Cy5.5-Asp-Gly-Glu-Ala (DGEA)

Cy5.5-DGEA

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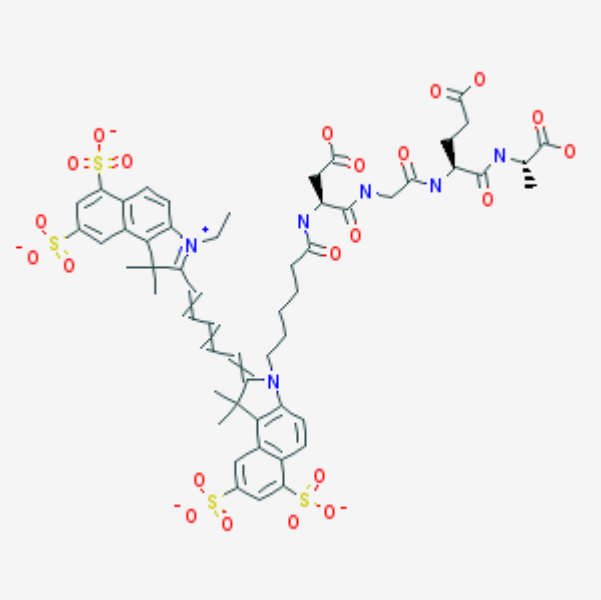
Chemical name:	Cy5.5-Asp-Gly-Glu-Ala (DGEA)
Abbreviated name:	Cy5.5-DGEA
Synonym:	
Agent category:	Peptide
Target:	Integrin $\alpha_2\beta_1$
Target category:	Receptor
Method of detection:	Optical, near-infrared (NIR) fluorescence
Source of signal:	Cy5.5
Activation:	No
Studies:	• *In vitro* • Rodents



Click on the above structure for additional information in PubChem.

Background

[PubMed]

Integrin receptors are a family of cell-surface heterodimeric glycoproteins that mediate diverse biological events (e.g., cell adhesion, migration, differentiation, proliferation, and apoptosis) involving cell–cell and cell–matrix interactions (1, 2). They consist of an α and

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a β subunit. They are important for cell adhesion and signal transduction. On the other hand, integrins affect tumor growth, tumor invasiveness, and metastasis (3, 4). The $\alpha_2\beta_1$ integrin binds mainly to collagen type I, laminins, E-cadherin, and matrix metalloproteinase 1 (5). The $\alpha_2\beta_1$ integrin is strongly expressed on tumor cells and has been implicated in tumor progression and metastasis (6, 7). In particular, prostate cancer cells and prostate cancer stem cells express high levels of $\alpha_2\beta_1$ integrin (8, 9). A tetrapeptide sequence consisting of Asp-Gly-Glu-Ala (DGEA) has been identified as a recognition motif used by the type I collagen to bind to $\alpha_2\beta_1$ integrin (10). DGEA was conjugated with Cy5.5 to study *in vivo* biodistribution of the tracer in prostate tumor-bearing mice (11). Cy5.5-DGEA exhibited high accumulation in $\alpha_2\beta_1$-positive PC-3 human prostate tumor cells in nude mice.

Related Resource Links:

- Chapters in MICAD (DGEA)
- Gene information in NCBI (α_2 integrin, β_1 integrin)
- Articles in Online Mendelian Inheritance in Man (OMIM) (α_2 integrin, β_1 integrin)

Synthesis

[PubMed]

DGEA peptides were obtained using solid-phase synthesis (11). Cy5.5-*N*-hydroxysuccinimide (NHS) ester was used to conjugate DGEA peptides using solid-phase synthesis to form Cy5.5-DGEA. The NHS ester of Cy5.5 reacted with the N-terminal amino group of the Asp of the DGEA peptides. The measured mass of Cy5.5-DGEA was *m/z* 1,287.3, which was ~1 Cy5.5/DGEA. The chemical purity was >98%. Cy5.5 is a NIR fluorescence dye with absorbance maximum at 675 nm and emission maximum at 694 nm, with a high extinction coefficient of 250,000 $M^{-1}cm^{-1}$. 5-Carboxyfluorescin-DGEA (FAM-DGEA) peptides were similarly prepared for *in vitro* studies.

In Vitro Studies: Testing in Cells and Tissues

[PubMed]

Flow cytometry analysis showed that 99.7% of PC-3 cells, 51.4% of CWR-22 cells, and 15.6% of LNCaP cells were positive for the $\alpha_2\beta_1$ receptors using FAM-DGEA (11). Binding of 1 μM FAM-DGEA to the three cell types was analyzed with fluorescence microscopy. PC-3 cells exhibited a higher fluorescence intensity signal than CWR-22 and LNCaP cells. The binding of FAM-DGEA to PC-3 cells could be completely blocked with 20 μM DGEA.

Animal Studies

Rodents

[PubMed]

Huang et al. (11) performed NIR fluorescence imaging of nude mice (n = 3) bearing PC-3 tumors at 0.5–24 h after intravenous injection of 1.3 nmol Cy5.5-DGEA. The tumor accumulation of Cy5.5-DGEA could be clearly visualized from 1 h to 24 h, with a maximum contrast at 2 h. The tumor/background ratio was ~10 at 2 h after injection. Co-injection of 300 nmol DGEA inhibited the signal by 40% at 4 h after injection. This low reduction of signal may be due to non-specific binding in the tumor. There was also some reduction of signal in the liver, lung, spleen, and muscle due to normal expression of $\alpha_2\beta_1$ integrin in these tissues. *Ex vivo* imaging of tissues at 28 h after injection showed that the tissues with highest signal were the tumor and kidney, followed by the liver, lung, pancreas, spleen, muscle, and heart. Immunohistochemistry staining of PC-3 tumor sections showed a strong expression of $\alpha_2\beta_1$ integrin in the tumor cells.

Other Non-Primate Mammals

[PubMed]

No publication is currently available.

Non-Human Primates

[PubMed]

No publication is currently available.

Human Studies

[PubMed]

No publication is currently available.

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