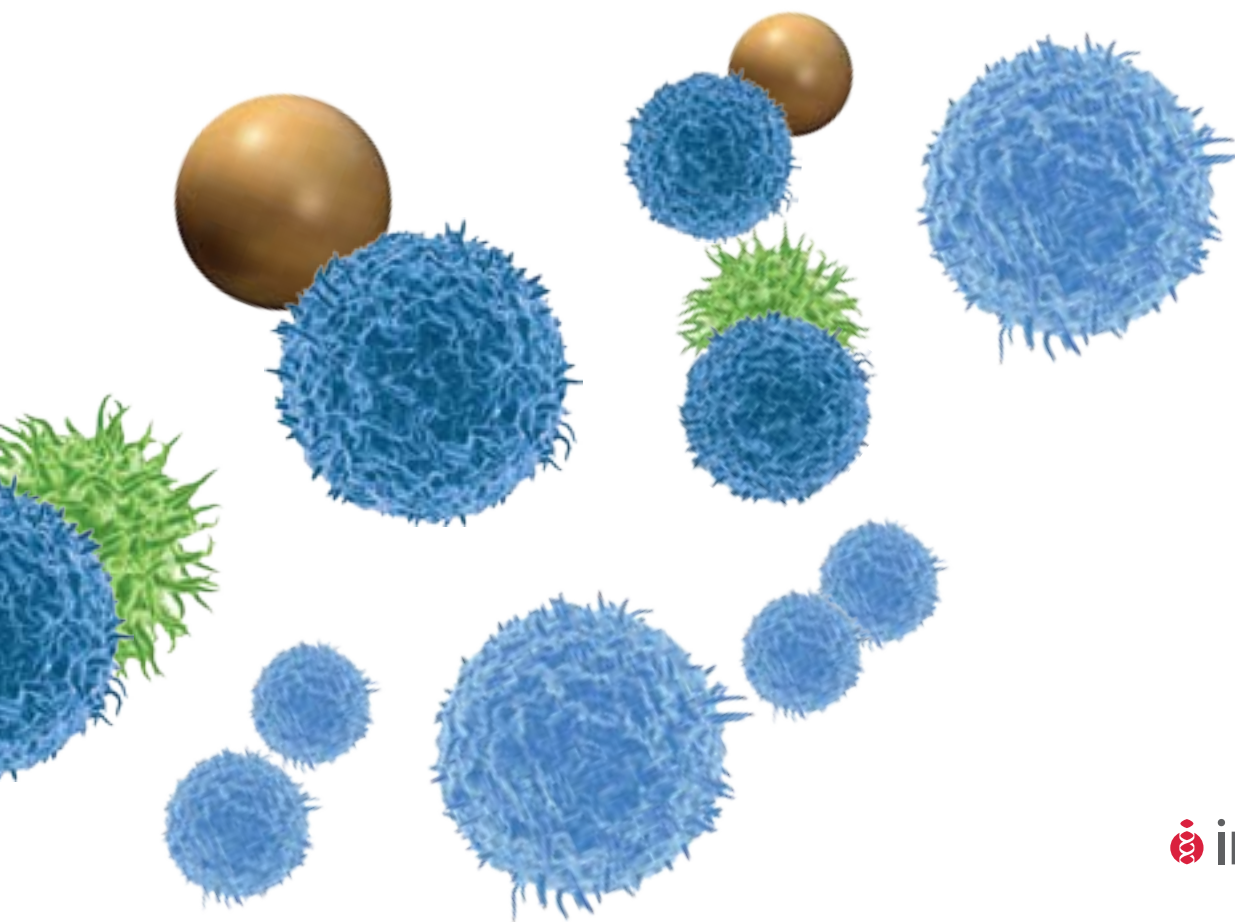




Expand your T cell research

Dynabeads® for cell activation and differentiation





Physiological T cell stimulation and expansion

Bridge the gap from mouse to human models

- Up to 3,000-fold expansion in just 14 days
- Easy adaptation of stimulation length and intensity
- Activated cells retain functional *in vivo*-like properties
- Restimulate cells without maintaining APC/feeder cell cultures
- Maximal reproducibility with minimal effort

You no longer have to perform tedious extractions of antigen-presenting cells (APCs) for T cell stimulation and expansion. And you don't have to worry about loss of T cell function or antigen recognition capability,¹ or even the potential failure to engraft after infusion.

Dynabeads® T cell expansion products mimic *in vivo* T cell activation via APCs. This gentle and efficient technology allows *ex vivo* physiological activation and expansion of T cells in both mouse and human settings (Figure 1).

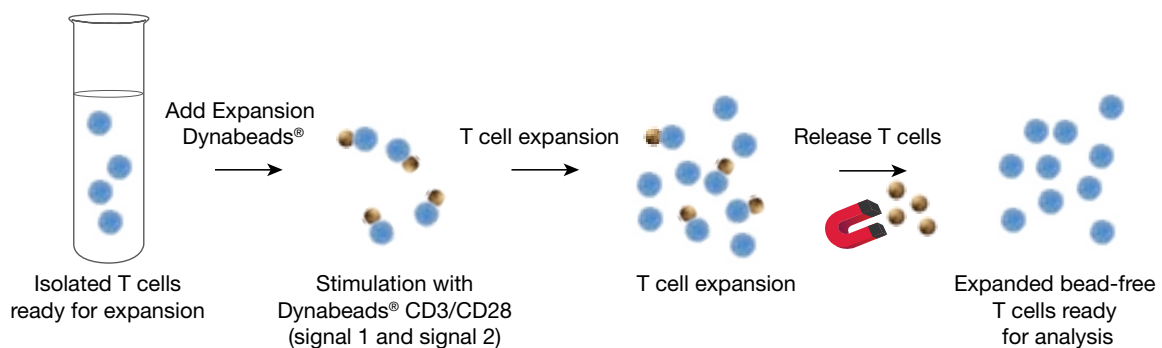


Figure 1—Overview of the simple and efficient Dynabeads® T cell expansion protocol.

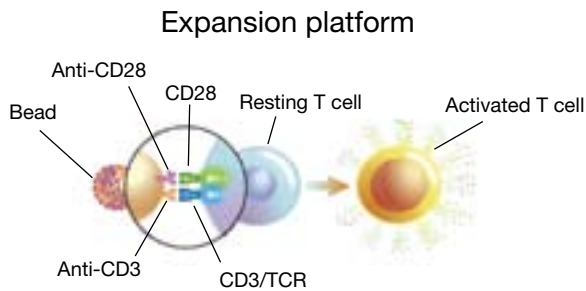
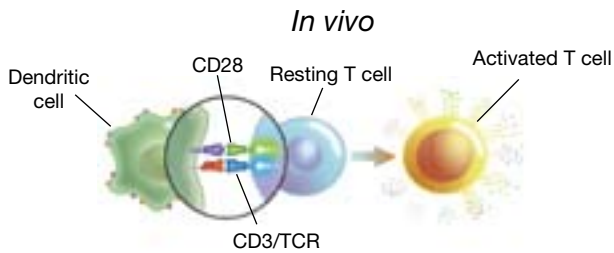


Figure 2—Consistent and reliable T cell expansion. Dynabeads® T cell expansion products offer a simple solution for mimicking the *in vivo* interaction of T cells with antigen-presenting cells (APCs) by utilizing the two activation signals present on APCs (CD3 and CD28) and a three-dimensional bead similar in size to APCs.

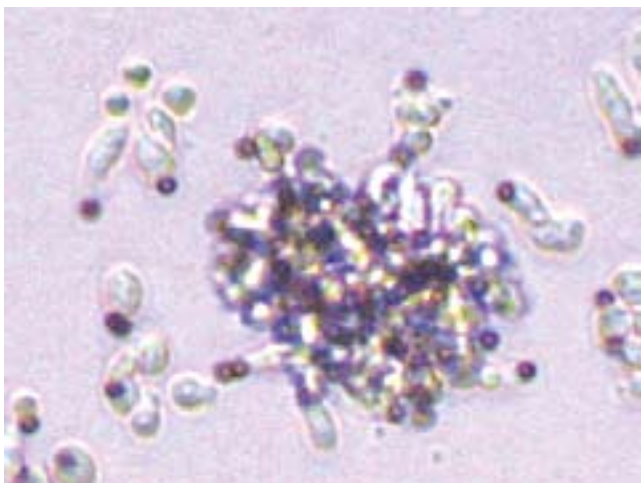


Figure 3—Dynabeads® for specific stimulation and expansion of T cells. The image shows activated T cells and Dynabeads® CD3/CD28.

How it works

T cell expansion couldn't be easier. Dynabeads® provide the key simultaneous signals to CD3/TCR and CD28 (Figures 2 and 3). Following specific activation and expansion, the bead-free T cells retain functional properties.² The cells can be restimulated several times; simply change the medium and add more beads (Figure 4). The whole process is antigen-independent, gentle, and efficient.

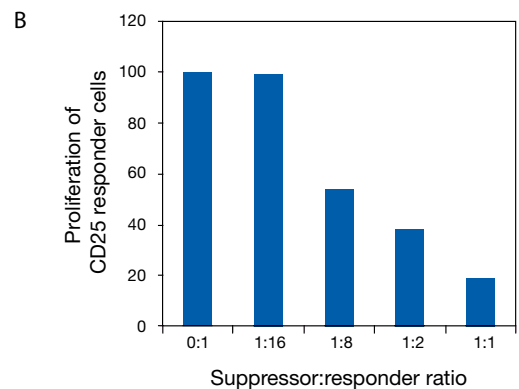
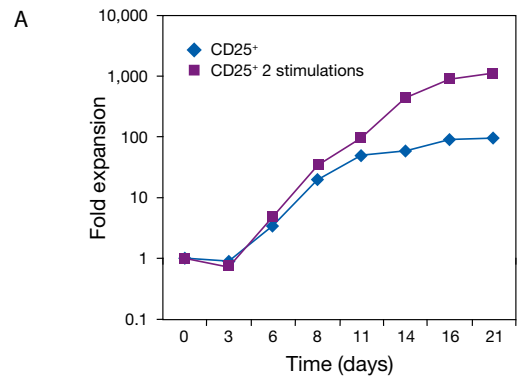


Figure 4—Expanded human Treg cells retain their phenotype and functionality. Human Treg cells were isolated using the Dynabeads® Regulatory CD4+CD25+ T Cell Kit, followed by activation using Dynabeads® Human Treg Expander. **A.** The Treg cells are expanded 100-fold (blue line). A higher expansion number can be obtained by restimulation at day 8 with >97% pure Treg cells to avoid overgrowth of non-Treg cells (purple line). **B.** Expanded human Treg cells were co-cultured with allogenic PBMC for 6 days at various suppressor:responder ratios. Proliferation was measured using a standard thymidine incorporation assay. At a 1:1 ratio, 80% suppression was achieved.

Quick, easy, and efficient

There's no need for autologous APCs or antigen, and you do not have to worry about APC/feeder cell contamination or culture maintenance. The ready-to-use Dynabeads® require only a short culture period for effective stimulation. Additional benefits include:

- Ease of use
- Consistent simultaneous signaling
- No negative signaling through CTLA4
- Expansion of CD4⁺, CD8⁺, and Treg cells
- Mouse and human research-grade and human clinical-grade products

Quality and consistency

Dynabeads® bring reproducibility and robustness to T cell stimulation and expansion. Stable beads with precise amounts of anti-CD3 and anti-CD28 antibodies ensure that the stimulated T cells retain their functional phenotype after proliferation, with *in vivo*-like and antigen-specific properties. Yet there are no contaminating by-products such as antibodies, beads, or feeder cells.

The expanded T cells are induced to express a wide array of immunomodulatory molecules (including CD137 and CD40L)² and cytokines such as IL-2, IFN- γ , TNF- α , and GM-CSF.³ Surface CD28 expression is maintained, and key homing receptors (e.g., L-selectin) and survival molecules (Bcl-XL) are induced.^{1,2}

Additionally:

- A broad T cell repertoire is maintained, securing antigen recognition capabilities³
- Expansion can reverse anergy and restore immunological responses⁴
- Expanded CD4⁺ and CD8⁺ cells retain their cytolytic and helper functions¹
- Expanded Treg cells retain their suppressive activity⁵
- Bead-activated T cells are easy to transduce⁶

From mouse models to clinical trials

Expanded mouse T cells can be used for further *in vitro* manipulations, or for adoptive transfer *in vivo*. This is relevant for mouse models for human disease, including the study of infectious diseases, autoimmunity, transplantation, and cancer. Antigen-specific T cell-based immunotherapy is being applied to a growing range of disease treatments.⁷

Our full portfolio of activation and expansion Dynabeads® includes a clinical research-grade product, allowing you to move from mouse studies to clinical research (Phase I/II) using the same technology platform. For scale-up, the Dynal *ClinExVivo*™ MPC® magnet has been developed for optimal performance with Dynabeads® *ClinExVivo*™ CD3/CD28 in translational research.

Dynabeads® ensure the optimal starting point for your T cell research, and makes T cell-based therapy practical. The attraction is simply *magnetisk*.*

References

1. Berger, C. et al. (2003) CD28 costimulation and immunoaffinity-based selection efficiently generate primary gene-modified T cells for adoptive immunotherapy. *Blood* 101:476–484.
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7. Rapoport, A.P. et al. (2005) Restoration of immunity in lymphopenic individuals with cancer by vaccination and adoptive T-cell transfer. *Nat Med* 11:1162–1163.

For further references and documentation, please contact us at dynal@invitrogen.com.

For information on the wide range of Dynabeads® products for positive and negative cell isolation, please visit www.invitrogen.com/cellisolation.

* *Magnetisk* is the Norwegian word for magnetic. Did you know that Dynabeads® magnetic separation technology was pioneered in the 1980s by the Norwegian company Dynal, now part of Invitrogen? To learn more, visit www.invitrogen.com/dynal.

Ordering information

Products	Quantity	Cat. no.
Dynabeads® Mouse CD3/CD28 T Cell Expander	2 ml	114-52D
Dynabeads® Mouse CD3/CD28 T Cell Expander	10 ml	114-53D
Dynabeads® CD3/CD28 T Cell Expander	2 ml	111-31D
Dynabeads® CD3/CD28 T Cell Expander	10 ml	111-32D
Dynabeads® CD3/CD28	10 ml	111-41D
Dynabeads® Human Treg Expander	2 ml	111-29D
Dynabeads® <i>ClinExVivo</i> ™ CD3/CD28 (formerly known as Xcyte™ Dynabeads®)	10 ml	402-03D
Related products		
DynaMag™-15 (holds 4 standard 15 ml tubes, alternatively 4 x 5 ml tubes used in flow cytometry)	1 unit	123-01D
DynaMag™-50 (magnet holding 2 x 5–50 ml tubes)	1 unit	123-02D
Dynal <i>ClinExVivo</i> ™ MPC® (magnet for medium- to large-scale handling for clinical research applications)	1 unit	121-02
OpTmizer™ T-Cell Expansion SFM (for human T cells)	500 ml	0080022SA
OpTmizer™ T-Cell Expansion SFM (for human T cells)	1 liter	0080022SC

DYNAL® has pioneered magnetic separation technology for biological discovery that is both simple and highly reproducible. Based on their patented superparamagnetic, monodisperse beads, Dynabeads® technologies represent a superior paradigm for cell and biomolecule separation in a wide range of basic and clinical research applications, diagnostic assays, and therapeutic protocols.



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