NRC·CNRC

Blood-brain barrier carriers

(L-11085, 11750, 12133, 12596, 12599, 12600)

Highlights

The blood-brain barrier (BBB) is the principal hurdle in developing drugs for central nervous system (CNS) diseases such as Alzheimer's, Parkinson's, brain cancer, epilepsy and others. Composed of tightly adjoined endothelial cells, the BBB actively repels foreign matter from the brain; virtu-ally no biologic molecules are able to cross it to elicit a therapeutic response.

To address the need for disease-modifying CNS biologics, the NRC has developed carriers for delivering therapeutics beyond brain barriers. They can be coupled to a wide range of client molecules in order to prevent, diagnose, and treat CNS diseases.

Technology transfer

- Non-exclusive commercial exploitation licence
- R&D agreement for development

Market applications

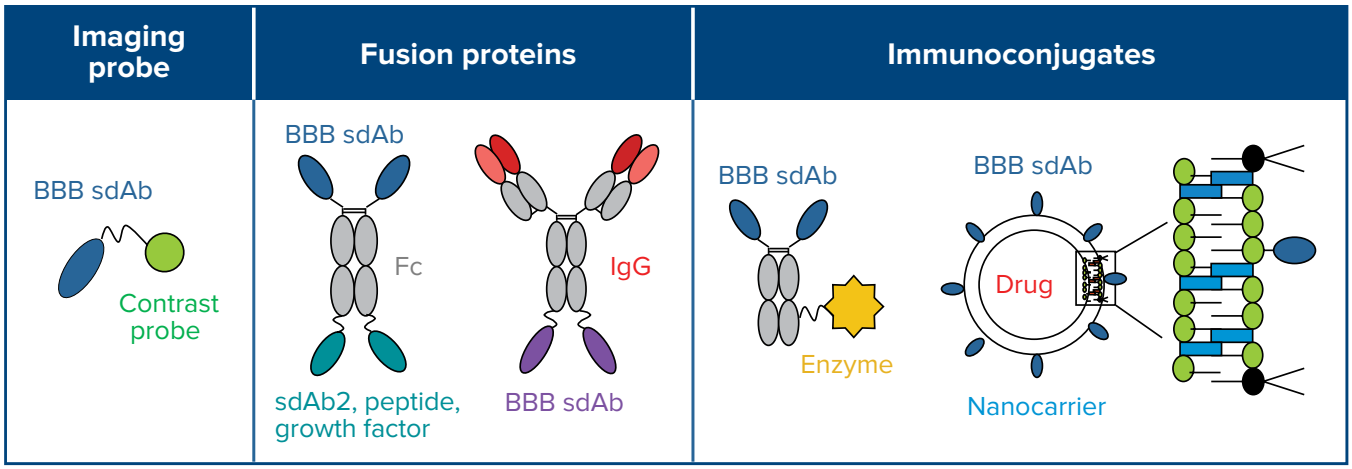
- Deliver therapeutic antibodies, peptides, enzymes and proteins across the BBB for prevention and treatment of neurodegenerative and other CNS diseases
- Deliver contrast agents across the BBB for diagnostic / prognostic imaging
- Deliver nanoparticles carrying therapeutics across the BBB

How it works

The NRC's BBB carriers are single-domain antibodies (sdAbs) that bind to BBB-expressed receptors, internal-ize into BBB cells and transmigrate across the BBB into the brain.

The technology exploits a process known as receptor-mediated trans-cytosis (RMT) across the BBB, which is amenable for delivery of both small molecular weight therapeutics and biologics including peptides, antibodies and RNA.

In contrast to competing RMT BBB delivery technologies that use the transferrin, insulin, or LRP1/2 receptor(s) expressed at the BBB to carry molecules into the brain, the



Various configurations of sdAbs used as BBB carriers: (1) with imaging probes; (2) as fusion proteins with other sdAbs, peptides, growth factors, and monoclonal antibodies; (3) as immunoconjugates with enzymes and nanocarriers.

NRC's technology utilizes novel, recently discovered receptors involved in BBB RMT. Unlike other receptors listed above, which are highly expressed in peripheral organs and therefore lack selectivity, the receptors exploited by the NRC are enriched in the blood-brain barrier and up-regulated in specific brain diseases. This enables carrier-coupled therapeutics to target the brain with higher selectivity.

Benefits

- Two generations of sdAbs that are small (13 kD), stable, humanized, and easily customizable
- sdAbs target novel, highly selective receptors
- Preclinical proof of concept established *in vivo*

Patents

NRC file 11085 (1st generation receptors): Patent issued in Canada, the United States, and Europe.

NRC file 11750 (1st generation sdAbs): Patent issued in Japan, pending in Canada, the United States, Europe and India.

NRC file 12133 (analgesic, anti-epileptic neuropeptide): Patents pending in Canada, the United States and Europe.

NRC files 12596, 12599, 12600 (2nd generation receptors and sdAbs): Provisional patents filed in the United States.

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