

## Red (orange) fluorescent protein TurboRFP

- Super bright red (orange) fluorescence
- Fast maturation, high pH-stability
- Recommended for gene expression analysis and cell and organelle labeling

TurboRFP is a red (orange) fluorescent protein (excitation/emission maxima are 553 and 574 nm, respectively) derived from sea anemone *Entacmaea quadricolor* [Merzlyak et al. 2007]. Possessing high photostability and pH stability, TurboRFP is more than twice brighter than DsRed2. Fast TurboRFP maturation makes it clearly detectable in mammalian cells as early as within 8-10 hrs after transfection.

TurboRFP is mainly intended for applications where fast appearance of bright fluorescence is crucial. It is specially recommended for cell and organelle labeling and tracking the promoter activity.

### Main properties of TurboRFP

Characteristic	
Molecular weight, kDa	26.1
Polypeptide length, aa	231
Fluorescence color	red (orange)
Excitation maximum, nm	553
Emission maximum, nm	574
Quantum yield	0.67
Extinction coefficient, $M^{-1}cm^{-1}$	92 000
Brightness*	61.6
Brightness, % of EGFP	187
pKa	4.4
Structure	dimer
Aggregation	no
Maturation rate at 37°C	super fast
Photostability	high
Cell toxicity	not observed

\* Brightness is a product of extinction coefficient and quantum yield, divided by 1 000.

### Performance and use

TurboRFP can be expressed and detected in a wide range of organisms. Mammalian cells transiently transfected with TurboRFP expression vectors produce bright fluorescence in 8-10 hrs after transfection. No cytotoxic effects or visible protein aggregation are observed.

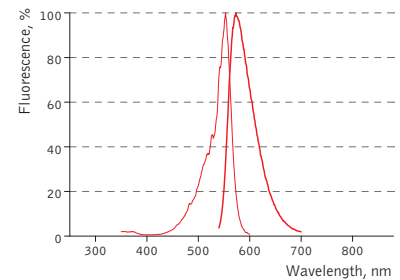
Despite its dimeric structure, TurboRFP performs well in some fusions. However, for protein labeling applications we recommend using specially optimized monomeric TagFPs.

TurboRFP can be used in multicolor labeling applications with blue, cyan, green, yellow, and far-red fluorescent dyes.

**TurboRFP maturation kinetics:** TurboRFP matures noticeably faster than other red fluorescent proteins. To compare maturation of TurboRFP and DsRed-related proteins, HeLa cells were transiently transfected with mammalian expression vectors comprising TurboRFP, DsRed2, or DsRed-Express fluorescent proteins under the control of CMV promoter. The DNA concentrations were equalized before transfection. Cells were photographed using fluorescent microscope after different periods of cultivation. Faster appearance of bright fluorescence was detected in the case of TurboRFP. In addition, unlike DsRed-related proteins, no abnormal Golgi-like localization of TurboRFP was observed within 7 days after transfection.

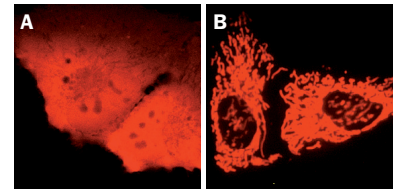
### Recommended filter sets and antibodies

TurboRFP can be recognized using Anti-tRFP antibody (Cat.# AB233-AB234) available from Evrogen.



### TurboRFP normalized excitation (thin line) and emission (thick line) spectra.

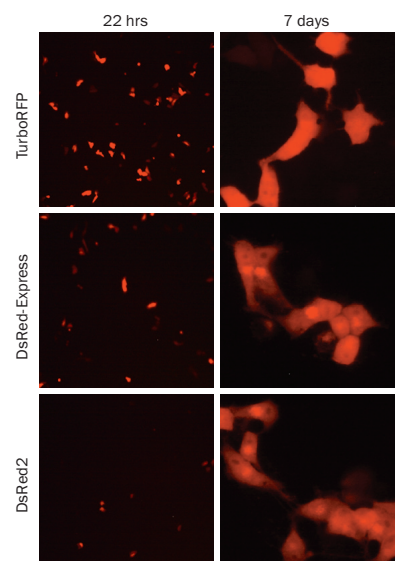
Complete TurboRFP spectra in Excel format can be downloaded from the Evrogen Web site at <http://www.evrogen.com>



### TurboRFP use for cell and organelle labeling.

(A) Fluorescent microscopy of mammalian cells expressing cytoplasmic TurboRFP; (B) Fluorescent microscopy of mammalian cells expressing TurboRFP fusion with mitochondrial targeting signal.

Images made from HeLa cells 24 hrs after transfection.



**Fluorescent microscopy of HeLa cells expressing TurboRFP, DsRed2, and DsRed-Express.** TurboRFP gives the brightest signal 22 hrs after transfection; DsRed2 and DsRed-Express show abnormal Golgi-like localization 7 days after transfection, whereas TurboRFP localizes evenly in the cytosol.

Recommended Omega Optical filter sets are QMAX-Yellow, XF108-2, XF101-2, and XF111-2. TurboRFP can also be detected using TRITC filter set or similar.

#### Available variants and fusions

TurboRFP mammalian expression vectors contain TurboRFP coding sequence with codon usage optimized for high expression in mammalian cells, i.e. humanized [Haas et al. 1996]. Humanized TurboRFP can also be expressed in *E. coli* and some other heterologous systems upon subcloning into appropriate vector.

The available vectors encoding TurboRFP variants and fusions are listed below in the section TurboRFP-related products. For most updated product information, please visit Evrogen website [www.evrogen.com](http://www.evrogen.com).

If you need TurboRFP codon variant or fusion construct that is not listed on our website, please contact us at [product@evrogen.com](mailto:product@evrogen.com).

#### Licensing opportunities

Evrogen technology embodied in TurboRFP is available for expanded and commercial use with an adaptable licensing program. Benefits from flexible and market driven license options are offered for upgrade and novel development of products and applications. For licensing information, please contact Evrogen at [license@evrogen.com](mailto:license@evrogen.com).

#### References

Haas, J. et al. (1996). *Curr Biol*, 6 (3): 315–324 / pmid: 8805248

Merzlyak, EM et al. (2007). *Nat Methods*, 4 (7): 555–557 / pmid: 17572680

#### TurboRFP-related products

Product	Cat.#	Description	Size
TurboRFP expression/source vectors			
pTurboRFP-C	FP231	Mammalian expression vector encoding humanized TurboRFP and allowing its expression and generation of fusions to the TurboRFP C-terminus	20 µg
pTurboRFP-N	FP232	Mammalian expression vector encoding humanized TurboRFP and allowing its expression and generation of fusions to the TurboRFP N-terminus	20 µg
pTurboRFP-B	FP233	Bacterial expression vector; source of the TurboRFP coding sequence	20 µg
pTurboRFP-PRL	FP235	Promoterless vector encoding humanized TurboRFP and designed for monitoring of activity of different promoters and promoter/enhancer combinations	20 µg
pTurboRFP-mito	FP237	Mammalian expression vector encoding humanized TurboRFP targeted to mitochondria	20 µg
Antibodies against TurboRFP			
Anti-tRFP	AB233	Rabbit polyclonal antibody against TurboRFP, TurboFP602, TurboFP635, TurboFP650,	100 µg
	AB234	NirFP, TagBFP, TagRFP, FusionRed, TagFP635, mKate2 and PA-TagRFP	200 µg

Please contact your local distributor for exact prices and delivery information.

#### Notice to Purchaser:

TurboRFP-related materials (also referred to as "Products") are intended for research use only.

The Products are covered by U.S. Pat. 8,138,320; European Pat. 1994149; and other Evrogen Patents and/or Patent applications pending. By use of these Products, you accept the terms and conditions of the applicable Limited Use Label License #001: <http://www.evrogen.com/products/Evrogen-FP-license.shtml>.

The CMV promoter is covered under U.S. Patents 5,168,062 and 5,385,839, and its use is permitted for research purposes only. Any other use of the CMV promoter requires a license from the University of Iowa Research Foundation, 214 Technology Innovation Center, Iowa City, IA 52242.

**MSDS information** is available at <http://www.evrogen.com/MSDS.shtml>