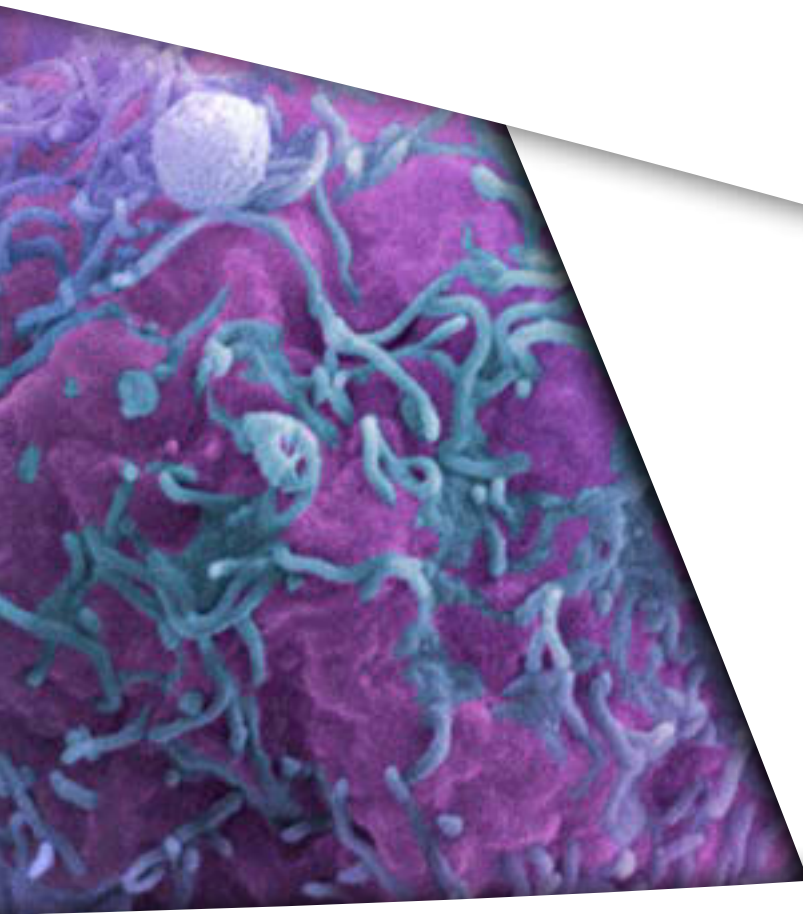# MELANOMA PEPTIDES

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# MELANOMA PEPTIDES OFFERED BY BACHEM

Malignant melanoma is a dramatically increasing public health problem with overall more than 232`000 new cases and about 55`000 deaths estimated in 2012. At an early stage melanoma is surgically completely curable, but recurrent or metastatic melanoma is often resistant to classical therapies and the outcome of advanced melanoma is almost always fatal. A major breakthrough in the treatment of melanoma was obtained in March 2011, when the FDA granted broad approval for use of the immune-checkpoint inhibitor ipilimumab for patients with late-stage metastatic melanoma. This brought a clear survival advantage observed for a patient group with no other therapeutic options. Nowadays, immunotherapy plays an outstanding role for the melanoma therapy, reflected by the fact, that only two of six drugs approved in recent years by the FDA are not immunotherapies. However, several therapeutic hurdles are still to overcome, and approaches like vaccination could contribute to further improvements in melanoma therapy. Thereby, peptides are indispensable tools for experimental research.

## Melanoma

Cutaneous melanoma is a malignant tumor of pigment-producing cells in the skin. These cells, known as melanocytes, produce the pigment melanin, which is responsible for the color of our skin. Melanoma is the most aggressive form of skin cancer. Although melanomas occur in more than 95 % of cases in the skin, they can also be found in the mucous membranes of the mouth, nose, anus, and vagina and, to a lesser extent, the intestine; melanocytes are also present in the conjunctiva, the retina, and the meninges [1].

The incidence varies 100-fold between countries worldwide, but has been increasing dramatically over the past decades in many populations that are predominantly fair-skinned. Accordingly, more than 80 % of the estimated new cases occurred in Oceania, Europe, and North America. Overall, more than 232`000 new cases of melanoma and about 55`000 deaths were estimated in 2012 [1, 2].

Although melanoma are surgically completely curable at an early stage, recurrent or metastatic melanoma is often resistant to classical therapies. Besides avoidance of excessive UV-irradiation as preventive measurement and the importance of early detection, recent advances have been made in therapeutic treatment of melanoma. Whereas the treatment was limited to interferon-α2b for adjuvant therapy and dacarbazine or high-dose interleukin 2 (IL-2) for metastatic disease prior to 2011, since then three new agents have been approved. These are pegylated interferon-α2b in the adjuvant setting, the monoclonal antibody ipilimumab for metastatic disease and an oral BRAF inhibitor vemurafenib in patients with metastatic melanoma harboring BRAFV600 mutations [3].

Overall, tumor immunotherapy seems to play an outstanding role for the treatment of melanoma, reflected by the fact that of the six approved drugs mentioned above only dacarbazine and vemurafenib are not immunotherapies [3]. In addition, pilot clinical data suggest potential benefits with targeted therapeutic melanoma vaccines [1].

## Immunotherapy

The approach to treat tumors by immunotherapeutic means reaches back more than 120 years, when the young surgeon William Coley conducted intra-tumoral injections of live or inactivated *Streptococcus pyogenes* and *Serratia marcescens* in an effort to reproduce the spontaneous remissions of sarcomas. The latter were observed in rare cancer patients who had developed erysipelas [4, 5]. Cancer immunotherapy aims to harness and enhance the innate immune system to fight against cancer and, after decades of disappointments, has become the most promising treatment approach in recent years [5, 6]. Important requirements are thereby the ability of the immune system to recognize tumor-associated antigens (TAAs), which are presented by tumor cells, and to elicit an immune response against these targets (Fig. 1).

Thereby, melanoma together with kidney and lung cancer are natural targets for immunotherapeutic approaches, because



Lysis

MHC  TCR

Tumor cell

T-lymphocyte
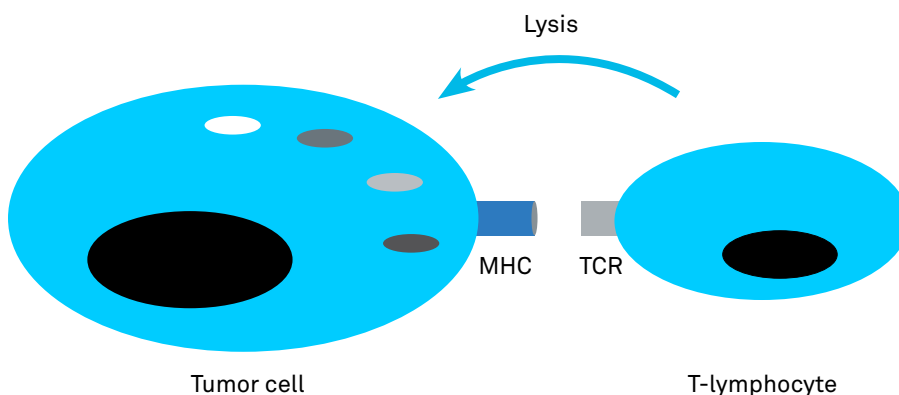
**Fig. 1.**
Induction of an immune response directed against tumor associated antigens (TAAs) leads to the destruction of tumor cells. MHC: Major histocompatibility complex, TCR: T-cell receptor. Simplified representation.

both tumor types are frequently infiltrated with CD8^{+} T-lymphocytes, and occasionally undergo spontaneous regression [7]. Tumor-specific CD8^{+} T-lymphocytes are believed to particularly mediate these anti-tumor effects [8].

The broad approval granted in March 2011 by the FDA for use of the drug ipilimumab for patients with late-stage metastatic melanoma, either as initial therapy or after relapse, was a major breakthrough in the immunotherapy for melanoma. This not only brought a clear survival advantage observed for a patient group with no other therapeutic options, but also employs a mechanism of action which is virtually certain to involve the modulation of endogenous T-cell responses [5].
Ipilimumab is a monoclonal antibody to CTLA4 (cytotoxic T-lymphocyte antigen-4). The latter is an immune checkpoint regulator protein and negative regulator of the immune response. Under physiological conditions, CTLA4 attenuates the chances for chronic autoimmune inflammation, but also inhibits the development of an active immune response by acting primarily at the level of T cell development and proliferation. Blocking of CTLA4 with an antibody overcomes the negative regulation [5, 9]. This, following a current rationale, gives rise to activation of pre-existing anticancer T-cell responses and possibly triggers new responses [5].
A second immune checkpoint, PD-1 (programmed cell death-1), has garnered significant interest since the blockade of PD-1 with a single agent was associated with objective responses in melanoma, kidney cancer, and lung cancer [7].

However, despite of the significant progress recently obtained, cancer immunotherapy is still suffering a number of limitations. In case of ipilimumab challenges are a significant rate of on-site toxicity effects, leading to serious colitis and hypophysitis due to induced inflammation in up to 23 % of the patients. In co-therapy with dacarbazine, significant elevations in liver function tests in 20 % of the so treated patients were observed. Moreover, the stimulation of T-cell response with ipilim-

umab may take several months to occur, while treatment with conventional cytotoxic therapies may trigger rapid tumor shrinkage due to direct killing of cancer cells [5]. The adverse effects with PD-1 blockade seem to be less pronounced, than with CTLA-4 blockade [7].

Both, for antibody-based therapy or for cancer vaccines, the search for human tumor antigens as potential immunotherapeutic targets has been a continuous task in the field of tumor immunology. For tumor antigens to be potential immunotherapeutic targets, the antigen must have no or highly restricted expression in normal tissues so that autoimmunity can be prevented [10,11].

**Tumor Associated Antigens**
The first TAA recognized by cytotoxic CD8^{+} T-lymphocytes was described in 1991 [12]. Since then, researchers utilize expression cloning of TAA cDNAs as well as novel strategies such as reverse immunology, biochemical methods, genetic approaches, and serological analysis of recombination expression libraries (SEREX) to identify TAAs. This aims to develop more refined approaches to immune-mediated cancer therapy [8]. This led to more than 400 T-cell-defined human tumor antigens registered in a relevant data base in 2013 [13]. Categories of tumor antigens can be discriminated according to their expression in neoplastic and normal tissues (Table 1).

Since most TAAs used for immunotherapy are considered to be "self"-antigens, one of the main challenges is to develop methods that can effectively and safely break tolerance to TAA. Peptides can be used for example in a simple and inexpensive strategy for vaccination, utilizing the host's endogenous antigen presenting cells to present TAA peptides. For this, the peptides are generally delivered in an adjuvant, required for effective activation of dentritic cells [5, 8].

| TAA Categories | Antigen Characteristics | Genes |
|---|---|---|
| Cancer-testis | Expressed in various tumors but not normal tissues except in testis and placenta | MAGE, GAGE, BAGE, NY-ESO-1 |
| Differentiation | Antigens shared between tumors and normal tissues from which they arose | Tyrosinase, Melan-A/MART-1, gp100, TRP-1, TRP-2 |
| Tumor-specific | Antigens generated by point mutations or splicing aberrations in ubiquitous genes | p53, Ras, CDK4, β-catenin, TRP-2/INT2 |
| Widely occurring over-expressed | Proteins over-expressed in histologically different types of tumors | Survivin, MUC1/2, AFP and EphA2 |

**Table 1.**
Summary of tumor antigen categories. Modified on basis of [8].

## Cancer/Testis Antigens

Cancer/testis antigens (CTs or CTAs) (Table 2) are protein antigens with normal expression restricted to adult testicular germ cells, but are aberrantly activated and expressed in some human cancers. Thereby, melanoma, ovarian and bladder cancer as well as lung cancer, particularly in case of the squamous cell type, have been found to have the highest frequency of CT expression and sometimes are referred to as "CT-rich" tumor types [10, 11].

Since the early 1980s, about 70 families of CT antigens have been identified with over 140 members [14], including for example the melanoma-associated antigens MAGE, BAGE, GAGE, PRAME, NY-ESO-I and HOM-MEL-40 (SSX-2) [15].

As well-known and intensively studied biomarkers in cancer, the MAGE (melanoma antigen gene) family may provide novel targets to develop cancer-specific therapies for a broad range of cancers because

| Antigen | Target Antigen | Restricting HLA | Epitope | Sequence / Prod. No. |
|---|---|---|---|---|
| Cancer/Testis Antigens | **MAGE-A1** | HLA-A1 | 161-169 | EADPTGHSY (H-3636) |
| | | HLA-A24 | | NYKHCFPEI |
| | | HLA-Cw16 | 230-238 | SAYGEPRKL |
| | **MAGE-A2** | HLA-A2 | 112-120 | KMVELVHFL |
| | | | 157-166 | YLQLVFGIEV |
| | **MAGE-A3** | HLA-A1 | 168-176 | EVDPIGHLY (H-3634) |
| | | HLA-A2 | 271-279 | FLWGPRALV (H-3714) |
| | | HLA-A24 | 195-203 | IMPKAGLLI |
| | | HLA-B44 | 167-176 | MEVDPIGHLY (H-3686) |
| | | HLA-DR13 | | AELVHFLLLKYRAR |
| | | | | LLKYRAREPVTKAE |
| | **BAGE** | HLA-Cw16 | 2-10 | AARAVFLAL |
| | **GAGE-1** | HLA-Cw6 | 9-16 | YRPRPRRY |
| | **PRAME** | HLA-A24 | 301-309 | LYVDSLFFL |
| | **NY-ESO-1/CAG-3/ LAGE** | HLA-A2 | 155-163 | QLSLLMWIT |
| | | | 157-165 | SLLMWITQC |
| | | | 157-167 | SLLMWITQCFL |
| | | HLA-A31 | 53-62 | ASGPGGGAPR |

**Table 2.**
Antigenic epitopes of cancer/testis antigens recognized by cytotoxic T-lymphocytes (CTL). HLA: human leucocyte antigen. Modified on basis of [15].

of their relatively restricted expression and antigenicity [6]. This family of proteins includes more than 50 identified members in humans, all of which containing a highly conserved MAGE homology domain (MHD) with a length of around 170 to 200 amino acids and multiple tandem winged-helix motifs [6, 16].

Based on the expression patterns in several tissues, two types of MAGEs can be discriminated: Type I includes MAGE-A, -B, and -C subfamily members and are clustered on the X-chromosome. They are normally restricted to expression in the testis, but are aberrantly expressed in cancers and have antigenic properties. Antigens of subfamilies MAGE-A and MAGE-C are reported to be associated with poor clinical prognosis in different types of cancers and are proved to have oncogenic activity [6]. Type II includes MAGE-D, -E, -F, -G, -H, -L subfamilies and necdin, which are not expressed in cancers [6].

As the first human tumor-associated antigen found to be specifically recognized by CD8+ T-cells, MAGE-A3 is promising for antigen-specific immunotherapy of malignant cells. Along with encouraging results obtained in mouse model, tests performed in non-small cell lung carcinoma patients and metastatic melanoma patients showed that patients receiving recombinant MAGE-A3-based vaccine will develop MAGE-A3-specific antibodies and have more clinical benefits than the placebo-treated group [6]. However, one of the largest-ever phase III lung cancer trials trying to investigate the efficacy of MAGE-A3 antigen-specific cancer immunotherapeutic agents in preventing cancer relapse, turned out to have no improvement in progression-free survival [6].

**Differentiation Antigens**
Differentiation antigens (Table 3) are tissue-specific tumor antigens with higher expression in cancer cells compared with normal cells. However, only a low immunogenicity is assigned to the melanocyte differentiation antigens, because of the development of an immunological tolerance for the potential epitopes of these "self" proteins [15]. Differentiation antigens include tyrosinase, Melan-A/MART-1, gp100, tyrosinase-related proteins-1 (TRP-1/gp75) and -2 (TRP-2) [8, 15, 17].
Tyrosinase consists of 529 amino acid residues and is involved in the synthesis of melanin [15]. In general, the generation of a tyrosinase-specific response in a melanoma patient is a relatively infrequent event and is usually only seen in patients showing a high response to several melanoma-associated antigens [15].

Melan-A/MART-1 (melanoma antigen A/melanoma antigen recognized by T cells 1) is a relatively small transmembrane protein consisting of 118 amino acid residues. It is expressed in most melanoma cells, but cannot be observed in other tumors [15]. The Melan-A/MART-1 gene codes for antigens that are recognized by HLA-A2-restricted cytotoxic T lymphocytes (CTLs) and, among the family of melanocyte differentiation antigens, Melan-A/MART-1 seems to represent the highest relative immunogenicity [15].

Studies identified a nonapeptide (AAGIGILTV) as an immunodominant epitope, which corresponds to residues 27-35 of Melan-A/MART-1 [15]. Further investigations identified the decapeptide Melan-A/MART-1 (26-35) (EAAGIGILTV), which is better recognized by HLA-A2-restricted CTLs [15]. It could be shown that substitutions of the amino acids in position 1 and/or 2 of Melan-A/MART-1 (26-35) lead to an increased binding of the peptide to HLA-A2 and therefore to an increased recognition by Melan-A/MART-1-specific CTLs [15].

The glycoprotein gp100 was originally identified as a melanocyte lineage-specific antigen by the monoclonal antibodies NKI/beteb, HMB45 and HMB50. These antibodies are used as diagnostic markers for human melanoma [15]. Noteworthy, this product of the "Silver" gene locus historically had been mentioned in several texts, and the nomenclature is controversial including names such as PMEL 17, gp100, gp95, gp85, ME20, RPE1, SILV and MMP115 [18].

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| Antigen | Target Antigen | Restricting HLA | Epitope | Sequence / Prod. No. |
|---|---|---|---|---|
| Melanocyte Differentiation Antigens | pMel-34/Tyrosinase | HLA-A2 | 1-9 | MLLAVLYCL |
| | | | 369-377 | YMNGTMSQV |
| | | | 369-377 | YMDGTMSQV (H-3862)/(H-7732)[1] |
| | | HLA-A24 | 206-214 | |
| | | HLA-B44 | 192-200 | AFLPWHRLF (H-3848) |
| | | HLA-A1 | 243-251 | SEIWRDIDF (H-3812) |
| | | | 146-156 | KCDICTDEY (H-3852) |
| | | | | SSDYVIPIGTY |
| | | HLA-DR4 | 450-462 | DAEKCDKTDEY |
| | | | 56-70 | SYLQDSVPDSFQD (H-4416) |
| | | | | QNILLSNAPLGPQFP |
| | TRP-1/gp75 | HLA-A31 | 1-9 [2] | MSLQRQFLR [2] |
| | TRP-2 | HLA-A31, A33 | 197-205 | LLPGGRPYR |
| | | HLA-A2 | 180-188 | SVYDFFVWL |
| | pMel17/gp100 | HLA-A2 | 154-162 | KTWGQYWQV (H-3958) |
| | | | 209-217 | ITDQVPFSV (H-4106) |
| | | | 457-466 | LLDGTATLRL |
| | | | 476-485 | VLYRYGSFSV |
| | | | 570-579 | SLADTNSLAV |
| | | | 177-186 | AMLGTHTMEV |
| | | | 178-186 | MLGTHTMEV |
| | | | 619-627 | RLMKQDFSV |
| | | | 639-647 | RLPRIFCSC |
| | | HLA-A24 | | VYFFLPDHL |
| | | HLA-A3 | 17-25 | ALLAVGATK |
| | | HLA-DR1, 3, 4 | 614-622 | LIYRRRLMK |
| | | | (44-59) | WNRQLYPEWTEAQRLT |
| | Melan-A/MART-1 | HLA-A2 | 26-35 | EAAGIGILTV (H-4102) |
| | | | 27-35 | AAGIGILTV (H-3956)/(H-7734) |
| | | | 32-40 | ILTVILGVL |
| | | | | GIGILTVL |
| | | | | GILTVILGV |
| | | HLA-B45 | | ALMDKSLHV |
| | | | | AEEAAGIGIL(T) |

**Table 3.**
Antigenic epitopes of melanocyte differentiation antigens recognized by cytotoxic T lymphocytes (CTL). Modified on basis of [15].

[1] Natural peptide identified by elution from HLA-A2 molecules.
[2] Antigenic peptide resulting from translation of an alternative open reading frame (ORF3) of the gp75 gene.

Gp100 alone has been shown to induce an immune response, but has limited anti-tumor activity [6]. A multi-center phase II clinical trial in patients with advanced melanoma showed that the gp100 peptide vaccine plus interleukin-2 (IL-2) group had a significant improvement in centrally verified overall clinical response and longer progression-free survival, compared with the IL-2-only group (16 % versus 6 %), but without overall survival benefit [6, 19].

**Neoantigens**
In contrast to other types of tumor-specific antigens, neoantigens are novel peptides that are not normally found in the host and are unique to a particular cancer [20, 21, 22] (Table 4). These peptides are not subject to central tolerance and hence appear as ideal targets for cancer immunotherapy [20, 21, 22]. They may also contribute to the understanding of the molecular mechanisms of malignant transformation [15]. Neoanti-

**Table 4.**
Antigenic epitopes of mutated or aberrantly expressed antigens recognized by cytotoxic T lymphocytes (CTL). Modified on basis of [15]

| Antigen | Target Antigen | Restricting HLA | Epitope | Sequence / Prod. No. |
|---|---|---|---|---|
| Mutated or Aberrantly Expressed Antigens | GnT-V [1] | HLA-A2 | nt38-64<br>nt38-67 | VLPDVFIRC<br>VLPDVFIRCV |
| | NY-ESO-1/CAG-3 | HLA-A31 | 18-27 [2] | LAAQERRVPR [2] |
| | gp100-in4 | HLA-A24 | 170-178 | VYFFLPDHL |
| | TRP-2 (int2) | HLA-A68011/<br>HLA-A3301 | | |
| | p15 | HLA-A24 | | (E)AYGLDFYIL |
| | β-Catenin | HLA-A24 | 29-37 | SYLDSGIHF |
| | SR-2 | HLA-A3 | | KIFSEVTLK |
| | MUM-1 [3] | HLA-B44 | nt782-808 | EEKLIVVLF |
| | CDK4 | HLA-A2 | | ACDPHSGHFV |

[1] N-acetylglucosaminyltransferase V (GnT-V). The peptide is encoded by an intron sequence.
[2] Antigenic peptide resulting from translation of an alternative open reading frame (ORF2) of the NY-ESO-1 gene.
[3] Mutation occurs in an intron sequence followed by a stop codon.

gens can arise from somatic mutations (or other genetic alterations) that result in the production of a novel peptide, or from viral peptides in virally induced cancers [20]. These antigens have been identified predominantly in melanoma, likely due to their relatively high mutation rate, but also in other tumor types including lung and renal cancers [21].

One major concern with regard to the suitability of neoantigens for tumor therapy is the heterogeneity of tumors. Neoantigens may be expressed in some, but not all tumor cells in an individual patient, leading to tumor escape from immunotherapy [21]. Potential approaches to address this concern are to target multiple neoantigens at the same time, so all tumor cells expressing at least one neoantigen can be destroyed, or to target a single neoantigen, which is ideally expressed in all tumor cells within a patient [21].

**Prospects**
Melanoma still is a live-threatening disease, for which, besides preventive measurements and conventional therapies, immunotherapies based on peptide epitopes give hope for future therapies. Significant

clinical breakthroughs have already been obtained with immune checkpoint inhibitors, and therapeutic approaches like vaccination have the potential to further improve the prognosis for the patients.

However, future research will need to address a broad variety of open questions. Optimal combinations of antigens, adjuvants and delivery vehicles need to be determined, and combinations of complementary immunotherapies are required to induce robust and sustained anti-tumor responses [23]. It is important to overcome immune tolerance and immune suppression [5, 23]. Appropriate pharmacodynamic biomarkers and diagnostics as well as new metrics for evaluating the effectiveness of immunotherapies will need to be implemented. The metrics of immunotherapies thereby differ significantly from those of conventional cytotoxic drugs [5, 23].

Another important scientific topic will be the use of optimum adjuvants, which might not have been optimally selected in initial trials with melanoma vaccines [5], and are important constituents in current strategies for immunotherapy of melanoma [3].

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## SKIN CANCER CELL, SEM

Colored scanning electron micrograph (SEM). Cultured melanoma cell showing the numerous blebs and microvilli characteristic of cancer cells. Skin cancer arises from the skin's melanocytes, the cells that produce the pigment melanin which gives skin its color. Melanoma is an aggressive cancer that often spreads (metastasis) to other tissues of the body. The long cell protrusions seen here are thought to help the cell to move. The main cause of melanoma is exposure to ultraviolet radiation in sunlight. Magnification: x10000 when printed at 10 centimeters wide.

# MELANOMA PEPTIDES

For additional catalog products on melanoma-associated peptides such as melanin-concentrating hormones (MCH), fibronectin fragments, kiss-peptins, thrombospondin-1 cell binding domain fragments, and more related products for cancer research, please go to our online shop at shop.bachem.com:

↪ Areas of Interest
     ↪ Cancer Research

# MELANOMA PEPTIDES

**MAGE-1 Antigen (161-169) (human)**
H-3636
EADPTGHSY

**MAGE-3 Antigen (167-176) (human)**
H-3686
MEVDPIGHLY

**MAGE-3 Antigen (168-176) (human)**
H-3634
EVDPIGHLY

**MAGE-3 Antigen (271-279) (human)**
H-3714
FLWGPRALV

**Melanocyte Protein PMEL 17 (44-59) (human, bovine, mouse)**
H-4406
WNRQLYPEWTEAQRLD

**Melanocyte Protein PMEL 17 (130-138) (human)**
H-3958
KTWGQYWQV

**Melanocyte Protein PMEL 17 (185-193) (human, bovine, mouse)**
H-4106
ITDQVPFSV

**(Des-Asp$^{187}$,Met$^{186}$)-Melanocyte Protein PMEL 17 (185-193) (human, bovine, mouse)**
H-4362
IMQVPFSV

**(Met$^{186}$)-Melanocyte Protein PMEL 17 (185-193) (human, bovine, mouse)**
H-4938
IMDQVPFSV

**H-Glu-Glu-Lys-Leu-Ile-Val-Val-Ala-Phe-OH**
H-3688
EEKLIVVAF

# MART-1 PEPTIDES

**MART-1 (26-35) (human)**
H-4102
EAAGIGILTV

**MART-1 (27-35) (human) acetate salt**
H-3956
AAGIGILTV

**MART-1 (27-35) (human) trifluoroacetate salt**
H-7734 NEW
AAGIGILTV

# TYROSINASE FRAGMENTS

**Tyrosinase (192-200) (human, mouse)**
H-3812
SEIWRDIDF

**Tyrosinase (206-214) (human)**
H-3848
AFLPWHRLF

**Tyrosinase (243-251) (human)**
H-3852
KCDICTDEY

**(Asp$^{371}$)-Tyrosinase (369-377) (human) acetate salt**
H-3862
YMDGTMSQV

**(Asp$^{371}$)-Tyrosinase (369-377) (human) trifluoroacetate salt**
H-7732 NEW
YMDGTMSQV

**(Val$^{438}$)-Tyrosinase (432-444) (human)**
H-4416
SYLQDSVPDSFQD

# KISSPEPTINS

**Kisspeptin-13 (human)**
H-5962
LPNYNWNSFGLRF-NH$_2$

**Kisspeptin-13 (4-13) (human)**
H-5544
YNWNSFGLRF-NH$_2$

**Kisspeptin-54 (human)**
H-6514
GTSLSPPPESSGSRQQPGL-
SAPHSRQIPAPQGAVLVQREK-
DLPNYNWNSFGLRF-NH$_2$

**Kisspeptin-54 (27-54) (human)**
H-5542
IPAPQGAVLVQREKDLPNYNWNSF-
GLRF-NH$_2$

# OTHER MELANOMA PEPTIDES

**Band 3 Protein (824-829) (human)**
H-1598
YVKRVK

**Collagen Type IV α3 Chain (185-203)**
H-4208
CNYYSNSYSFWLASLNPER

**Fibronectin CS-1 Fragment (1978-1982)**
H-2592
EILDV

**Fibronectin CS-1 Fragment (1978-1985)**
H-2094
EILDVPST

**rec GRO/Melanoma Growth Stimulating Activity (human)**
H-1714

**(Phe$^{13}$,Tyr$^{19}$)-MCH (human, mouse, rat)**
H-2218
DFDMLRCMLGRVFRPCWQY

**Ac-muramyl-Thr-D-Glu-NH$_2$**
G-4270

**rec Oncostatin M (human)**
H-1716

**RGD-4C**
H-7946
ACDCRGDCFCG

**Peptide 74**
H-8545
TMRKPRCGNPDVAN

**Peptide 810**
H-2586
QDLTMKYQIF

**Thrombospondin-1 (1016-1023) (human, bovine, mouse)**
H-1414
RFYVVMWK

**H-Tyr-Lys-OH**
G-3445
YK

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PIONEERING PARTNER FOR PEPTIDES

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