

中性子捕捉療法の原理

Table. Neutron Capture Cross Section of Typical Atoms

Atom	Cross section (barn)	Reaction
^{16}O	0.00019	
^{12}C	0.0035	
^1H	0.333	$^1\text{H}(n, \gamma)^2\text{H}$
^{14}N	1.83	$^{14}\text{N}(n, p)^{14}\text{C}$
^{10}B	3840	$^{10}\text{B}(n, \alpha)^7\text{Li}$
^{157}Gd	254000	$^{157}\text{Gd}(n, \gamma)^{158}\text{Gd}$

Neutron-capture therapy (NCT) is a cancer therapy which utilizes radiation emitted as a result of the neutron-capture reaction (NCR) with ^{10}B or ^{157}Gd located in the tumor and thermal- and/or epithermal-neutrons irradiated from the outside of the body.

中性子捕捉療法 (Neutron Capture Therapy, NCT)

中性子捕捉療法 (NCT) は、がん組織内にあらかじめ中性子増感元素を取り込ませておき、そこに熱中性子を照射することによって生ずる放射線によりがん治療を行う。

	Neutron-capture element	
	B-10	Gd-157
Reaction	$^{10}\text{B} (n, \alpha) ^7\text{Li}$	$^{157}\text{Gd} (n, \gamma) ^{158}\text{Gd}$
Thermal neutron cross-section	3833 barn (1)	255000 barn (66)
Emitted radiation	α -rays, ^7Li	γ -rays, e^- , X-rays
Range of emitted radiation	10 μm	>100 μm
To induce cell inactivation	intracellular	vicinity of cell



中性子捕捉療法に必要なもの

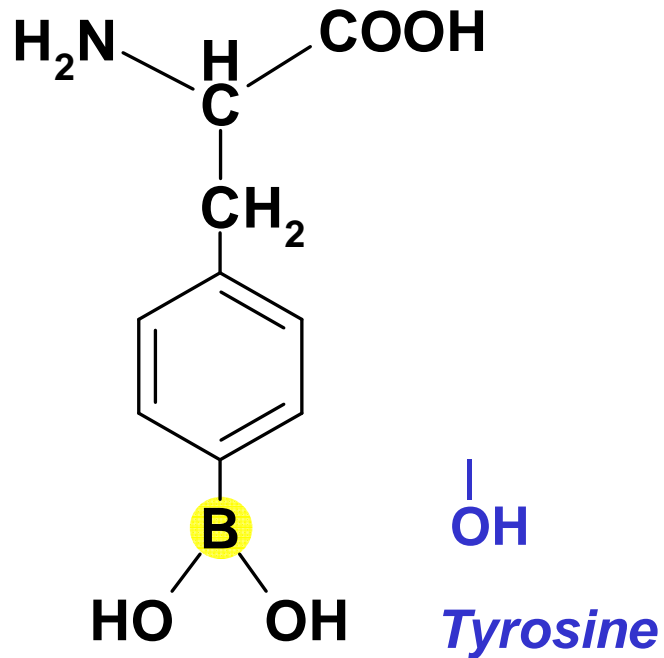
中性子源	原子炉、加速器
適用対象	悪性黒色腫、脳腫瘍
化合物	BPA, BSH
原子送達技術	？

原子送達技術

Boron compounds

BPA

p-Boronophenylalanine



MW 208.2

Phenylalanine derivative

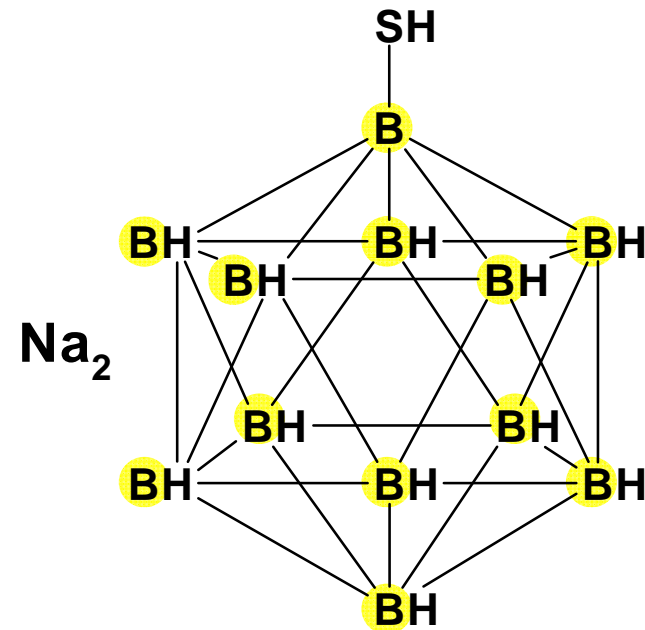
Water-solubility 1.6 g/L (20°C)

Infused as water-soluble fructose complex

Melanoma-specific accumulation

BSH

Borocaptate sodium



MW 210.3

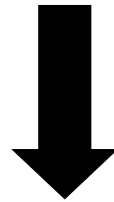
12 boron atoms and an SH group

Cage-shaped compound

Highly water-soluble

Drug Delivery System:

Dosage forms (drug-carriers) for delivering intrinsically **bio-active** compounds without destroying their total structures.



Atom Delivery System:

Dosage forms (atom-carriers) for delivering **bio-inactive** compounds containing the atoms to be activated by externally administered energy-carriers.

NCT  *Bimodal treatment system*

ガドリニウム中性子捕捉療法への +/粒子の適用

BNCT

Intra-cellular accumulation of B-compounds

GdNCT

Tumoral tissue accumulation by delivery technology
because of very poor tumoral retention
of Gd-compounds:

Gd-DTPA

