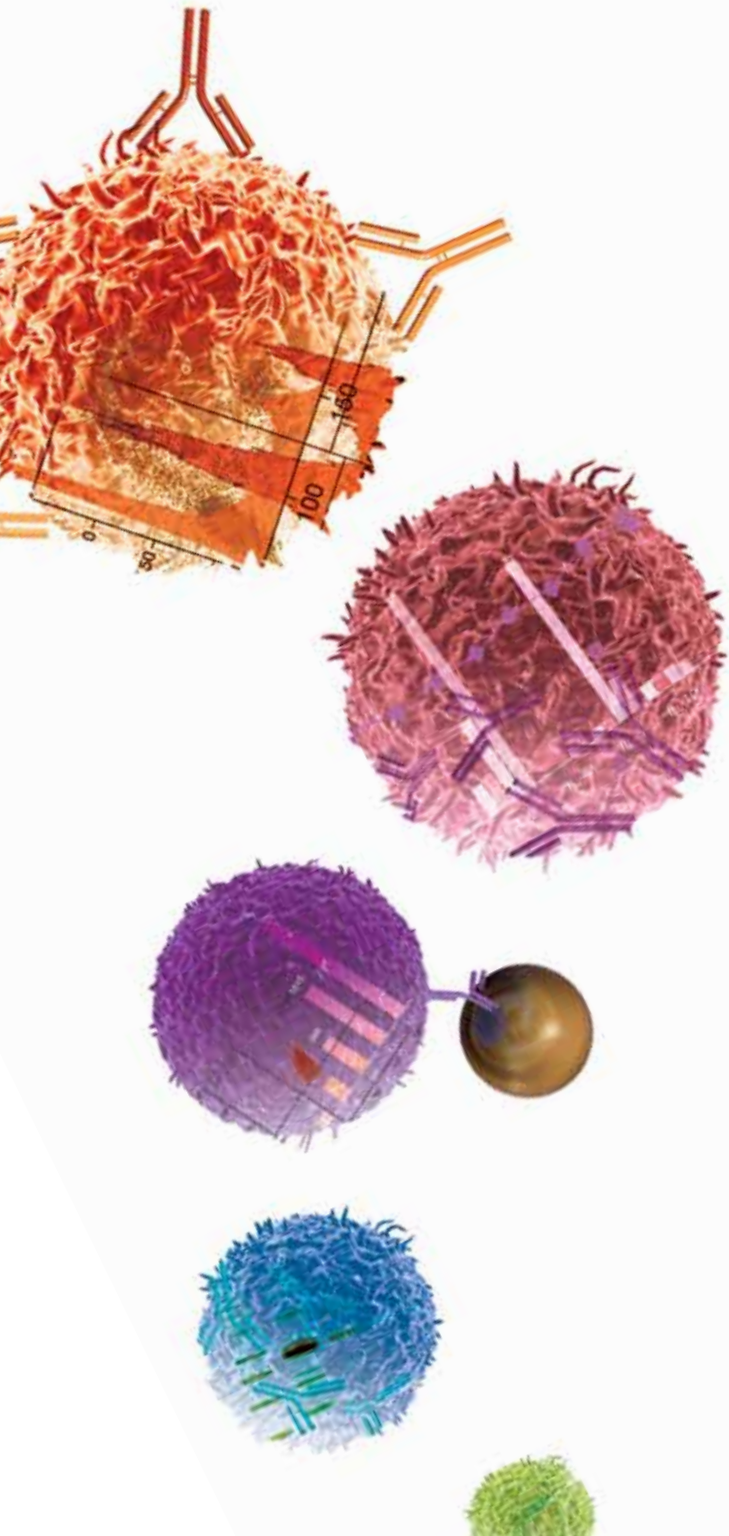




Cell Isolation and Activation



# Healthy cells in = good data out

Product guide



## Dynabeads® magnetic cell separation technology

- Fast, easy-to-use kits
- Gentle on cells—no mechanical stress from columns or iron exposure
- Consistent high purity and yield

Invitrogen is dedicated to delivering thoroughly tested and high-quality products that do not adversely affect cells during isolation. Dynabeads® magnetic separation technology can be used to isolate pure, viable, and functional cells of the immune system to advance your immunology research. With this technology, your cells are not exposed to the stress of passing through a dense column, so there's no risk of artifacts caused by the isolation method.

### Why Dynabeads® tube-based cell separation?

When cells are removed from their natural environment, there is a risk that experimental procedures will negatively impact cell phenotype and function. The mechanical stress of being passed through a dense column matrix, as well as the exposure to iron oxide and dextran from biodegradable particles (known to be present in other isolation methods), may increase the risk of cell activation or cell death. Choosing the right cell separation method is therefore critical to your downstream experiments.

Dynabeads® are designed with an inert coating to eliminate the risk that any unwanted material such as iron is left in the sample after separation. In addition, since the cells are released from the beads after the gentle magnetic separation, high purity and viability of the cells are obtained with no artificial remnants that could affect your downstream results.

### Unparalleled reproducibility and quality

In studies where patient material is scarce, difficult to obtain, or collected over a long period of time, it is critical that you can depend on the quality and reproducibility of your cell isolation method. Dynabeads® have unmatched batch-to-batch consistency, so your results are reproducible every time.

Dynabeads® tube-based cell separation technology is available in a variety of formats to suit your experimental needs: Dynabeads® flow-compatible positive isolation kits, Dynabeads® for depletion/negative isolation of cells from your sample, and secondary-coated Dynabeads® for coupling with your own antibodies. By combining our products, rare cell populations or cell subsets can be isolated. For protocols on how to optimally combine our kits, contact Technical Support or visit our website, [www.invitrogen.com/cellseparation](http://www.invitrogen.com/cellseparation).

### What are Dynabeads®?

Dynabeads® are superparamagnetic, monosized polymer beads coated with a thin polymer shell to encase the magnetic material. This specific and defined surface is ideal for the adsorption or coupling of various bioreactive molecules (ligands). The unique batch-to-batch reproducibility of Dynabeads® secures the quality of your results.

The advantages of Dynabeads® biomagnetic separation technology can be applied in a variety of manual and automated protocols for research in proteomics, protein isolation, immunology, and cellular and molecular biology, as well as diagnostic applications.



## Products for cell separation

Negative and positive isolation kits and depletion products are designed for isolating cells prior to downstream cell-based assays and phenotyping. Since there are no beads left on the cells after isolation, the kits are fully compatible with flow cytometry-based applications (Figure 1).

### Negative isolation kits

Negative isolation (Untouched™) kits use Dynabeads® in combination with an antibody cocktail to remove all unwanted cells from your sample, leaving only the target cells of interest behind. These kits are optimal for the isolation of fragile cells or when there are concerns that activation via antibody binding can interfere with downstream assays. Our antibody cocktails have been optimized to give you high cell purity and yield, and your resulting cells are both antibody- and bead-free.

### Positive isolation kits

Dynal® positive isolation kits and FlowComp™ kits use Dynabeads® to isolate cells of interest directly from your sample (e.g., human or mouse whole blood, bone marrow or peripheral blood mononuclear cells, spleen, or lymph nodes) by binding to antibody-coated Dynabeads®. After a simple step in which the beads are removed, the cells can be used directly in all downstream experiments, including flow cytometry (Figure 2). Positive isolation is ideal when cells of the highest purity and viability are required. Our products are ideal for all types of sample material and are particularly suited for isolation of cells from viscous materials such as whole blood.

### Depletion products

Dynabeads® depletion products are ideal for removal of one unwanted cell type at a time from your sample. Dynabeads® are precoated with an antibody toward one target cell type that can be depleted from all types of starting material. Our products are particularly suited for removal of cells from viscous materials such as whole blood.

### Isolation of cells for molecular studies

Dynabeads® precoated with an antibody toward one target cell type can also be used for positive cell isolation when the downstream application includes molecular studies. Lyse the cells directly after isolation, and isolate proteins, DNA, or mRNA to be used in PCR, microarrays, proteomics, and other applications where the removal of Dynabeads® is not required. Target cells may be isolated from all types of starting material. These products are particularly suited for the isolation of cells from viscous materials such as whole blood.

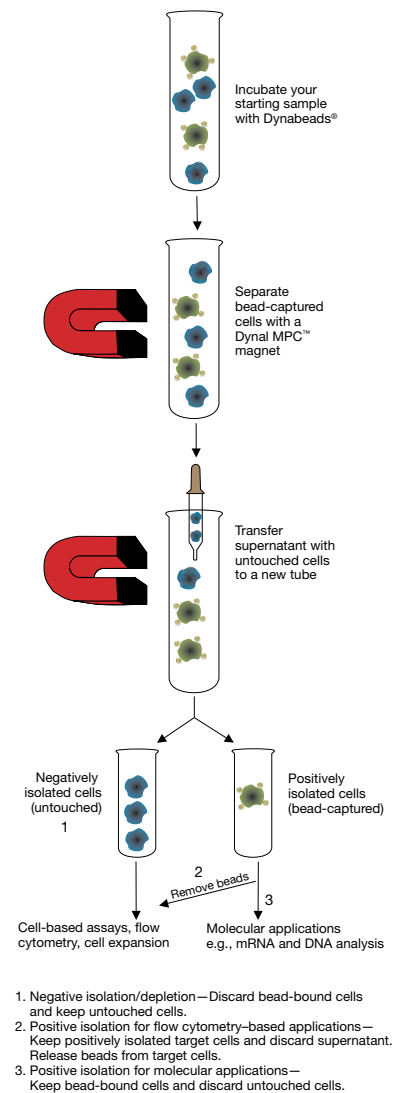


Figure 1. The workflow using Dynabeads® for positive or negative tube-based cell isolation.

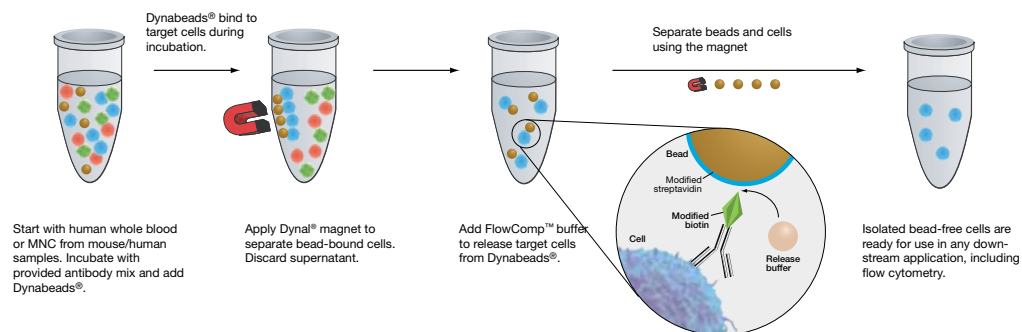


Figure 2. Overview of the Dynabeads® FlowComp™ isolation procedure. The starting sample is mouse or human mononuclear cells (MNC) or human whole blood.



## Ordering information

Isolation of human cells					
Subset	Product	Application	# of cells processed	Quantity	Cat. No.
<b>T cells</b>					
Pan	Dynabeads® Untouched™ Human T Cells	N, Flow	1 x 10 <sup>9</sup>	2 x 5 mL	113-44D
	Dynabeads® FlowComp™ Human CD45RA	WB, Pd, Flow	2 x 10 <sup>9</sup>	3 mL	113-68D <b>NEW</b>
CD2 <sup>+</sup> T cells	Dynabeads® CD2 Pan T	WB, MA, D	2 x 10 <sup>9</sup>	5 mL	111-59D
CD3 <sup>+</sup> T cells	Dynabeads® CD3	WB, MA, D	2 x 10 <sup>9</sup>	5 mL	111-51D
	Dynabeads® FlowComp™ Human CD3	WB, Pd, Flow	2 x 10 <sup>9</sup>	3 mL	113-65D
CD4 <sup>+</sup> T cells	Dynabeads® CD4	WB, MA, D	2 x 10 <sup>9</sup>	5 mL	111-45D
	Dynal® CD4 Positive Isolation Kit	WB, Pd, Flow	2 x 10 <sup>9</sup>	5 mL	113-31D
	Dynabeads® FlowComp™ Human CD4	WB, Pd, Flow	2 x 10 <sup>9</sup>	3 mL	113-61D
	Dynabeads® Untouched™ Human CD4 T Cells	N, Flow	1 x 10 <sup>9</sup>	2 x 5 mL	113-46D
CD8 <sup>+</sup> T cells	Dynabeads® CD8	WB, MA, D	2 x 10 <sup>9</sup>	5 mL	111-47D
	Dynal® CD8 Positive Isolation Kit	WB, Pd, Flow	2 x 10 <sup>9</sup>	5 mL	113-33D
	Dynabeads® FlowComp™ Human CD8	WB, Pd, Flow	2 x 10 <sup>9</sup>	3 mL	113-62D
	Dynabeads® Untouched™ Human CD8 T Cells	N, Flow	1 x 10 <sup>9</sup>	2 x 5 mL	113-48D
CD25 <sup>+</sup> T cells	Dynabeads® CD25*	WB, MA, D	5 x 10 <sup>9</sup>	5 mL	111-57D
Treg cells	Dynabeads® Regulatory Human CD4 <sup>+</sup> CD25 <sup>+</sup> T Cells	Pd, Flow	1 x 10 <sup>9</sup>	10 mL	113-63D
* Can also be used for other cells expressing CD25, such as B cells.					
<b>B cells</b>					
Pan	Dynabeads® Untouched™ Human B Cells	N, Flow	1 x 10 <sup>9</sup>	2 x 5 mL	113-51D
CD 19 <sup>+</sup> B cells	Dynabeads® CD19 Pan B*	WB, MA, D, Pd, Flow	5 x 10 <sup>9</sup>	5 mL	111-43D
CD 19 <sup>+</sup> B cells	DETACHaBEAD® CD19, for use with 111-43D		—	5 mL	125-06D
* For cell-based assays (or cultivation) when used in combination with DETACHaBEAD® CD19.					
<b>NK cells</b>					
	Dynabeads® Untouched™ Human NK Cells	N, Flow	1 x 10 <sup>9</sup>	2 x 5 mL	113-49D
<b>Monocytes</b>					
	Dynabeads® CD14	WB, MA, D	2 x 10 <sup>9</sup>	5 mL	111-49D
	Dynabeads® FlowComp™ Human CD14	WB, Pd, Flow	2 x 10 <sup>9</sup>	3 mL	113-67D <b>NEW</b>
	Dynabeads® Untouched™ Human Monocytes	N, Flow	1 x 10 <sup>9</sup>	2 x 5 mL	113-50D
* With additional antibodies for improved purity.					
<b>Dendritic cells</b>					
	Dynabeads® Human DC Enrichment Kit*	N, Flow	2 x 10 <sup>9</sup>	2 x 10 mL	113-08D
* Using this kit, all DC subsets are present in the enriched fraction. Combine with FACS sorting to get the specific DC subpopulation of choice. Dendritic cells may also be derived from monocytes or stem cells using Dynabeads® Untouched™ Human Monocytes or the Dynal® CD34 Progenitor Cell Selection System.					
<b>Tumor cells</b>					
Epithelial cells	CELLlection™ Epithelial Enrich	WB, Pd, Flow	2 x 10 <sup>9</sup>	5 mL	162-03
Epithelial cells	Dynabeads® Epithelial Enrich	WB, MA	4 x 10 <sup>9</sup>	5 mL	161-02
Epithelial cells	Dynabeads® CD45*	WB, N, Flow	5 x 10 <sup>8</sup>	5 mL	111-53D
* For circulating tumor cell enrichment using Dynabeads® CD45, this product should not be used in combination with Dynabeads® CD15.					
<b>Leukocytes</b>					
	Dynabeads® CD45*	WB, MA, D	5 x 10 <sup>8</sup>	5 mL	111-53D
* To effectively deplete all leukocytes including myeloid cells, this kit should be used in combination with Dynabeads® CD15.					

D = depletion of unwanted cells (remaining cells may be used in downstream assays such as flow cytometry); **ESC** = embryonic stem cells; **Flow** = suitable for any cell-based downstream application such as flow cytometry, functional studies, or cell culture; **MA** = positive isolation for molecular downstream applications; **N** = negative isolation ; **Pc** = positive isolation for further culture; **Pd** = positive isolation with bead release from the cells; **WB** = ideal for whole blood.

## Isolation of human cells

Subset	Product	Application	# of cells processed	Quantity	Cat. No.
<b>Granulocytes</b>					
CD15 <sup>+</sup> cells	Dynabeads® CD15	WB, MA, D	2 x 10 <sup>9</sup>	5 mL	111-37D
<b>Endothelial cells</b>					
CD31 <sup>+</sup> cells	Dynabeads® CD31 Endothelial Cell	Pc, D	2 x 10 <sup>10</sup>	5 mL	111-55D
<b>Stem cells</b>					
CD34 <sup>+</sup> stem cells	Dynal® CD34 Progenitor Cell Selection System	WB, Pd, Flow	5 x 10 <sup>9</sup>	5 mL	113-01D
Embryonic stem cells	Dynabeads® SSEA-4	ESC, Pc, D	5 x 10 <sup>8</sup>	5 mL	111-60D <b>NEW</b>

For isolation of other human cell types, see the "Use your own antibody" section (pPage 6).

D = depletion of unwanted cells (remaining cells may be used in downstream assays such as flow cytometry); **ESC** = embryonic stem cells; **Flow** = suitable for any cell-based downstream application such as flow cytometry, functional studies, or cell culture; **MA** = positive isolation for molecular downstream applications; **N** = negative isolation; **Pc** = positive isolation for further culture; **Pd** = positive isolation with bead release from the cells; **WB** = ideal for whole blood.

## Isolation of mouse cells

Subset	Product	Application	# of cells processed	Quantity	Cat. No.
<b>T cells</b>					
Pan	Dynabeads® Mouse Pan T (Thy1.2)	MA, D	2 x 10 <sup>9</sup>	5 mL	114-43D
	Dynabeads® FlowComp™ Mouse Pan T (CD90.2)	Pd, Flow	2 x 10 <sup>9</sup>	3 mL	114-65D <b>NEW</b>
	Dynal® Mouse T Cell Negative Isolation Kit	N, Flow	1 x 10 <sup>9</sup>	2 x 10 mL	114-13D
CD4 <sup>+</sup> T cells	Dynabeads® Mouse CD4 (L3T4)*	MA, D (Pd, Flow)	2 x 10 <sup>9</sup>	5 mL	114-45D
	DETAHaBEAD® Mouse CD4, for use with 111-45D	DETAHaBEAD®	—	5 mL	124-06D
	Dynabeads® FlowComp™ Mouse CD4	Pd, Flow	2 x 10 <sup>9</sup>	3 mL	114-61D
	Dynal® Mouse CD4 Negative Isolation Kit	N, Flow	1 x 10 <sup>9</sup>	2 x 10 mL	114-15D
CD8 <sup>+</sup> T cells	Dynabeads® Mouse CD8 (Ly-2)	MA, D	2 x 10 <sup>9</sup>	5 mL	114-47D
	Dynabeads® FlowComp™ Mouse CD8	Pd, Flow	2 x 10 <sup>9</sup>	3 mL	114-62D
	Dynal® Mouse CD8 Negative Isolation Kit	N, Flow	1 x 10 <sup>9</sup>	2 x 10 mL	114-17D
Treg cells	Dynabeads® FlowComp™ Mouse CD4 <sup>+</sup> CD25 <sup>+</sup> Treg Cells	N, Pd, Flow	1 x 10 <sup>9</sup>	2 x 10 mL	114-63D

For mouse T cell expansion kits, see the "T cell activation and expansion products" section (pPage 7).

\* Compatible with cell-based assays when used in combination with DETAHaBEAD® Mouse CD4.

### NK cells

	Dynabeads® FlowComp Mouse CD49b	Pd, Flow	2 x 10 <sup>9</sup>	3 mL	114-64D <b>NEW</b>
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### B cells

Pan	Dynabeads® Mouse Pan B (B220)	MA, D	2 x 10 <sup>9</sup>	5 mL	114-41D
	Dynabeads® Mouse CD43 (Untouched™ B Cells)	N, Flow	1 x 10 <sup>9</sup>	5 mL	114-22D <b>NEW</b>

### Dendritic cells

	Dynabeads® Mouse DC Enrichment Kit	N, Flow	5 x 10 <sup>8</sup>	5 mL	114-29D
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\* Using this kit, all DC subsets are present in the enriched fraction. Combine with FACS sorting to get the specific DC subpopulation of choice.

For isolation of other mouse cell types, see especially Dynabeads® Sheep Anti-Rat IgG in the "Use your own antibody" section (pPage 6).

D = depletion of unwanted cells (remaining cells may be used in downstream assays such as flow cytometry); **Flow** = suitable for any cell-based downstream application such as flow cytometry, functional studies, or cell culture; **MA** = positive isolation for molecular downstream applications; **N** = negative isolation; **Pd** = positive isolation with bead release from the cells; **WB** = ideal for whole blood.



## Use your own antibody

Dynabeads® for use with your own antibody give you the flexibility to isolate any cell type of interest. We provide a wide range of products, including Dynabeads® coated with species-specific secondary antibodies, streptavidin-coated Dynabeads®, and surface-activated Dynabeads®. Your

own antibodies can also be added to the generic positive isolation kits, such as CELLlection™ and FlowComp™, for applications where bead-free cells are desired, e.g., flow cytometry.

## Ordering information

### Use your own antibody

Product	Specificity	Application	# of cells processed	Quantity	Cat. No.
<b>Streptavidin Dynabeads®</b>					
Dynabeads® FlowComp™ Flexi*	DSB-X™ biotinylate your antibody	WB, Pd, Flow	~2 x 10 <sup>9</sup>	3 mL	110-61D
CELLlection™ Biotin Binder	Any biotinylated antibody	WB, Pd, Flow	~2 x 10 <sup>9</sup>	5 mL	115-33D
Dynabeads® Biotin Binder	Any biotinylated antibody	WB, MA D, N Flow	~2 x 10 <sup>9</sup>	5 mL	110-47
* DSB-X™ biotinylation reagents are supplied in the kit.					
<b>Secondary antibody-coated Dynabeads®</b>					
Dynabeads® Sheep Anti-Rat IgG	All rat IgGs	WB, MA D, N Flow	~2 x 10 <sup>9</sup>	5 mL	110-35
Dynabeads® Pan Mouse IgG	All mouse IgGs	WB, MA D, N Flow	~2 x 10 <sup>9</sup>	5 mL	110-41
Dynabeads® Pan Mouse IgG	All mouse IgGs	WB, MA D, N Flow	~1 x 10 <sup>10</sup>	5 x 5 mL	110-42
CELLlection™ Pan Mouse IgG	All mouse IgGs	WB, Pd, Flow	~2 x 10 <sup>9</sup>	5 mL	115-31D
Dynabeads® Sheep Anti-Mouse IgG	Mouse IgG1, IgG2a, and IgG2b	WB, MA D, N Flow	~2 x 10 <sup>9</sup>	5 mL	110-31
Dynabeads® ClinExVivo™ Sheep Anti-Mouse IgG	Mouse IgG1, IgG2a, and IgG2b	WB, CR		10 mL	422-01
Dynabeads® Goat Anti-Mouse IgG	All mouse IgGs	WB, MA D, N Flow	~2 x 10 <sup>9</sup>		110-33
Dynabeads® Rat Anti-Mouse IgM	All mouse IgM	WB, MA D, N Flow	~2 x 10 <sup>9</sup>	5 mL	110-39D
Dynabeads® M-280 Sheep Anti-Rabbit IgG	All rabbit IgGs	WB, MA D, N Flow		2 mL	112-03D
Dynabeads® M-280 Sheep Anti-Rabbit IgG	All rabbit IgGs	WB, MA D, N Flow		10 mL	112-04D
<b>Surface-activated Dynabeads®</b>					
Dynabeads® M-450 Epoxy	Any purified antibody/ligand	WB, MA D	~2 x 10 <sup>9</sup>	5 mL	140-11
Dynabeads® M-450 Tosylactivated	Any purified antibody/ligand	WB, MA D	~2 x 10 <sup>9</sup>	5 mL	140-13

**CR** = clinical research product (cGMP-grade); **D** = depletion of unwanted cells (remaining cells may be used in downstream assays such as flow cytometry); **Flow** = suitable for any cell-based downstream application such as flow cytometry, functional studies, or cell culture; **MA** = positive isolation for molecular downstream applications; **N** = negative isolation; **Pd** = positive isolation with bead release from the cells; **WB** = ideal for whole blood; **MA D** = Secondary Dynabeads® in combination with one target antibody can be used to deplete the target cell or positively isolate for molecular studies; **N Flow** = Secondary Dynabeads® in combination with several target antibodies can be used to make your own negative isolation kit where the cells labeled with Dynabeads® are discarded and the remaining untouched cells can be used in any downstream assay.

# Dynabeads® for mouse and human T cell activation and expansion

## Dynabeads® CD3/CD28 for polyclonal T cell activation and expansion

- No need for antigen-presenting cells (APC) or antigen
- Gentle and easy, yet efficient, robust, and highly reproducible
- Activated cells retain their functional properties
- Use the same technology for mouse and human research-grade studies and human clinical research

### Mimic *in vivo* activation of T cells

The activation of naive and memory T cells is initiated through contact-dependent antigen recognition involving antigen-presenting cells (APCs) such as dendritic cells. Activation occurs through the engagement of the T cell receptor complex (TCR/CD3, signal 1) and the CD28 costimulatory molecule (signal 2) on the surface of the T cell. Both signals are required to trigger cell-mediated immunity. Triggering of signal 1 alone can lead to T cell inactivation by anergy or apoptosis.

Dynabeads® T cell activation and expansion products offer a simple solution for mimicking the *in vivo* interaction of T cells with APCs by utilizing the two activation signals, CD3 and CD28, and a three-dimensional bead similar in size to APCs. Dynabeads® CD3/CD28 can be used for both short-term activation and long-term expansion and are easily removed from culture, allowing you to analyze your cells by flow cytometry (Figure 3). Activated cells are bead- and antibody-free, and their functions, cytokine profiles, and T cell repertoires reflect those of *in vivo* activation [1].

### Controllable and reproducible activation using Dynabeads®

Traditional methods for activating and expanding T cells can be cumbersome and complex, leading to experimental variability. The use of

autologous APCs requires tedious maintenance of cultures and multiple isolations of cells. In addition, undesirable signals or soluble factors from APCs can influence experimental conditions. Soluble or plate-bound antibody stimulation or methods employing mitogens such as ConA and PHA are not ideal solutions, because they are difficult to control and reproduce. In the case of soluble antibodies the stimulation is not easily removed, and with both plate-bound and soluble methods the amount of antibody binding can vary from experiment to experiment.

Dynabeads® CD3/CD28 technology is the only activation solution that allows for a controllable setting. Dynabeads® CD3/CD28 technology is designed with covalently linked anti-CD3 and anti-CD28 antibodies for simple use and easy removal (Figure 4). Several CD3/CD28 antibody clones and ratios are available for more flexibility and optimization for your particular application (Table 1). Custom conjugations are also available (pPage 11).

## Dynabeads® CD3/CD28/CD137 for antigen-specific T cell activation and expansion

A new addition to the Dynabeads® activation/expansion product portfolio, Dynabeads® CD3/CD28/CD137 is specifically optimized for activation and expansion of mouse and human antigen-specific T cells. In addition to the anti-CD3 and anti-CD28 antibodies, the new beads are also coated with anti-CD137 that recognizes CD137 (4-1BB), a costimulatory molecule expressed primarily but not exclusively on activated CD8<sup>+</sup> and CD4<sup>+</sup> T cells. Thus, Dynabeads® precoated with monoclonal antibodies towards CD3, CD28, and CD137 specifically enhance proliferation of antigen-specific T cells. For more information, please visit [www.invitrogen.com/cellexpansion](http://www.invitrogen.com/cellexpansion).

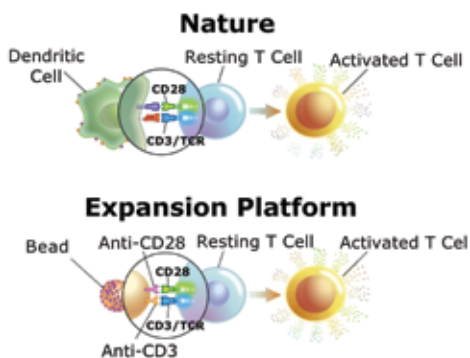


Figure 3. The Dynabeads® T cell activation/expansion platform mimics *in vivo* activation/expansion.

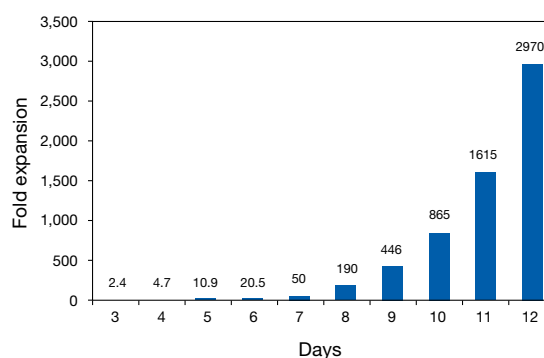


Figure 4. Expansion of naive T cells from human peripheral blood using Dynabeads® Human T-Activator CD3/CD28 for 12 days.



## Ordering information

### T cell activation and expansion products

Mouse cells	Application	Quantity	Cat. No.
Dynabeads® Mouse T-Activator CD3/CD28*	Polyclonal activation/expansion	0.4 mL	114-56D
Dynabeads® Mouse T-Activator CD3/CD28*	Polyclonal activation/expansion	2 mL	114-52D
Dynabeads® Mouse T-Activator CD3/CD28*	Polyclonal activation/expansion	10 mL	114-53D
Dynabeads® Mouse T-Activator CD3/CD28/CD137	Antigen-specific activation/expansion	0.4 mL	114-54D <b>NEW</b>
Dynabeads® Mouse T-Activator CD3/CD28/CD137	Antigen-specific activation/expansion	2 mL	114-55D <b>NEW</b>
Human cells	Application	Quantity	Cat. No.
Dynabeads® Human T-Activator CD3/CD28*	Polyclonal activation/expansion	0.4 mL	111-61D
Dynabeads® Human T-Activator CD3/CD28*	Polyclonal activation/expansion	2 mL	111-31D
Dynabeads® Human T-Activator CD3/CD28*	Polyclonal activation/expansion	10 mL	111-32D
Dynabeads® Human T-Activator CD3/CD28/CD137	Antigen-specific activation/expansion	0.4 mL	111-62D <b>NEW</b>
Dynabeads® Human T-Activator CD3/CD28/CD137	Antigen-specific activation/expansion	2 mL	111-63D <b>NEW</b>
Dynabeads® Human Treg Expander Kit	Treg activation/expansion	2 mL	111-29D
Dynabeads® Human T-Expander CD3/CD28†	Polyclonal expansion	10 mL	111-41D
Dynabeads® CD3/CD28 CTS™ ‡	Polyclonal expansion, CR	10 mL	402-03D <b>NEW NAME</b>

\* Renamed from CD3/CD28 T Cell Expander. † Research use version of 402-03D. ‡ Renamed from Dynabeads® ClinExVivo™ CD3/CD28.

## Products for clinical research

T cells expanded with Dynabeads® CD3/CD28 CTS™:

- Preserve or restore a broad T cell receptor repertoire
- Enable long-term engraftment and exhibit appropriate homing properties
- Have been employed in a number of phase I/II clinical investigations

Dynabeads® CD3/CD28 CTS™ is a unique platform for T cell isolation and expansion in the development of T cell-based therapies. This technology is also available as a research-grade version designed with the same clones, and offers a comprehensive translational research platform (Table 1, and [www.invitrogen.com/DynabeadsCTS](http://www.invitrogen.com/DynabeadsCTS)).

T cells expanded with Dynabeads® CD3/CD28 CTS™ have been used in a number of research and clinical investigations in adoptive T cell therapies for various diseases (Xcellerated T Cells™) [2–12]. T cells exhibit a broad T cell receptor repertoire following polyclonal expansion. Expanded T cells appear to have enhanced *in vivo* survival and homing potential while preserving both cytolytic and T-helper functions [13].

Large-scale expansion protocols using Dynabeads® CD3/CD28 CTS™ have been developed utilizing cost- and labor-saving bioreactor systems

that are capable of generating over  $1 \times 10^{11}$  T cells in a single culture bag or reactor [14].

Dynabeads® CD3/CD28 CTS™ complies with ISO 9001:2000, ISO 13485:2003, and Quality System Regulation, Medical Devices, 21 CFR Part 820. In the USA, a Master File for Dynabeads® CD3/CD28 CTS™ is on file with the Food and Drug Administration and is available for cross-referencing within an approved IND application.

### DynaMag™ CTS™ magnet

The DynaMag™ CTS™ magnet is ideal for T cell isolation in closed, sterile blood bags and tubing systems. This versatile magnetic device is designed for medium- to large-scale sterile cell isolation and removal of beads prior to, during, and after expansion in translational research. The DynaMag™ CTS™ magnet is intended for use with Dynabeads® CTS™ products, but can be used with all Dynabeads® cell separation products. The scale-up capacity is 50–330 mL in static systems, and >10 L in continuous-flow systems.

For regulatory documentation for these products, contact Technical Support.



Table 1. Polyclonal T cell activation/expansion product guide.

Product	Species	Ab clones	Features			Recommended starting sample			For activation/expansion of					Cat. No.	Notes
			Isolation	Activation	Expansion	Leukopheresis product/elutriation	MNC/PBMC from whole blood or buffy coat	CD3 <sup>+</sup> T cells, CD4 <sup>+</sup> , or CD8 <sup>+</sup> T cell subsets, Treg cells, T cell clones	Cell lines or clones	CD3 <sup>+</sup> T cells, naive T cells, activated T cells (CD4 <sup>+</sup> or CD8 <sup>+</sup> )	T cell clones (CD4 <sup>+</sup> or CD8 <sup>+</sup> )	Memory T cells (CD4 <sup>+</sup> or CD8 <sup>+</sup> )	Treg cells (CD4 <sup>+</sup> )		
Dynabeads® Mouse T-Activator CD3/CD28	Mouse		●	●		●	●		●	●	●	○		114-56D (0.4 mL) 114-52D (2 mL) 114-53D (10 mL)	Ideal for activation/expansion of mouse T cell subsets (research use)
Dynabeads® Mouse T-Activator CD3/CD28/CD137	Mouse				●		●					●		114-54D (0.4 mL) 114-55D (2 mL)	Efficient expansion and increased survival rate of Ag-specific T cells
Dynabeads® Human T-Activator CD3/CD28	Human		●	●		●	●		●	●	●	●		111-61D (0.4 mL) 111-31D (2 mL) 111-32D (10 mL)	Ideal for activation/expansion of antigen-specific human T cells (research use)
Dynabeads® Human Treg Expander	Human		●	●			●					●		111-29D (2 mL)	Optimized to retain suppressive phenotype and capacity in expansion of Treg cells
Dynabeads® Human T-Activator CD3/CD28/CD137	Human				●		●					●		111-62D (0.4 mL) 111-63D (2 mL)	Efficient expansion and increased survival rate of Ag-specific T cells
Dynabeads® Human T-Expander CD3/CD28	Human		● <sup>1</sup>	● <sup>2</sup>	●	●	●	●	● <sup>3,4,5</sup>	● <sup>6</sup>	● <sup>7</sup>			111-41D (10 mL)	The research version of Dynabeads® <i>ClinExVivo</i> ™ CD3/CD28; intended for preclinical research applications
Dynabeads® CD3/CD28 CTS™	Human		● <sup>1</sup>	● <sup>2</sup>	●	●	●		● <sup>3,4,5</sup>	● <sup>6</sup>	● <sup>7</sup>			402-03D (10 mL)	Intended for clinical research applications

● See product package insert or visit [www.invitrogen.com/cell-expansion](http://www.invitrogen.com/cell-expansion) for protocols and references.  
○ Unpublished data.

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## Ordering information

### Clinical research products

Product	Application	Quantity	Cat. No.
Dynabeads® CD3/CD28 CTS™	T cell isolation [1] and expansion, CR	10 mL	402-03D
Dynabeads® <i>ClinExVivo</i> ™ Sheep Anti-Mouse IgG*	Cell isolation/depletion, CR	10 mL	422-01
DynaMag™ CTS™ Magnet†	For use with blood bags, CR	<330 mL	121-02
OpTmizer™ T Cell Expansion SFM (bottle kit)	T cell expansion medium, CR	1 L	A1048501
OpTmizer™ T Cell Expansion SFM (bag kit)	T cell expansion medium, CR	1 L	00800225C

1. *J Immunol* 174:2366 (2005).

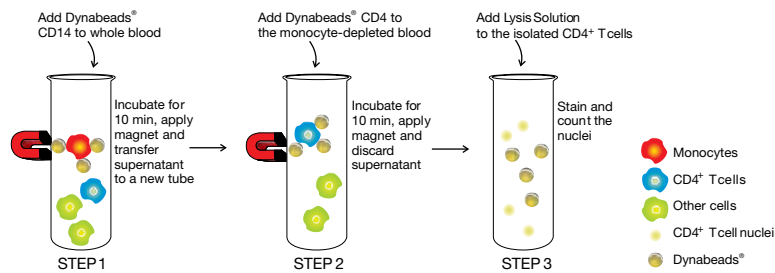
\*Combine with your own mouse IgG antibody (GMP-grade). †Renamed from Dynal® *ClinExVivo*™ MPC™. Scalable volumes: 50–330 mL in static separations, >10 L in continuous-flow separations. CR = clinical research product (cGMP-grade).



## CD4<sup>+</sup> cell counting

The Dynal® T4 Quant Kit is designed for cost-efficient and reliable quantification of CD4<sup>+</sup> T cells directly from whole blood. Cell isolation takes place at room temperature in 30 minutes—with no need for sophisticated equipment and calibration curves. Cells are easily counted with a microscope, and the results are presented as the number of CD4<sup>+</sup> T cells

per microliter of whole blood. A range of products are recommended for use with the Dynal® T4 Quant Kit, including staining solutions, buffer, tubes, and a hemocytometer (Figure 5). This kit is designed for monitoring immunodeficiencies, including HIV infection, and has been used successfully in developing countries. Learn more at [www.invitrogen.com/t4quant](http://www.invitrogen.com/t4quant).



**Figure 5. The Dynabeads® T4 Quant isolation procedure is fast, robust, and easily performed in three main steps.** (1) Depletion of monocytes with Dynabeads® CD14. (2) Positive isolation of CD4<sup>+</sup> T cells with Dynabeads® CD4. (3) The lysis solution releases the nuclei for staining or automatic counting.

### Ordering information

#### CD4<sup>+</sup> cell counting

Product	Application	Quantity	Cat. No.
Dynal® T4 Quant*	CD4 <sup>+</sup> cell counting in blood, WB	2 mL	113-21D

\*This product is CE-marked. WB = ideal for whole blood.

## Magnets and mixers

The new DynaMag™ magnets are optimized for efficient cell isolation using Dynabeads®. The DynaMag™ magnets combine a strong magnetic attraction for efficient separations with flexible and smart ergonomic designs that ensure comfortable working positions. The magnets can be used for any starting sample in combination with all types of Dynabeads®.

### Ordering information

Product	Optimal working volume	Cat. No.
<b>Magnets</b>		
DynaMag™-Spin	10 µL–1.5 mL	123-20D
DynaMag™-2	10 µL–2 mL	123-21D
DynaMag™-15	1 mL–15 mL	123-01D
DynaMag™-50	5 mL–50 mL	123-02D
DynaMag™ CTS™ *	50 mL–330 mL	121-02

#### Mixers

HulaMixer™ Sample Mixer †	NA	159.20D
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See [www.invitrogen.com/magnets-selection](http://www.invitrogen.com/magnets-selection) for magnet and mixer specifications.

\* Renamed from Dynal ClinExVivo™ MPC™. For use with blood bags. Scalable volumes: 50–330 mL in static separations, >10 L in continuous-flow separations. † Provided with 2 tube holder plates to accommodate various tube types (0.5 mL–50 mL).

## References

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## Dynabeads® CustomDesign™ products in cellular applications

### *Meeting your functional and regulatory needs*

The Dynabeads® CustomDesign™ service allows you to take advantage of our proprietary technology and years of experience and know-how to customize the coupling of your ligand of interest to Dynabeads®. We have developed Dynabeads® customized products for a wide range of academic and industrial partners (including genomics, functional genomics, diagnostic, pharmaceutical, clinical, and therapeutic companies).

Since every ligand has unique characteristics, coupling conditions must be individually selected and optimized. We will help you create a unique product that suits your experimental needs, improves performance in your application, and meets your method development and regulatory requirements for cell isolation and expansion:

- Dedicated support you expect from a full-service provider
- Years of experience with ligand-coupling optimization and assay design
- Quality control and testing for sterility and endotoxins according to the United States Pharmacopeia
- ISO 13485 compliance in product development and production
- Procedures in compliance with EU's Medical Device Directive 93/42/EC, Vol 4 EU GMP Annex 18/Annex 1, 21 CFR part 820 QSR, 21 CFR part 210/211 as well as ISO 13408, as required

Contact us at [eurotech@lifetech.com](mailto:eurotech@lifetech.com) or [techsupport@lifetech.com](mailto:techsupport@lifetech.com).



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