotechnology plan and is associate vice president of health sciences technology and commercialization at Ohio State University in Columbus. He and others discussed their views at the NanoCommerce & SEMI NanoForum conference in Chicago on Tuesday.

The first kind of nanoparticle therapy, approved more than 10 years ago, wraps anti-cancer drugs in liposomes, which are essentially microscopic bubbles of fat that help reduce a drug's side effects. While originally designed to treat Kaposi's sarcoma, it now is getting approved for other cancers, including breast and ovarian. The other, which the Food and Drug Administration approved in January, is Abraxane from American Pharmaceutical Partners in Schaumburg, Ill., which is made of nanoparticles containing the tumor-fighting drug paclitaxel bound to albumin protein. Abraxane can be taken without the toxic solvents normally used with paclitaxel, which means more of the drug can be taken with fewer side effects.

Ferrari noted that roughly 150 more nanoparticle cancer therapies were in development. Still, he and others noted they face many challenges simply reaching their intended target. If they are made too small, they simply get flushed out the body, while ones that are too big get stuck in blood vessels for immune cells to gobble. In addition, layers upon layers of biological tissue often stand in their way.

"To move beyond the nanoparticle drugs we have now, we'll need multiple approaches against all the traps the body puts up against them," Ferrari said. For instance, creating multilayered nanoparticles could lead to an outer layer that prevents immune cells from engulfing it, with the layers underneath that enabling it to penetrate through multiple kinds of tissue or help doctors see if the nanoparticles have reached the right cells, in addition to delivering a drug payload, he explained.

"Great examples" of multifunctional nanoparticle therapies in development include 6-nanometer-wide branched nanoparticles known as dendrimers from the University of Michigan at Ann Arbor that carry different molecules on their branches that enable a dendrimer to latch onto specific cells, deliver anti-cancer drugs and let doctors image the dendrimer's location via magnetic resonance imaging scans, Ferrari said. Another included nanoparticles from MIT announced in July that carry both anti-angiogenic drugs targeting the abnormal blood vessels feeding the tumors as well as anti-cancer drugs against the tumor cells themselves.

In addition to nanoparticle therapies that carry drugs to attack tumors cells, others exist that kill cancers by roasting them. Nanospectra Biosciences in Houston has an exclusive worldwide license to nanoparticles known as nanoshells, which have a gold crust and a glass core. When exposed to near-infrared light -- the kind that best penetrates the body without harm -- the nanoshells heat up. Such therapy would involve delivering nanoshells into target cancers and shining near-infrared light outside the patient to cook a tumor from the inside, explained Nanospectra President Donald Payne.

Since cancers are such complex diseases, employing multiple therapies "might be the most useful," Payne said. While Ferrari acknowledged that combining several clinical approaches that by themselves are complicated into multifunctional nanoparticle or multiple nanoparticle therapies that would prove even more complex to develop, he noted that "Albert Einstein once said to make your theory as simple as possible but no simpler. While we are in agreement that by adding more complexity, you add more worries, if you ask me, it's the only way to beat this damn thing. You cannot make the therapy any simpler if the simpler things don't work."