Introduction
Session 7

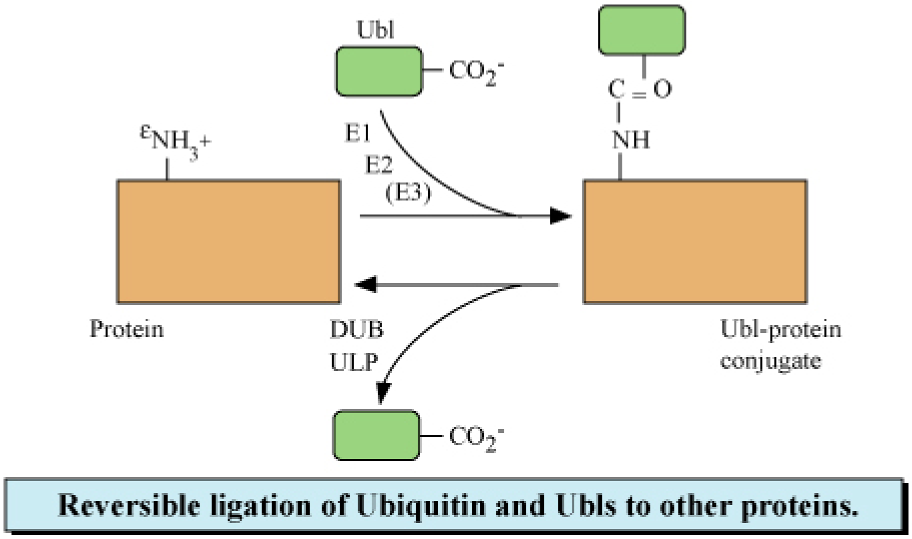

Figure by MIT OCW.
After Figure 1 in Hochstrasser M. Evolution and function of ubiquitin-like protein-conjugation systems. Nat Cell Biol. 2000 Aug; 2 (8): E153-7

UBL	Variants	Function	Known Substrates
Ubiquitin	Mono	Endocytosis/lysosomal degradation, meiosis, chromatin remodeling	Histones, ion channels, receptors
	Poly (Lys29)	26S proteasomal degradation?	UFD substrates
	Poly (Lys48)	26S proteasomal degradation	Many short lived proteins, mis-folded proteins
	Poly (Lys63)	Post-replicative DNA repair, translation, endocytosis	L28 ribosomal protein, TRAF6, PCNA, plasma membrane proteins
ISG15 (UCRP)		Immune response	Serpin 2a, Stat1, ERK1, others
AUT7 (APG8)	GATE16 (Golgi-associated ATPase Enhancer of 16 kDa), LC3 (microtubule-associated protein 1 light chain 3), GABARAP	Autophagy, cytoplasm-to-vacuole targeting, vesicular transport	Phosphatidylethanolamine
APG12		Autophagy, cytoplasm-to-vacuole targeting	APG5
NEDD8 (RUB 1)		Auxin response, meiosis-to-mitosis transition	Cullins
SUM01 (SMT3)	SUMO2, 3	Nuclear transport, chromosome segregation, transcriptional regulation	Many
HUB1		Cell polarity	Sph1, Hbt1
FAT10		Apoptosis	Unknown
URM1 (Ubiquitin Related Modifier 1)		Growth at high temperature	Unknown
MNSF		T-cell activation	TCRα-like protein

Fgiure by MIT OCW.

After Table 1 in Schwartz and Hochstrasser, TIBS 28 (2003) 321-328.

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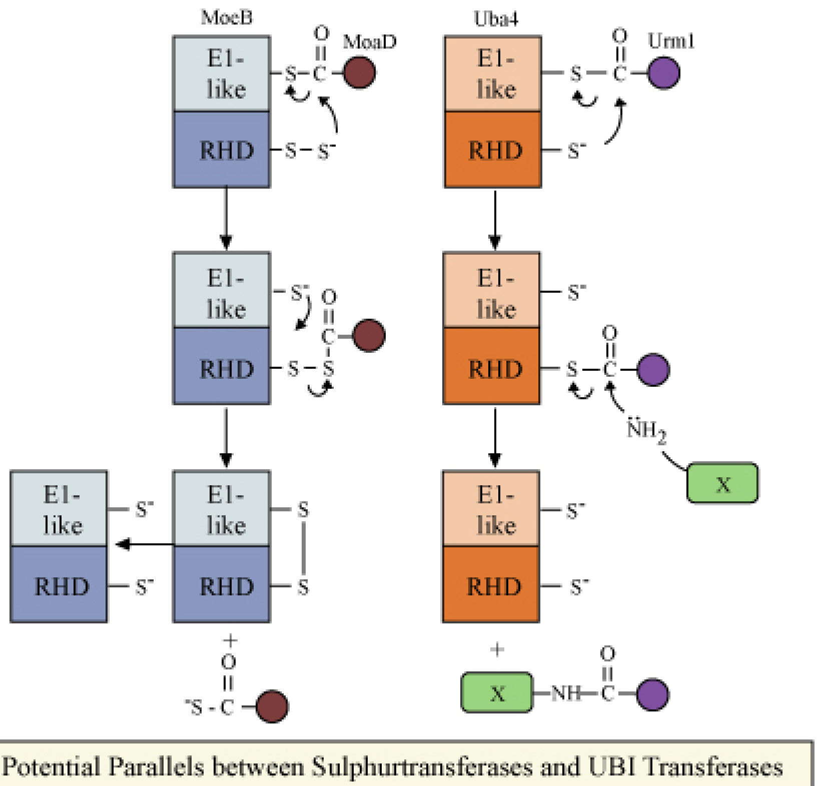
See Figure 2 in Hochstrasser M. Evolution and function of ubiquitin-like protein-conjugation systems. Nat Cell Biol. 2000 Aug; 2 (8): E153-7.



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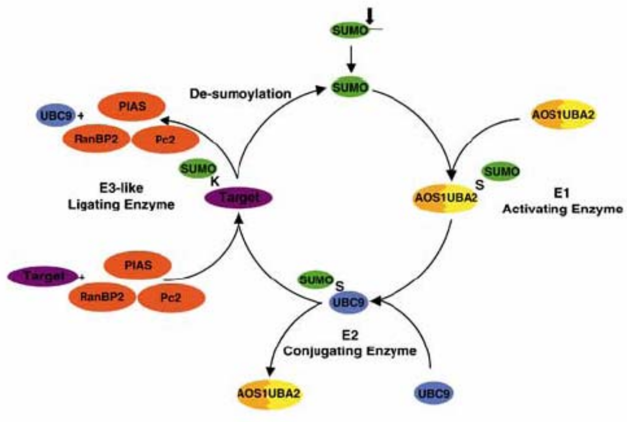
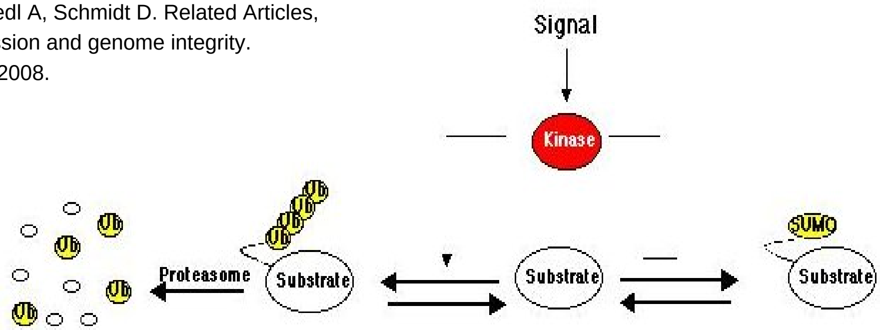


Figure 1 Pathway of SUMO conjugation/deconjugation. SUMO is synthesized as a precursor and C-terminally processed (arrowhead). The conjugation involves SUMO activating E1 enzyme (AOS1/UBA2) and an E2 conjugating enzyme (Ubc9) that form thioesters (S) with the modifier. E3-like factors stimulate the attachment to specific lysine residues within a target protein. The cleavage of SUMO from its target proteins is catalysed by the SUSP/SENP isopeptidase family

Source Figures 1 / Figure 2, Muller S, Ledl A, Schmidt D. Related Articles, Links SUMO: a regulator of gene expression and genome integrity. Oncogene. 2004 Mar 15; 23 (11): 1998-2008.



Source: Figure 2 in Andreas Gast, Andrea Pichler, Sowmya Swaminathan and Frauke Melchior. SUMO shifts to new functions. In The ELSO Gazette: e-magazine of the European Life Scientist Organization (http://www.the-elso-gazette.org/magazines/issue1/mreviews/mreviews6.asp), Issue 1 (1 September, 2000)

SUMO antagonizing **Ubiquitin** and substrate phosphorylation favoring ubiquitination over sumoylation.

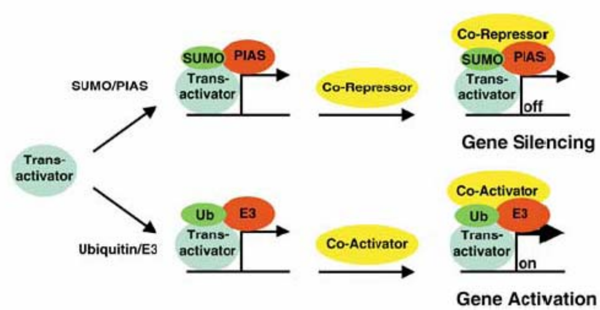


Figure 2 A model for the interplay of the SUMO and ubiquitin system in transcriptional regulation. PIAS-triggered SUMOylation of a transcription factor within a repressor domain induces the recruitment of a transcriptional corepressor leading to gene silencing. Ubiquitination of a transcription factor and/or binding of a ubiquitin E3-ligase within a transactivation domain can facilitate binding of a coactivator leading to gene activation

Source Figures 1 / Figure 2, Muller S, Ledl A, Schmidt D. Related Articles, Links SUMO: a regulator of gene expression and genome integrity.Oncogene. 2004 Mar 15; 23 (11): 1998-2008.