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List of Fluorescent Dyes, Labels, Markers, Derivatization Reagents and Conjugatable Nanoparticles

vs. of 14-Jan-2021; edited by O. S. Wolfbeis

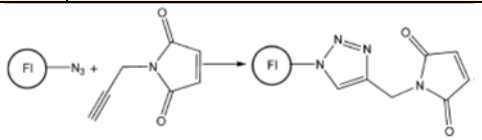
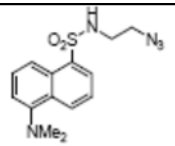
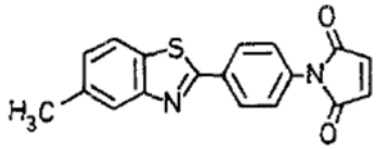
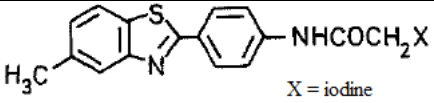
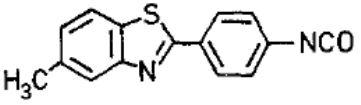
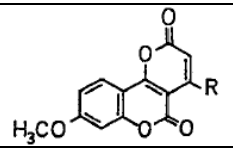
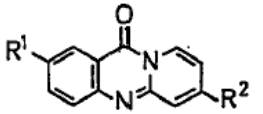
This group of compounds and nanoparticles includes labels and nanoparticles that can be conjugated to organic molecules or biomolecules. This process sometimes is referred to as derivatization, mainly in chromatography and electrophoresis. This group also includes fluorescent dyes and doped (and often conjugatable) nanoparticles. They all are supposed to render an organic molecule or a biomolecule or a cell fluorescent. They are *NOT* supposed to respond to other species or parameters in their environment. Labeling of biomolecules is widely applied in analytical biochemistry, bioassays, sequencing and imaging. Materials are listed according to their longest-wave absorption or excitation maximum (Abs).

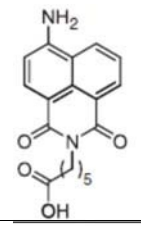
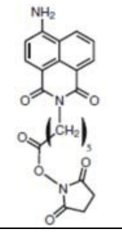
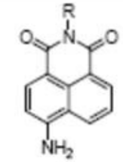
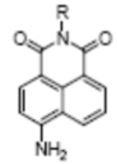
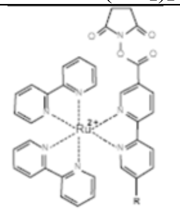
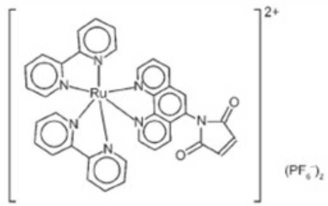
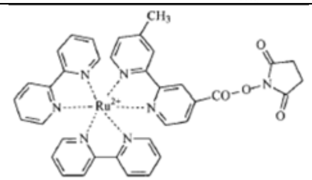
(i) The first number gives the longest-wave absorption or excitation wavelength.
(ii) The first number is followed by a low-case identification letter.
(iii) The *Extended Code* indicates the function. See the list of codes below.
(iv) The column on absorption and emission maxima gives the longwave absorption peak (Abs), log ε values, emission maxima (Em), quantum yields (QY) and decay times (τ) where available.

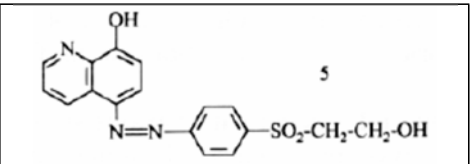
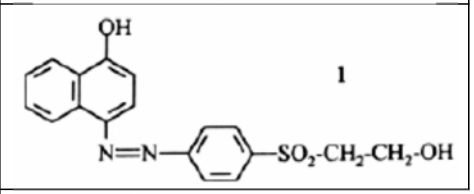
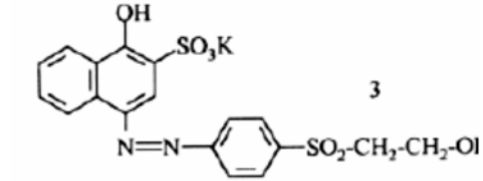
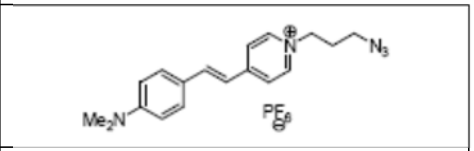
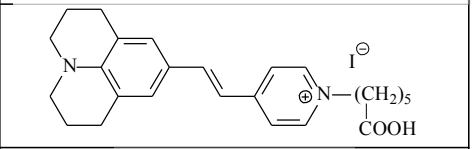
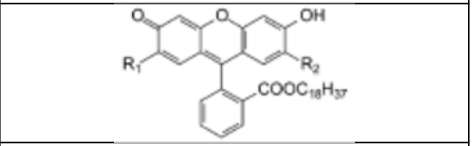
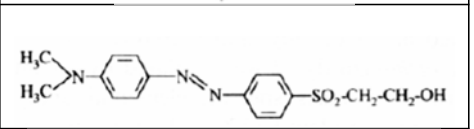
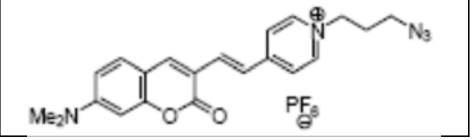
Codes

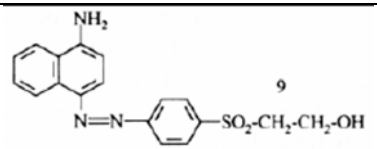
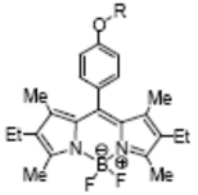
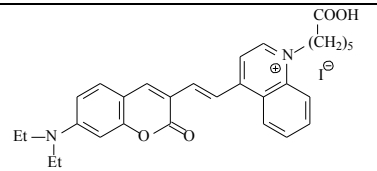
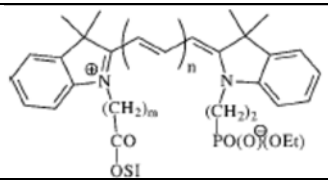
-BRO: label containing a reactive bromo atom at a C-atom (NH- and/or OH-reactive)	-MAL: label containing a maleimide group; mainly thiol-reactive
-BTN: label containing a biotin unit	-NCO: Label containing an isocyanato group (mostly for alcohols)
-CCH: label containing a terminal alkyne group; for use in click reactions	-NCS: label containing an isothiocyanate group; amino-reactive
-CLO: label containing a reactive chloro atom at a carbon atom; usually NH-reactive	-NHS: label containing an N-hydroxysuccinmide ester; amino-reactive
-CRB: dye containing a carboxy group; used to dope micro- and nanoparticles	-NNN: label containing an azido group; for use in click reactions
-DOP: fluorophore without reactivity; used for doping particles	-PYR: pyrylium label; usually of the chameleon type; amino-reactive
-IOD: label containing a reactive iodine atom at a carbon atom; usually SH-reactive	-UCNP: upconversion nanoparticles
-LIP: lipophilic dye as a fluorescent dopant for particles made from organic polymers	-VIN: label containing a hydroxyethylsulfonyl group which, in strong acid, is converted to a vinylsulfonyl group that reacts with cellulose and other polysaccharides.

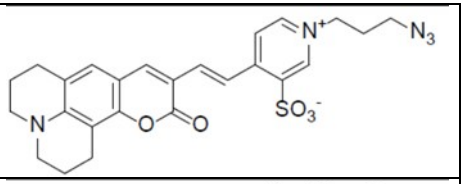
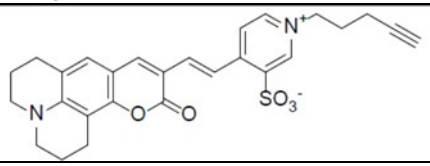
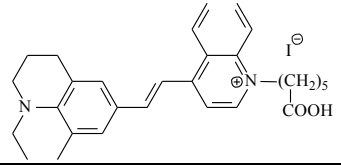
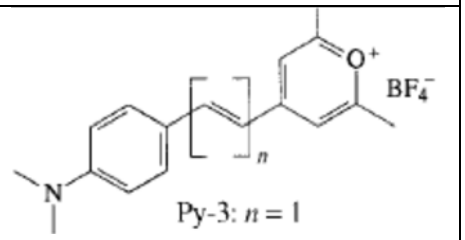
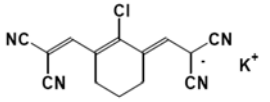
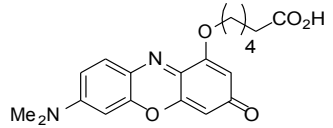
List of Labels

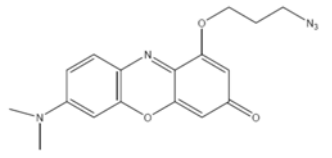
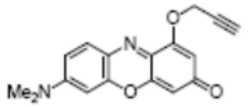
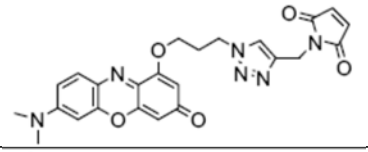
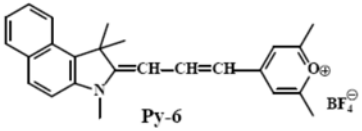
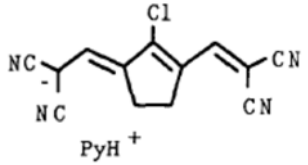
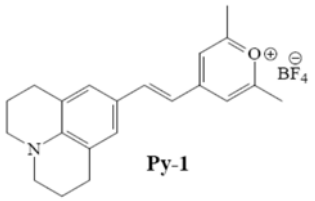
Label Code	Abs. max. (log ε) Em. max., QY, τ	Remarks and References	Formula
UR-000-f-MAL		A reagent (N-propynylmaleinimide) to introduce a maleinimido group into all kinds of fluorophores or fluorescent nanoparticles modified with an azido group (Fl-N_3) via a Cu(I)-catalyzed click reaction. *Ref.*: M. Link et al.; *Eur. J. Org. Chem.* (2010), 6922. DOI: 10.1002/ejoc.201001085. Fluorescently labeled silica nanoparticles with maleinimide function for conjugation to thiols also have been described: D. E. Achatz et al.; *Sensors Actuat. B (Chemical)* 150 (2010), 211. DOI: 10.1016/j.snb.2010.07.014.	
UR-302-a-NNN	Abs: 332 nm (log ε 3.53) (MeOH); Em: 460 nm	Click reagent for labeling **proteins**. Can be linked to molecules (proteins) modified with alkyne groups (-C≡CH). *Ref.*: P. Kele et al.; Org. Biomol. Chem., 2009; DOI: 10.1039/b907741c. H. S. Mader et al.; *Annals New York Acad. Sci.* (2008), 1130, 218. DOI: 10.1196/annals.1430.053.	
UR-330-z-MAL	Abs: 330 nm (log ε 4.1) (MeOH); Em. of thiol-conjugate: 390 nm.	Nonfluorescent thiol label but displaying strong blue fluorescence on conjugation to thiols. Selective for thiols. Used to derivatize thiols in chromatographic separations. Ref.: O. S. Wolfbeis, H. Marhold, Monatsh. Chem. 114 (1983) 599. DOI: 10.1007/BF00798615	
UR-331-l-IOD	Abs: 331 nm (log ε 4.1) (MeOH); Exc./Em. of thiol-conjugate: 365/390 nm.	Iodoacetyl-type of thiol label. Selective for thiols. Used to derivatize thiols in chromatographic separations. *Ref.*: O. S. Wolfbeis, H. Marhold, *Monatsh. Chem.* 114 (1983) 599. DOI: 10.1007/BF00798615	
UR-332-x-NCO	Abs: 332 nm (log ε 4.1) (MeOH); Em. of thiol-conjugate: 390 nm.	Nonfluorescent derivatization reagent for compounds carrying –OH or –NH– or $–NH_2$ groups. Used for fluorescence derivatization of pharmaceutical drugs containing alcohol or amino groups. Displays strong blue fluorescence. *Ref.*: O. S. Wolfbeis, H. Marhold, *Monatsh. Chem.* 114 (1983) 599. DOI: 10.1007/BF00798615	
UR-360-i-BRO	Abs: 360 nm (log ε 4.3) (CH_3CN); Em: 422 nm.	A bromoacetyl-modified blue emitting coumarin fluorophore (R = bromoacetyl (= CO-CH2-Br) for labelling of compounds containing –NH–, or –NH2, or –OH groups. Used for derivatization of barbiturate drugs: Ref.: R. Wintersteiger, O. S. Wolfbeis; Z. Naturforsch. 38B (1983) 248. DOI: 10.1515/znb-1983-0223	
UR-369-r-BRO	Abs: 369 nm (log ε 4.32) (MeOH); Em: 454 nm.	Derivatization reagent. R_1 = bromoacetyl (–CO-CH_2-Br), R_2 = H. A blue emitting quinazoline fluorophore for labelling compounds containing –NH–, or $–NH_2$, or –OH groups. Used for derivatization of sulfonamide drugs prior to chromatography. *Ref.*: R. Wintersteiger, O. S. Wolfbeis; *Z. Naturforsch.* 38B (1983) 248. DOI: 10.1515/znb-1983-0223.	

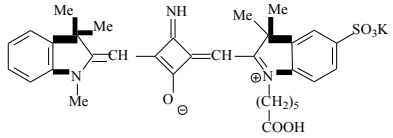
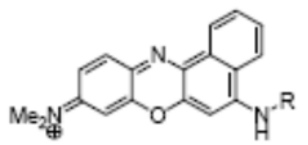
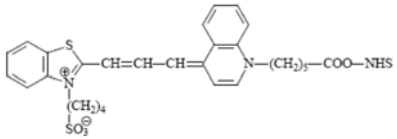
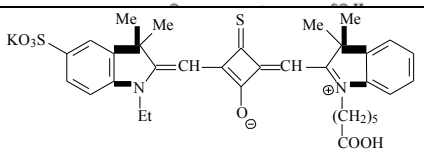
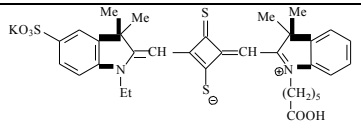
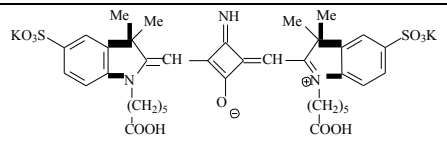
UR-431-c-CRB - - - - - - **UR-431-s-NHS**	Abs: 431 nm (log ε 3.8) Em: 551 nm; QY 0.6. - - - - - - - - - - - - - - - - -	UR-431-c-CRB is a deeply yellow dye with strong yellow-green fluorescence. Used to prepare fluorescent micro- and nanoparticles. Dye described in: M. Link et al; *Microchim. Acta*, 2009. DOI: 10.1007/s00604-009-0169-8. - UR-431-s-NHS is the amino-reactive N-hydroxysuccinimide (NHS) ester of UR431-c. Good **protein label**. Used in protein electrophoresis: P. Schulze et al.; *Electrophoresis* 31 (2010) 2749. DOI: 10.1002/elps.201000007.	CRB:  NHS: 
UR-445-e-NNN	Abs: 445 nm (log ε 3.83) Em: 538 nm	Azido click label. Can be linked to **proteins** modified with alkyne groups (-C≡CH). Ref.: (a) H. S. Mader et al.; Annals New York Acad. Sci. (2008), 1130, 218. DOI: 10.1196/annals.1430.053. (b) P. Kele et al.; Org. Biomol. Chem., 2009. DOI: 10.1039/ b907741c.	 R = $-(CH_2)_2-N_3$
UR-451-o-CCH	Abs: 451 nm (log ε 3.83) Em: 539 nm	Alkyne click label. Can be linked to **proteins** modified with azido groups ($-N_3$). Ref.: (a) H. S. Mader et al.; Annals New York Acad. Sci. (2008), 1130, 218. DOI: 10.1196/annals.1430.053. (b) P. Kele et al.; Org. Biomol. Chem. 7 (2009) 3486. DOI: 10.1039/ b907741c	 R = $-(CH_2)_2-C{\equiv}CH$
UR-453-n-NHS	Abs: 456 nm (log ε 4.16); Em: 663 nm. QY: 0.036. τ ~ 600 ns. Luminescence is quenched by O_2.	This ruthenium complex in its NHS form is a **protein label** . *Ref.*: A. Duerkop et al., *Anal. Bioanal. Chem.* 372 (2002) 688 Was used as a probe in a luminescence polarization assay. *Ref.*: B. Wetzl et al., J. Chromatogr. B 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0. The NHS ester is a label for proteins and all kinds of amines.	
UR-454-o-MAL	Abs: 454 nm (log ε 4.18); Em: 606 nm. QY: 0.01. τ near 0.8 µs.	Ruthenium label for thiols. Very large Stokes shift. Reagent is stable in MeOH solution but instable in buffer. Once conjugated to a proteins, it is quite stable. Luminescence is quenched by oxygen. Used in a rResonance energy transfer immunoassay using a longwave emitting acceptor dye (**UR-642-z-NHS)**. *Ref.*: J. Weh et al.; *ChemBioChem* 8 (2007) 122. DOI: 10.1002/cbic.200600316.	
UR-455-a-NHS	Abs: 455 nm (log ε 4.16); Em: 670 nm; small QY;	Ruthenium(II) metal-ligand complex. **Protein label**. Used in an immuno FRET study as the donor fluorophore along with UR-634-u as the acceptor fluorophores. *Ref.*: C. M. Augustin et al., *Anal. Biochem.* 305 (2002) 166. DOI: 10.1006/abio.2002.5633.	

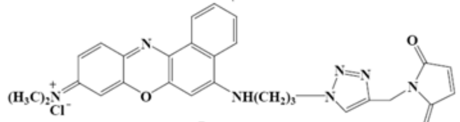
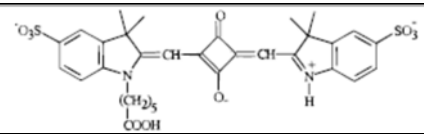
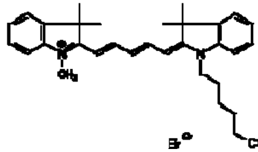
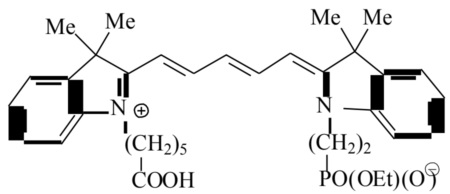
UR-463-s-VIN	Abs: 463 nm (yellow; log ε 4.33) at pH 5, and 519 nm (red) at pH 10.	Cellulose-conjugatable yellow azo dye. Requires harsh conditions for immobilization (strong sulfuric acid). In strong acid, the hydroxyethylsulfonyl group (-SO_2-CH_2-CH_2-OH) is converted to a vinylsulfonyl group that reacts with cellulose. *Ref.*: G. J. Mohr et al., *Dyes & Pigments* 24 (1994) 223. DOI: 10.1016/0143-7208(94)80011-1	
UR-466-q-VIN	Abs: 466 nm (yellow; log ε 4.5) at pH 5, and 541 nm (red) at pH 10.	Cellulose-conjugatable yellow azo dye. Nonfluorescent. Moderately water-soluble. Requires harsh conditions for immobilization (strong sulfuric acid). In strong acid, the hydroxyethylsulfonyl group (-SO_2-CH_2-CH_2-OH) is converted to a vinylsulfonyl group that reacts with cellulose. *Ref.*: G. J. Mohr et al., *Dyes & Pigments* 24 (1994) 223. DOI: 10.1016/0143-7208(94)80011-1	
UR-479-r-VIN	Abs: 479 nm (orange; log ε 4.5) at pH 5, and 527 nm (red) at pH 10.	Cellulose-conjugatable red orange dye. Better water-solubole than UR-466-q-VIN. Requires harsh conditions for immobilization (strong sulfuric acid). In strong acid, the hydroxyethylsulfonyl group (-SO_2-CH_2-CH_2-OH) is converted to a vinylsulfonyl group that reacts with cellulose. *Ref.*: G. J. Mohr et al., *Dyes & Pigments* 24 (1994) 223. DOI: 10.1016/0143-7208(94)80011-1	
UR-480-a-NNN	Abs: 480 nm, (log ε 4.67); Em: 602 nm	Azido click label. Can be linked to **proteins** modified with alkyne groups (-C≡CH). Fluorescein analog but with much larger Stokes shift; pH independent fluorescence; ref.: P. Kele et al.; Org. Biomol. Chem. 7 (2009) 3486. DOI: 10.1039/b907741c	
UR-495-p-NHS	Abs: 495 nm (log ε 4.34) E :636 nm; QY 0.01; ; QY up to 0.41 on protein.	Very large Stokes' shift dye; B. Wetzl et al., *J. Chrom. B* 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0. This NHS ester (with –CO-NHS in place of –COOH) is a **label for proteins and amines.**	
UR-496-i-LIP	Abs: 496 nm (log ε 4.52); Em: 532 nm. QY 0.9 at pH > 8; τ ~4.5 ns.	Lipophilic dye with strong green fluorescence. R_1 and R_2 can be chloro substituents (see UR-502-b). Synthesis described by B. M. Weidgans et al., *Analyst* 129 (2004) 645. DOI: 10.1039/b404098h. Can be used to render **particles** prepared from lipophilic polymers (such as polystyrene) fluorescent.	
UR-500-u-VIN	Abs: 500 nm (red; log ε 4.46) at pH 5, and 481 nm (orange) at pH 10.	Cellulose-conjugatable red azo dye. Nonfluorescent. Requires harsh conditions for immobilization (strong sulfuric acid). In strong acid, the hydroxyethylsulfonyl group (-SO_2-CH_2-CH_2-OH) is converted to a vinylsulfonyl group that reacts with cellulose. *Ref.*: G. J. Mohr et al., *Dyes & Pigments* 24 (1994) 223. DOI: 10.1016/0143-7208(94)80011-1	
UR-505-a-NNN	Abs: 505 nm (log ε 4.65) Em: 630 nm	Azido click label. Can be linked to **proteins** modified with alkyne groups (-C≡CH). Ref.: (a) P. Kele et al.; Org. Biomol. Chem. 7 (2009) 3486. DOI: 10.1039/b907741c. (b) H. S. Mader et al.; Annals New York Acad. Sci. (2008), 1130, 218. DOI: 10.1196/annals.1430.053.	

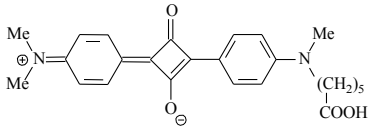
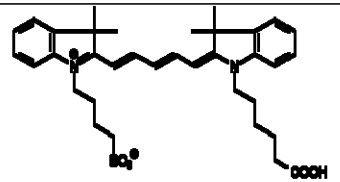
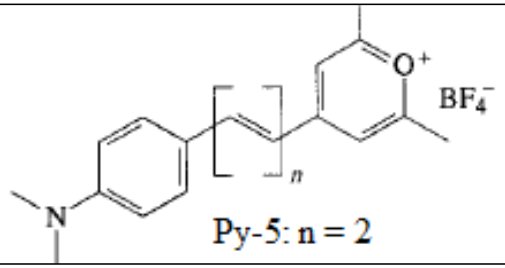
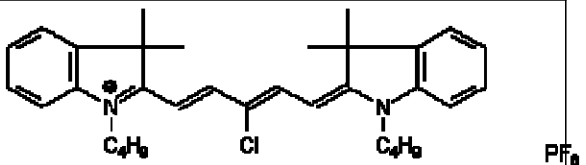
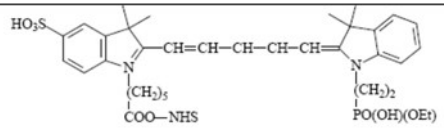
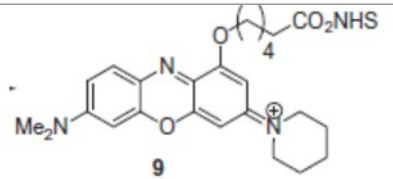
UR-505-a-CCH	Abs: 505 nm (log ε 4.65) Em: 630 nm	Alkyne click label. Can be linked to organic molecules and **proteins** modified with azido groups (-N_3). ef.: P. Kele et al.; Org. Biomol. Chem. 7 (2009) 3486. DOI: 10.1039/b907741c. (b) H. S. Mader et al.; Annals New York Acad. Sci. (2008), 1130, 218. DOI: 10.1196/annals.1430.053.	Same formula as above but with the –N_3 group replaced by a –C≡CH group
UR-512-t-VIN	Abs: 512 nm (log ε 4.55) at pH 5, and 497 nm (red) at pH 10.	Cellulose-conjugatable deep red azo dye. Requires harsh conditions for immobilization (strong sulfuric acid). In strong acid, the hydroxyethylsulfonyl group (-SO_2-CH_2-CH_2-OH) is converted to a vinylsulfonyl group that reacts with cellulose. *Ref.*: G. J. Mohr et al., *Dyes & Pigments* 24 (1994) 223. DOI: 10.1016/0143-7208(94)80011-1	
UR-516-e-NNN	Abs: 520 nm (log ε 4.80); Em: 535 nm	Azido **click** label of the bodipy type; R = -$(CH_2)_2$-N_3. Can be linked to molecules modified with alkyne groups (-C≡CH). *Ref.*: P. Kele et al.; *Org. Biomol. Chem.* 7 (2009) 3486. DOI: 10.1039/ b907741c. (b) H. S. Mader et al.; *Annals New York Acad. Sci.* (2008), 1130, 218. DOI: 10.1196/annals.1430.053.	
UR-516-y-CCH	Abs: 520 nm (log ε 4.80); Em: 535 nm	Alkyne click label of the bodipy type. Can be linked to **proteins** modified with azido groups (-N_3). *Ref.*: (a) *S. Mader et al.*; Annals New York Acad. Sci. (2008), 1130, 218. DOI: 10.1196/annals.1430.053. (b) P. Kele et al.; *Org. Biomol. Chem.* 7 (2009) 3486. DOI: 10.1039/ b907741c.	Same as above but with R = -(CH_2)-C≡CH
UR-520-h-CRB	Abs: 520 nm (log ε 4.45) Em: 700 nm; QY 0.01 in water but much higher in non-protic solvents and polymers.	Very large (180 nm) Stokes' shift fluorophore. Ref.: B. Wetzl et al., J. Chrom. B 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0. Potentially useful for **dying particles.**	
UR-520-n-NHS	Abs: 520 nm (log ε 4.45) Em: 700 nm; QY 0.01	Very large Stokes' shift **protein** label; B. Wetzl et al., J. Chrom. B 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0.	Same formula as above but with –CO-NHS in place of –COOH
UR-543-c-CRB	Abs: 543 nm; Em: 560 nm; QY: 0.04 in MeOH but lower in water; log ε 4.56	Red dye with yellow fluorescence; moderately bright; a.k.a. FEW's dye S-0771 (www.few.de). Moderately soluble in water. Well soluble in organic solvents and polymers. Potentially useful to prepare red **nanoparticles** with yellow-green fluorescence.	
UR-543-o-NHS	Abs: 543 nm; Em: 560 nm; QY: 0.04 in MeOH but lower in water; log ε 4.56	Red cyanine NHS ester; label for **amines and proteins**.	Same formula as above but with –CO-O-NHS in place of –COOH
UR-546-n-NHS	Abs: 546 nm (log ε 4.92); Em: 562 nm; QY 0.04 to 0.1, but 0.1 – 0.6 if conj. to protein	This NHS ester ("-OSI" means the same as "–NHS") is a **protein and amine label** a.k.a. *Chromeo 546* and as *FO-546* (Sigma); n = 1. Used as a label for an oligonucleotide and as a donor in a fluorescence resonance energy transfer hybridization assay for a 15-meric oligo. *Ref.*: M. Gruber et al.; *J. Fluoresc.* 15 (2005) 207. DOI: 10.1007/s10895-005-2619-y.	

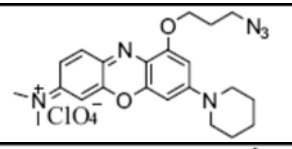
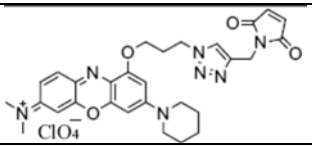
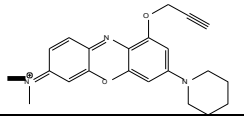
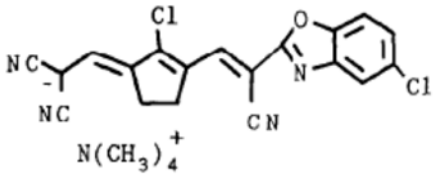
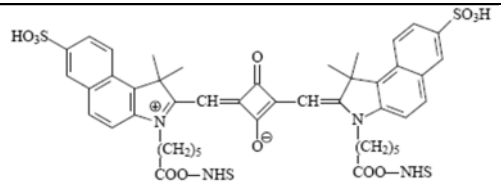
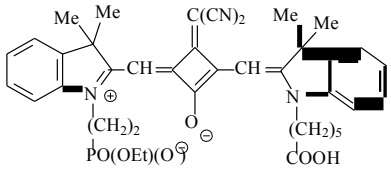
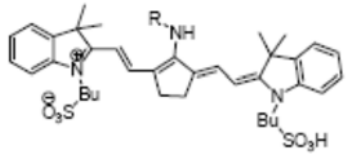
UR-564-z-NNN	Abs: 564 nm (water); Em: 714 nm (unreacted label) but 673 nm when conjugated to a protein such as albumin.	Azido click label. Applied to **tyrosine-specific sequential labeling** of albumin: G. B. Cserep et al., Bioorg. Med. Chem. Lett. 23 (2013) 5776. DOI: 10.1016/j.bmcl.2013.09.002.	
UR-564-y-CCH	Abs: 564 nm (log ε xxx) (solvent?); Em: 714 nm (label) but 673 nm when conjugated to albumin. τ: 3 – 4 ns.	Alkyne click label. Applied to **tyrosine-specific sequential labeling** of albumin: G. B. Cserep et al., Bioorg. Med. Chem. Lett. 23 (2013) 5776. DOI: 10.1016/j.bmcl.2013.09.002.	
UR-568-h-CRB	Abs: 568 nm (4.46); Em: 670 nm; low QY in water.	Large Stokes' shift fluorophore. Ref.: B. Wetzl et al., J. Chromatogr. B 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0. Potentially useful to prepare purple **nanoparticles** with yellow fluorescence.	
UR-568-g-NHS	Abs: 568 nm (4.46); Em: 670 nm; QY up to 0.4 if conj. to protein	The NHS ester is a label for **proteins and amines** with large Stokes' shift. *Ref.*: B. Wetzl et al., J. Chromatography B 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0.	Same formula as above but its HNS ester
UR-572-y-PYR	Abs: 572 nm (log ε 4.7) before conj. to amine; Abs: 464 nm (log ε 4.3) after conjugation. Em: 641 nm before conj. but 582 nm after conj.	**Chameleon label** for **amino groups on proteins and oligonucleotides**. A.k.a. Py-3. Has a purple color and poor QY before labeling a protein., but becomes orange colored with higher QY (0.1 – 0.2) after conjugation. τ >0.5 ns before conj.; 2.3 ns after conj. to amine or protein. Ref.: B. Wetzl et al.; *Angew. Chem. Intl. Ed.* 43 (2004) 5400. DOI: 10.1002/anie.200460508. Reacts with primary amino groups only and does not change the charge of the labeled protein at physiological pH values.	
UR-580-h-ALB	Abs: 580 nm (log ε 5.1);. Em: 616 nm.	Deep-purple dye for non-covalent labeling of HSA and other albumins. Binding occurs through mainly electrostatic interaction. Binding results in a color change to blue. Refs.: M. A. Kessler, O.S. Wolfbeis; *Anal. Biochem.* 200 (1992) 254. DOI: 10.1016/0003-2697(92)90462-G. Also used to quantify HSA in urine: (a) M. K. Kessler et al.; *Clin. Chem.* 43 (1997) 996. DOI: 10.1093/clinchem/43.6.996 (AB-580); (b) M. A. Kessler et al.; *Anal. Biochem.* 248 (1997) 180. DOI: 10.1006/abio.1997.2113	 Albumin Blue 580
UR-589-c-CRB	Abs: 589 nm (log ε 4.26) in water but 560 nm in MeOH); Em: 630 nm	Purple **phenoxazine** dye with orange-colored fluorescence. Can be used to prepare fluorescent dyed **nanoparticles**.	

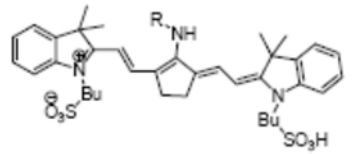
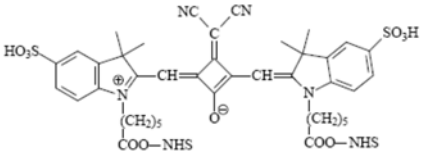
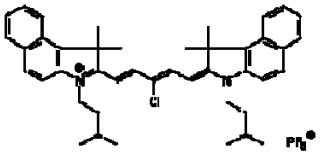
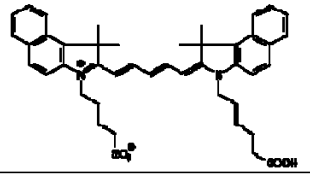
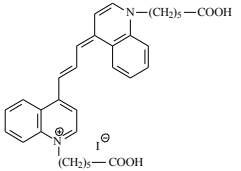
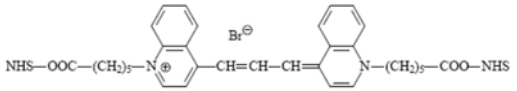
UR-589-n-NHS	Abs: 589 nm (log ε 4.26) in water but 560 nm in MeOH); Em: 630 nm; QY of protein conjugates around 0.14	This is the NHS ester of UR-589-c-CRB (above). Purple phenoxazine label with orange-colored fluorescence. Used to **proteins and amines**. Also referred to as ROx dye. *Ref.*: M.Link et al.; *Bioorg. Med. Chem. Lett.* 21 (2011) 5538. DOI: 10.1016/j.bmcl.2011.06.133. Also see UR-648-n (the blue-colored equivalent to this label).	Same formula as above but the –COOH group is replaced by –CO-NHS
UR-595-a-NNN	Abs: 595 nm (log ε 4.31) in water but 560 nm in MeOH; E (water): 629 nm; QY ~0.01 in water; 0.12 in MeOH	Purple azido click label. Can be linked to **proteins** modified with alkyne groups (-C≡CH). Ref.: (a) Diploma thesis J. Kleim (2009); (b) P. Kele et al.; Org. Biomol. Chem. 7 (2009) 3486. DOI: 10.1039/b907741c. Also referred to as ROx label. Strongly solvatochromic (solutions in hexane are yellow)	
UR-596-o-CCH	Abs: 596 nm (log ε 4.28) in water but 557 in MeOH; Em: 631 nm (water)	Purple click label; strongly solvatochromic (550 nm in MeOH). Can be linked to **proteins** modified with azido groups (-N_3). Ref.: P. Kele et al.; Org. Biomol. Chem. 7 (2009) 3486. DOI: 10.1039/b907741c	
UR-597-b-MAL	Abs: 597 nm (log ε 4.33); 557 nm in MeOH; Em: 628 nm (620 in MeOH); QY 0.12 in MeOH; probably higher on protein	Purple **thiol** label with spacer group (= ROx label); strongly solvatochromic; possibly a probe for local protein polarity. Ref.: P. Kele et al.; Org. Biomol. Chem. 7 (2009) 3486. DOI: 10.1039/b907741c	
UR-598-y-PYR	Abs: 598 nm (log ε 4.8) before conj. to amine; 540 nm (log ε 4.4) after conj.; Em: 627 nm before conj.; 598 nm after conj.	Blue **protein label** that becomes red on conjugation. A.k.a. Py-6; Ref.: D. B. Craig et al.; *Electrophoresis* 26 (2005) 2208. DOI: 10.1002/elps.200410332. QY 0.01 before conj. to amine, but 0.4 after conjugation.	 Py-6
UR-602-g-ALB	Abs: 602 nm; log ε 5.1 (in iPrOH). Em: 617 nm. When bound to HSA, the abs/em maxima are shifted to 620/635 nm.	Blue anionic reagent for non-covalent labeling of HSA and other albumins. Binding (with binding constant of $1.3 \cdot 10^7$ M^{-1}) occurs via mainly electrostatic interaction. *Ref.*: M. A. Kessler, O.S. Wolfbeis; *Anal. Biochem.* 200 (1992) 254. DOI: 10.1016/0003-2697(92)90462-G . In this paper, the dye is referred to as AB-633 because it is compatible with the 670-nm diode laser.	 PyH $^+$
UR-621-y-PYR	Abs: 621 nm (log ε 4.7) before conj. to amine (solution A). After conj. : Abs.: 503 nm (log ε 4.3) (solution B). Em: 665 nm before conj.; Em: 602 nm after conjugation. QY becomes much higher (0.3 – 0.6) on conjugation. Decay time >0.5 ns before conj., but 2.8 ns after conj.	Chameleon **label** for amino groups of proteins, oligonucleotides or on surfaces. Changes color from blue to red on conjugation. A.k.a. Py-1. Reacts with primary amino groups only and does not change the charge of a protein at physiological pH values. *Ref.*: B. K. Wetzl et al.; *Angew. Chem. Intl. Ed.* 43 (2004) 5400–5402. DOI: 10.1002/anie.200460508. Applications: (a) Photometric protein assay: B. K. Hoefelschweiger et al., *Anal. Biochem.* 344 (2005) 122. DOI: 10.1016/j.ab.2005.06.030. (b) As a protein label in CE: D. B. Craig et al.; *Electrophoresis* 26 (2005) 2208. DOI: 10.1002/elps.200410332. (c) A a label in protein PAGE: R. Meier et al., *Anal. Chem.* 80 (2008) 6274. DOI: 10.1021/ac800581v. Commercially available (Chromeo dye®)	 Py-1 

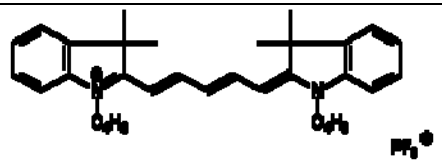
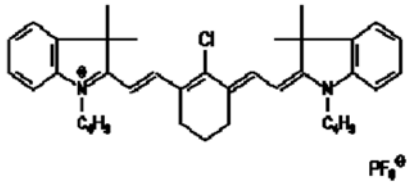
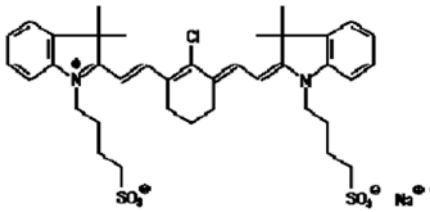
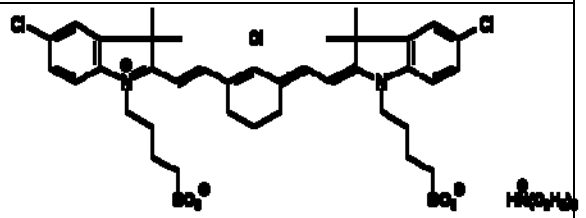
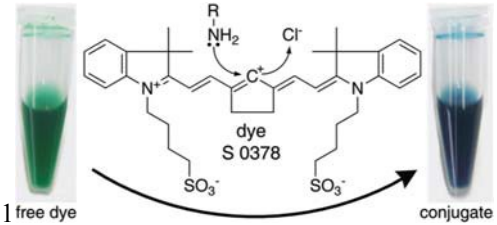
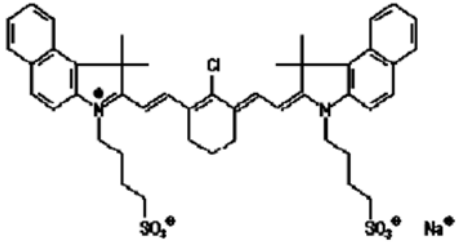
UR-626-q-CRB	Abs: 626 nm (log ε 5.24); Em: 636 nm; QY up to 0.2 on proteins	Squarylium dye. Potentially useful to prepare purple-colored **nanoparticles** with orange fluorescence. The NHS ester is a protein label. *Ref.*: B. Wetzl et al., J. Chromatography B 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0.	
UR-626-n-NHS	Abs: 626 nm (log ε 5.24); Em: 636 nm; QY up to 0.2 on protein	Squarylium dye. The NHS ester is a covalent label for **proteins and amines**. Ref.: B. Wetzl et al., *J. Chromatogr.* B 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0.	Same formula as above but –CO-NHS in place of –COOH
UR-627-e-NNN	Abs: 627 nm (log ε 4.26); Em: 673 nm; QY ~ 0.2	Azido click label. Smaller molar absorbance than other oxazine labels. R = $-(CH_2)_2-N_3$. Can be linked to **proteins** modified with alkyne groups (-C≡CH). *Ref.*: (a) H. S. Mader et al.; Annals New York Acad. Sci. (2008), 1130, 218. DOI: 10.1196/annals.1430.053. (b) Kele et al., *Org. Biomol. Chem.* 7 (2009) 3486. DOI: 10.1039/ b907741c	
UR-627-o-CCH	Abs: 627 nm (log ε 4.26); Em: 673 nm; QY ~ 0.2	Alkyne click label; much smaller molar absorbance than other oxazine labels. Can be linked to **proteins** modified with azido groups ($-N_3$). Ref.: (a) H. S. Mader et al.; *Annals New York Acad. Sci.* (2008), 1130, 218. DOI: 10.1196/annals.1430.053. (b) P. Kele et al.; *Org. Biomol. Chem.*, 2009; DOI: 10.1039/ b907741c	Same formula as above, with R = $-CH_2-C\equiv CH$.
UR-627-u-NHS	Abs: 627 nm (log ε 5.10); Em: 650 nm; QY 0.01; much higher if conj. to HSA; τ 1.4	Blue **protein label** with high molar absorbance. Ref.: B. Oswald et al., Photochem. Photobiol. 74 (2001) 237. DOI: 10.1562/0031-8655(2001)074<0237:NDLCFA>2.0.CO.2.	
UR-628-c-CRB	Abs: 628 nm (log ε 5.22); Em: 641 nm; QY up to 0.3 on protein	Blue thio-squarylium dye. Potentially useful for preparing blue **nanoparticles**. Synthesis described in B. Wetzl et al., *J. Chrom. B* 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0.	
UR-628-n-NHS	Abs: 628 nm (log ε 5.22); Em: 641 nm; QY up to 0.3 on protein	The NHS ester is a blue label for **proteins and amines**. Ref.: B. Wetzl et al., *J. Chromatogr. B* 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0.	Same formula as above but –CO-O-NHS in place of –COOH
UR-631-r-CRB	Abs: 631 nm (log ε 5.23); Em: 643 nm; QY up to 0.2 on protein	Blue dithio-squarylium dye. Potentially useful for preparing blue **nanoparticles**. B. Wetzl et al., *J. Chrom. B* 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0.	
UR-631-w-NHS	Abs: 631 nm (log ε 5.23); Em: 643 nm; QY up to 0.2 on protein	Blue **protein** label. Ref.: *B. Wetzl et al., J. Chrom. B* 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0.	Same formula as above but –CO-O-NHS in place of –COOH
UR-632-q-CRB	Abs: 631 nm (log ε 5.36); Em: 645 nm; QY up to 0.4 on protein	Imino squarylium dye; large ε. Potentially useful for preparing blue **nanoparticles**. Ref.: B. Wetzl et al., *J. Chrom. B* 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0.	

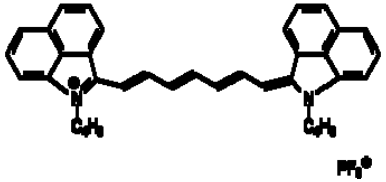
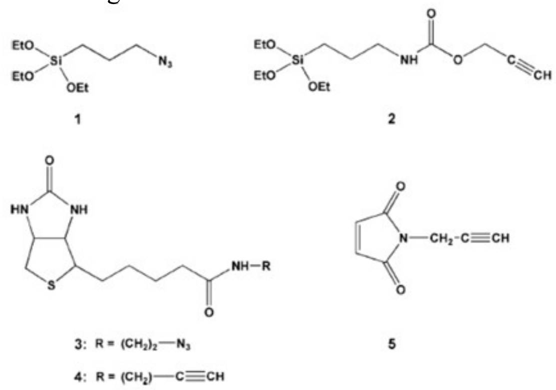
UR-632-h-NHS	Abs: 631 nm (lg ε 5.36); Em: 645 nm; QY up to 0.4 on protein	The NHS ester is a label for **proteins** and amines. Ref.: B. Wetzl et al., *J. Chrom. B* 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0.	Same formula as above but –CO-O-NHS in place of –COOH
UR-633-s-MAL	Abs: 633 nm (log ε 4.17) and 597 nm (log ε 4.2); Em: 653 nm; QY 0.015 before conj. to thiol.	Thiol label with long spacer arm; QY increases strongly on conjugation to a thiol. Ref.: P. Kele et al.; *Org. Biomol. Chem.*, 2009; DOI: 10.1039/b907741c	 7
UR-635-u-CRB	Abs: 635 nm (log ε 5.21); Em: 644 nm in water. τ ~2 ns in water.	A water soluble blue squaraine dye. Potentially useful for preparing blue **nanoparticles**. Compatible with the 633-nm laser. Binds to HSA by electrostatic interaction. The NHS ester is listed below as UR-635-e-NHS. *Ref.*: B. Oswald et al.; *Bioconj. Chem.* 10 (1999) 925. DOI: 10.1021/bc9801023.	
UR-635-e-NHS	Abs: 635 nm (log ε 5.21); Em: 676 nm if conj. to protein. QY 0.4 – 0.5 if conj. to protein. τ ~2 ns in water.	Blue squaraine-type of **protein** label. *Ref.*: B. Oswald et al.; *Bioconj. Chem.* 10 (1999) 925. DOI: 10.1021/bc9801023.	Same formula as above but –CO-O-NHS in place of –COOH
UR-641-k-NHS	Abs: 641 nm (MeOH); Em: 663 nm; QY: 0.23 in MeOH but lower in water; high ε.	A.k.a. FEW's S-0223 (www.few.de). The NHS ester of this cyanine dye is a blue **protein** label with red fluorescence..	
UR-642-j-CRB	Abs: 642 nm (log ε 5.26); Em: 663 nm; QY up to 0.5 on electrostatic binding to a protein	Deep blue cyanine dye. Potentially useful for preparing blue **nanoparticles** with red fluorescence. Synthesis described by Gruber et al., *J. Fluoresc.* 15 (2005) 207. DOI: 10.1007/s10895-005-2619-y. Used as a label for an oligonucleotide and as an acceptor in a fluorescence resonance energy transfer hybridization assay for a 15-meric oligo. *Ref.*: M. Gruber et al.; *J. Fluoresc.* 15 (2005) 207. DOI: 10.1007/s10895-005-2619-y.	
UR-642-z-NHS	Abs: 642 nm (log ε 5.26); Em: 663 nm; QY up to 0.6 if conjugated to a protein.	The NHS ester is a label for **proteins and amino-modified oligonucleotides.** A.k.a. Chromeo 642 (Chromeon) and as FR-642 (Sigma). *Ref.*: Gruber et al.; *J. Fluoresc.* 15 (2005) 207. DOI: 10.1007/s10895-005-2619-y. (a) Used as a label: B. Wetzl et al., *J. Chromatogr. B* 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0. (b) Used, as a single- and dual-NIR fluorescent labeled nucleic acid conjugate, for nucleic acid detection. Z. Lin et al., Proc. SPIE 4414 (2001) 111-114. DOI: 10.1117/12.440165	**UR-642-a-NHS** has the same formula as above but –CO-O-NHS in place of –COOH

UR-643-d-CRB	Abs: 641 nm (log ε 4.86); Em: 666 nm;	Blue di-aryl squarylium dye with red fluorescence. Potentially useful for preparing blue **nanoparticles**. Synthesis described by Gruber et al.; *J. Fluoresc.* 15 (2005) 207. DOI: 10.1007/s10895-005-2619-y.	
UR-643-k-NHS	Abs: 641 nm (log ε 4.86); Em: 666 nm; QY up to 0.52 on protein	This NHS ester (of 643-d) is a label for **proteins and amino-modified oligos**. Ref.: Gruber et al.; *J. Fluoresc.* 15 (2005) 207. DOI: 10.1007/s10895-005-2619-y.	Same formula as above but –CO-O-NHS in place of –COOH
UR-644-l-CRB	Abs: 644 nm (MeOH); Em: 666 nm; QY: 0.29 in MeOH but lower in water; high ε.	Blue dye. Same as FEW's dye S-0436 (formula given). Was used to dye **silica nanoparticles** and to make them fluorescent. Ref.: S. M. Saleh et al., *Microchim Acta* (2011), 174, 429. DOI: 10.1007/s00604-011-0627-y.	
UR-644-l-NHS	Abs: 644 nm (MeOH); Em: 666 nm; QY: 0.29 in MeOH but lower in water. High ε.	Derived from UR-644-CRB (above). The NHS ester is a blue **label for amines and proteins.**	Same formula as above but –CO-O-NHS in place of –COOH
UR-644-y-PYR	Abs: 644 nm (log ε 4.7) before conj. to amine; Abs: 465 nm (log ε 4.3) after conj.; Em: 732 nm before conj.; 629 nm after conj.	**Chameleon label** a.k.a. Py-5 (n = 2) for **proteins** and amino groups on biomolecules or surfaces. The label is blue and has a poor QY before conjugation but becomes orange-red with yellow fluorescence after conjugation. Much higher QY (0.1 – 0.2) after conj.. Decay time τ is >0.5 ns before conj.; 2.3 ns after conj. *Ref.*: B. Wetzl et al.; *Angew. Chem. Intl. Ed.* 43 (2004) 5400. DOI: 10.1002/anie.200460508. Reacts with primary amino groups only and does not change the charge of the labeled protein at physiological pH values.	
UR-645-w-CLO	Abs: 645 nm (MeOH); Em: 661 nm (MeOH); QY 0.09 in MeOH but 0.50 in toluene	Amino-reactive chlorocyanine label for **proteins**. Same as FEW S-2053 (www.few.de). Soluble in MeOH; insoluble in water; used to label **nanoparticles** carrying surface amino groups. Used to dye **silica nanoparticles** and to make them fluorescent: S. M. Saleh et al., *Microchim Acta* 174 (2011) 429. DOI: 10.1007/s00604-011-0627-y.	
UR-646-x-NHS	Abs: 646 nm (log ε 5.26); Em: 666 nm; QY 0.2 if conj. to HSA. τ 1.6 ns.	Deep blue **protein** label. A.k.a. RB-646 (Sigma); undergoes slight longwave shift on conjugation: B. Oswald et al., *Photochem. Photobiol.* 74 (2001) 237. DOI: 10.1562/0031-8655(2001)074<0237:NDLCFA>2.0.CO.2.	
UR-648-n-NHS	Abs: 648 nm (log ε 4.86); Em: 670 nm; QY moderate	Blue phenoxazine label for **proteins** and amines. Also referred to as BOx label. *Ref.*: M. Link et al., *Bioorg. Med. Chem. Lett.* 21 (2011) 5538. DOI: 10.1016/j.bmcl.2011.06.133. Also see UR-589-n (the purple-colored equivalent to this label).	

UR-649-d-NNN	Abs: 649 nm (log ε 4.72); Em: 669 nm; QY ~0.01 in water	Blue azido-type of click label. Can be linked to **proteins** modified with alkyne groups (-C≡CH). Ref.: M. Link et al., *Eur. J. Org. Chem.* (2010), 6922. DOI: 10.1002/ejoc.201001085.	
UR-650-j-MAL	Abs: 650 nm (log ε 4.76); Em: 668 nm; QY 0.01 in water but 0.03 in MeOH	Blue-green maleinimide-type of **protein thiol label** with spacer group. Ref.: M. Link et al., *Eur. J. Org. Chem.* (2010), 6922. DOI: 10.1002/ejoc.201001085.	
UR-651-u-CCH	Abs: 651 nm (log ε 4.86); Em: 673 nm	Blue-green alkyne click label. Can be linked to **proteins modified with azido** groups (-N_3). Ref.: P. Kele et al.; *Org. Biomol. Chem.*, 2009; DOI: 10.1039/b907741c	
UR-655-e-ALB	Abs: 655 nm; log ε 5.2 (in iPrOH). Em: 648 nm. When bound to HSA, the abs/em maxima are shifted to 669/687 nm.	Deep-blue anionic dye for non-covalent labeling of HSA and other albumins. Binding (with binding constant of 1.8 · 107 M-1) occurs mainly via electrostatic interaction. Dye can be released from albumin by addition of anions of fatty acids. *Refs*.: (a) Synthesis and spectra: M. A. Kessler, O.S. Wolfbeis; *Anal. Biochem.* 200 (1992) 254. DOI: 10.1016/0003-2697(92)90462-G . In this paper, the dye is referred to as AB-670 because it is compatible with the 670-nm diode laser. (b) Used to quantify HSA in urine: M. A. Kessler et al., *Clin. Chem.* 38 (1992) 2089. DOI: 10.1093/clinchem/38.10.2089 (dye "AB-670").	
UR-661-v-NHS	Abs: 661 nm (log ε 5.20); Em: 680 nm; QY 0.05; much higher if conj. to HSA; τ 1.4 ns.	Dark-blue squarylium **label for antibodies.** Undergoes slight longwave shift on conjugation. Ref.: B. Oswald et al., *Photochem. Photobiol.* 74 (2001) 237. DOI: 10.1562/0031-8655(2001)074<0237:NDLCFA>2.0.CO.2. Also used as an acceptor label in a FRET immunoassay along with UR-635-n: B. Oswald et al., *Anal. Biochem.* 280 (2000) 272. DOI: 10.1006/abio.2000.4553.	
UR-662-c-CRB	Abs: 662 nm (log ε 5.22); Em: 682 nm	Blue-green dicyanomethylene squarylium dye. Potentially useful for preparing blue-green **nanoparticles** with deep red fluorescence. Synthesis: Gruber et al.*; J. Fluoresc.* 15 (2005) 207. DOI: 10.1007/s10895-005-2619-y. Used as a protein label: B. Wetzl et al., *J. Chromatog. B* 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0.	
UR-662-n-NHS	Abs: 662 nm (log ε 5.22); Em: 671 nm; QY up to 0.2 on protein	A deeply colored label for **proteins** and amines. It is the NHS ester of UR-652-c. Ref.: Gruber et al.; *J. Fluoresc.* 15 (2005) 207. DOI: 10.1007/s10895-005-2619-y.	Same formula as above but –CO-O-NHS in place of –COOH
UR-663-i-NNN	Abs: 663 nm (log ε 5.0 in MeOH); Em: 718 nm	Azido **click label**; R = -$(CH_2)_2$-N_3. Can be linked to **proteins** modified with alkyne groups (-CH_2-C≡CH). Ref.: P. Kele et al.; *Org. Biomol. Chem.* (2009) 7, 3486. DOI: 10.1039/ b907741c	

UR-664-o-CCH	Abs: 664 nm (log ε 5.0 in MeOH); Em: 718 nm	Alkyne **click label**; R = -CH_2-C≡CH. Can be linked to **proteins** and other molecules modified with azido groups (-N_3). Ref.: P. Kele et al.; *Org. Biomol. Chem.* (2009) 7, 3486. DOI: 10.1039/ b907741c	
UR-667-s-NHS	Abs: 667 nm (log ε 5.20); Em: 685 nm; QY 0.04; much higher if conj. to HSA.	Blue-green **protein label**. *Ref.*: B. Oswald et al., *Photochem. Photobiol.* 74 (2001) 237. DOI: 10.1562/0031-8655(2001)074<0237:NDLCFA>2.0.CO.2. Also binds to HSA by electrostatic interaction.	
UR-683-j-CLO	Abs: 683 nm (in MeOH); Em: 670 nm (MeOH); QY 0.10 in MeOH but 0.51 in toluene	Amino-reactive chlorocyanine **label** of the chameleon type (undergoing a strong color change on conjugation to amino-modified particles and to proteins). A.k.a. FEW S-2086 (www.few.de). Soluble in MeOH; insoluble in water; used to label nanoparticles carrying amino groups. Ref.: H. H. Gorris et al.; *Bioconj. Chem.* (2011), 22, 1433. DOI: 10.1021/bc200192k.	
UR-678-h-CRB	Abs: 644 nm (MeOH); Em: 666 nm; QY: 0.29 in MeOH but lower in water; log ε >5.3	Blue-green dye with red fluorescence. A.k.a. FEW's S-0247 (www.few.de). Potentially suitable for dying **nanoparticles**.	
UR-678-m-NHS	Abs: 644 nm (MeOH); Em: 666 nm; QY: 0.29 in MeOH but lower in water; log ε > 5.3.	This is the NHS ester of UR-678-h. It is a **label for amines and proteins.** Moderately soluble in water or buffer.	Same formula as above but –CO-O-NHS in place of –COOH
UR-701-c-CRB	Abs: 701 nm (log ε 5.32); Em: 718 nm.	Very longwave green dye. Potentially useful for preparing green **nanoparticles** with deep red fluorescence. Synthesis described by B. Wetzl et al.; *J. Chromatogr., part B*, 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0. (Paper gives 710 nm as the absorption maximum).	
UR-701-n-NHS	Abs: 701 nm (log ε 5.32); Em: 718 nm. QY increases to up to 0.3 on conjugation to a protein.	This NHS ester is a label for proteins and amines. Ref. B. Wetzl et al.; *J. Chromatogr., part B,* 793 (2003) 83. DOI: 10.1016/S15170-0232(03)00366-0. (Paper gives 710 nm as the absorption maximum).	Same formula as above but –CO-O-NHS in place of –COOH
UR-702-u-NHS	Abs: 702 nm (log ε 5.16); Em: 718 nm; QY poor (0.005) but much higher if conj. to HSA.	Green **protein label.** With deeep-red fluorescence. A.k.a. RG-702 (Sigma). *Ref.*: B. Oswald et al., *Photochem. Photobiol.* 74 (2001) 237. DOI: 10.1562/0031-8655(2001)074<0237:NDLCFA>2.0.CO.2.	

UR-747-c-DOP	Abs: 747 nm (MeOH); Em: 774 nm (MeOH)	Non-reactive dopant for making green micro- and nanoparticles with red fluorescence. Well soluble in many polymers. A.k.a. FEW S-2137 (www.few.de). Soluble in MeOH and toluene; insoluble in water. Was used to fluorescently dope silica nanoparticles: S. M. Saleh et al., *Microchim Acta*, 174 (2011) 429. DOI: 10.1007/s00604-011-0627-y.	
UR-781-e-CLO	Abs: 781 nm (log ε 5.4) before conj. to amine; 621 nm (log ε ca 5.29) after conj. to amine; Em: not detectable before conj.; 736 nm after conj.	**Protein label**. Amino-reactive chlorocyanine chameleon dye. A.k.a. FEW S-0749. On reaction with an amino group, its color changes from green to blue: H. H. Gorris et al., *Bioconj. Chem.* 22 (2011) 1433. DOI: 10.1021/bc200192k. Suited for labeling particles carrying amino groups (in MeOH solution). Insoluble in water; ref.: H. Mader et al.; Ann. NY Acad. Sci. 1130 (2008) 218.	
UR-783-a-CLO	Abs: 783 nm (log ε 5.4) in MeOH before conj. to amine; Abs: 617 nm (log ε ca 5.27) in water after conj. to amine; Em: not detectable before conj.; 663 nm after conj.	**Protein label**. Amino-reactive chlorocyanine label of the chameleon type; a.k.a. FEW S-0121. See www.few.de. On reaction with an amino group, its color changes from green to blue: H. H. Gorris et al., *Bioconj. Chem.* 22 (2011) 1433. DOI: 10.1021/bc200192k. Good protein label (in buffer of pH 8). Soluble in DMF, MeOH; less soluble in water; also suited for labeling particles carrying amino groups (in MeOH).	
UR-791-u-CLO	Abs: 791 nm (MeOH); Em: 805 nm (MeOH); log ε > 5.3. Spectra distinctly shortwave-shifted after conj. to protein	**Protein label**. Amino-reactive chlorocyanine label of the chameleon type; a.k.a. FEW S-2168 (www.few.de). On reaction of the centrral chloro atom with an amino group, its color changes from green to blue. Soluble in DMF and MeOH; less so in water. Ref.: H. H. Gorris et al., *Bioconj. Chem.* 22 (2011) 1433. DOI: 10.1021/bc200192k. Potentially useful for preparing deep-green polystyrene nanoparticles with NIR fluorescence.	
UR-800-i-CLO **(NIR emitter)**	Abs: 800 nm (log ε 5.37) but 806 nm in MeOH; before conj. to amine; Abs: 663 nm (log ε ca 5.25) in water after conj. to amine; Em: not detectable before conj.; Em: 710 nm after conj.	Best chlorocyanine type of NIR chameleon **label for proteins**. A.k.a. FEW S-0378 (www.few.de). Changes color from deep green to blue on conjugation. Soluble in DMF, MeOH and – less so – in water. *Ref.*: H. H. Gorris et al., *Bioconj. Chem.* 22 (2011) 1433. DOI: 10.1021/bc200192k. Also used to label silica and polystyrene nanoparticles: *Ref.*: (a) S. M. Saleh et al.; *Microchim Acta* (2011), 174, 429. DOI: 10.1007/s00604-011-0627-y. (b) H. Mader et al.; *Ann. NY Acad. Sci.* 1130 (2008) 218. DOI: 10.1196/annals.1430.053.	
UR-820-o-CLO **(NIR emitter)**	Abs: 820 nm (log ε 5.41) in MeOH before conj. to amine, but 657 nm (log ε ca 5.30) in water after conj. to amine; Em: not detectable before conj.; at 785 nm after conj. to amine	Very longwave chameleon type **protein label**; works in buffer of pH 8; chlorocyanine dye; a.k.a. FEW S-0306 (Na salt) or S-2161 (TEA salt). *Ref.*: S. M. Saleh et al.; *Microchim Acta* 174 (2011) 429. DOI: 10.1007/s00604-011-0627-y. Soluble in DMF, MeOH and – less so – in water. Spectra strongly depend on concentration of dye (tends to aggregate). Potentially useful for preparing green nanoparticles with NIR fluorescence. Also used to label silica and polystyrene nanoparticles: *Ref.*: (a) S. M. Saleh et al.; *Microchim Acta* (2011) 174, 429. DOI: 10.1007/s00604-011-0627-y. (b) H. Mader et al.; *Ann. NY Acad. Sci.* 1130 (2008) 218. DOI: 10.1196/annals.1430.053.	

UR-973-y-DOP **(NIR)**	Abs: 973 nm (MeOH); Em: unknown (very longwave)	Non-reactive and very longwave black dye. A.k.a. as FEW dye S-2058. Soluble in MeOH and toluene; insoluble in water. Used to fluorescently dope silica **nanoparticles** to obtain particles with near-IR fluorescence. See: www.few.de	
UR-980-b-NHS	Abs: 980 nm (water); Em: 465/645/695 nm. τ: up to 80 µs.	**Proteit label.** Blue emitting **upconversion nanoparticles** (NaYF4 doped with Yb/Tm) for protein conjugation. S. Wilhelm et al., *Theranostics* 3 (2013) 239. DOI: 10.7150/thno.5113. The NPs display predominantly blue emission (465 nm), but also weaker red emission (peaking at 645 and 695 nm. Have been conjugated to streptavidin-modified magnetic beads.	Lanthanide-doped hexagonal-phase NaYF4 upconversion nanoparticles with silica shell, poly(ethylene glycol), and carrying NHS groups on their surface.
UR-980-g-NHS **(NIR emitter)**	Abs: 980 nm (water); Em: 540/655 nm. τ: up to 80 µs.	**Protein label.** Green emitting **upconversion nanoparticles** (NaYF4 doped with Yb/Er) for protein conjugation. S. Wilhelm et al., *Theranostics* 3 (2013) 239. DOI: 10.7150/thno.5113. The NPs predominantly have green emission (540 nm) but also weaker red emission (655 nm). Have been conjugated to streptavidin-modified magnetic beads.	Lanthanide-doped hexagonal-phase NaYF4 upconversion nanoparticles with silica shell, poly(ethylene glycol), and carrying NHS groups on their surface.
UR-980-m-UCNP-MAL	Abs: 980 nm (water); Em: 520/540/655 nm. τ: up to 80 µs.	**Nanoparticles for protein labeling.** Green-emitting maleimide label. Also displays weaker red luminscence. *Ref*:: R. B. Liebherr et al., *Nanotechnol*. 23 (2012) 485103 (7 pp). DOI: 10.1088/0957-4484/23/48/485103.	Consist of oleic acid-coated upconversion nanoparticles with an NaYF4:Yb;Er core and a NaYF4 shell. Surface carries maleinimido groups.
UR-980-w-UCNP-MAL **(NIR)**	Abs.: 980 nm (water); multiple emission colors (blue, green, yellow, deep-red, NIR) depending on dopant of UCNP.	**Maleinimide-modified upconversion microparticles and** nanoparticles for labelling thiols. H. S. Mader et al.; *Chem.- Eur. J.* 16 (2010) 5416. DOI: 10.1002/chem.201000117.	Reagents used for surface modification: 
UR-980-y-UCNP-BTN **(NIR)**	Abs.: 980 nm (water); multiple emission colors (blue, green, yellow, deep-red, NIR) depending on dopant of UCNP.	**Maleinimide-modified upconversion microparticles and nanoparticles** for labelling thiols. H. S. Mader et al.; *Chem.- Eur. J.* 16 (2010) 5416. DOI: 10.1002/chem.201000117.	

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