

LC-MS/MS Identification of the O-Glycosylation
and Hydroxylation of Amino Acid Residues
of Collagen α -1 (II) chain from
Bovine Cartilage

*Ehwang Song, and Yehia Mechref**

Department of Chemistry and Biochemistry, Texas Tech University,
Lubbock, TX

*Corresponding author

Email: yehia.mechref@ttu.edu

Tel: 806-742-3059

Fax: 806-742-1289

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Bovine	QMAGGFDEK AGGAQMGVMQ GPMGPMGPRG PPG ^P PAGA ^P PGP QGFOGN ^P PGEP ^P GEP ^P PGVSGPMG	240
Human	QMAGGFDEK AGGAQLGVMQ GPMGPMGPRG PPGPAGAPGP QGFOGNPGEP GEPGVSGPMG	
Bovine	PRG ^{PP} PPG ^{PP} PGK ^P PGDDGEAGK ^P PK ^P GKSGERG ^P PPG ^P PQGARGF ^P PGT ^P PGL ^P PGV ^K KGHR ^K GYPGLDGAK ^K G	300
Human	PRGPPGPPGK PGDDGEAGKP GKAGERGPPG PQGARGFPGT PGLPGVKGHR GYPGLDGAKG	
Bovine	EAGAPGV ^K KGE ^K SGS ^P PGEDGS ^P PK ^N GPMGPRGL ^P PG ^P ERGRTGPAGA AGARG ^N DDGQ ^P GPAGP ^P PG ^P PVG	360
Human	EAGAPGVKGE SGSPGENGSP GPMGPRGLPG ERGRTGPAGA AGARGNDGQP GPAGPPGPVVG	
Bovine	PAGG ^P PGF ^P PGA ^P PGAK ^K GEAGPT GARGPEGAQ ^K PRGE ^P PGT ^P PGS ^P PGPAGAAGNP ^K GTDGI ^K PGAK ^K G	420
Human	PAGGPGFPGA PGAKGEAGPT GARGPEGAQ PRGEPGT PGS PGPAGASNP GTDGI PGAKG	
Bovine	SAGAPGIAGA PGF ^{PP} PGPRG ^{PP} GPQGATGPLG PK ^K QOTGE ^P PGI ^P AGF ^K KGE ^K QGP ^K GEP ^K PGPAGPQG	480
Human	SAGAPGIAGA PGFPGPRGPP GPQGATGPLG PKQOTGEPGI AGFKGEQGP GEPGPAGPQG	
Bovine	APGPAGEEGK RGARGE ^P PGGA ^P GPAG ^P PPGERG ^N APGDRGF ^P PGQ ^K DGLAGP ^K KGAP ^P GERG ^P PSGLAG	540
Human	APGPAGEEGK RGARGEPPGV GPIGPPGERG APGNRGFPGQ DGLAGPKGAP GERGPSGLAG	
Bovine	PK ^K GADGD ^P PR ^N PGE ^P PGL ^P PGAR ^P GLTGR ^P PGDAG ^K PQKVGPSGA ^P PGEDGR ^P PG ^P PP ^P GPQGARGQ ^P PG	600
Human	PKGANGDPPR PGEPPGPPGAR GLTGRPPDAG PQKVGPSGA PGEDGRPPPG GPQGARGQPG	
Bovine	VMGF ^K PG ^K PKGA ^K DGE ^N PGKAGE ^P K ^K GLPGAP ^P GLRG ^P LPGKDGETGA AGP ^P PG ^P PAG ^P PA GERGEQ ^P GAPG	660
Human	VMGFPPGPKGA NGEPPKAGEK GLPPGAPGLRG LPGKDGETGA AGPPGPAGPA GERGEQGAPG	
Bovine	PSGFQGLPGP ^P PG ^P PPGEGGK ^P GDQGV ^P PGEAG ^P APGLVGPRGE ^P RGFP ^P GERGSP ^P GSQGLQ ^P GARG	720
Human	PSGFQGLPPG PGPPEGGGKP GDQGVPPGEAG APGLVGPRGE RGFPGERGSP GAQGLQGPRG	

Bovine	<u>LPGT</u> ^P <u>PGTDGP</u> <u>KGAAGPAG</u> ^P <u>PP</u> <u>GAQG</u> ^P <u>PPGLQG</u> <u>MPGERGAAGI</u> <u>AGP</u> ^P <u>KGDRGDV</u> <u>GEKGPEGA</u> ^P <u>PG</u>	780
Human	<u>LPGT</u> <u>PGTDGP</u> <u>KGASGPAGPP</u> <u>GAQGPPGLQG</u> <u>MPGERGAAGI</u> <u>AGPKGDRGDV</u> <u>GEKGPEGA</u> ^P <u>PG</u>	
Bovine	<u>KDGG</u> <u>RGLTGP</u> <u>IGP</u> ^P <u>PPAGAD</u> <u>GE</u> ^P <u>KGEVGP</u> ^P <u>PG</u> <u>PAGTAGARGA</u> <u>PPERGETG</u> ^P <u>PP</u> <u>GPAGFAG</u> ^P <u>PPG</u>	840
Human	<u>KDGG</u> <u>RGLTGP</u> <u>IGPPGPAGAN</u> <u>GE</u> ^K <u>KGEVGP</u> ^P <u>PG</u> <u>PAGSAGARGA</u> <u>PPERGETG</u> ^P <u>PP</u> <u>GPAGFAG</u> ^P <u>PPG</u>	
Bovine	<u>ADGQ</u> ^P <u>PGA</u> ^P <u>KGE</u> <u>QGEAGQ</u> ^P <u>KGDA</u> <u>GAP</u> ^P <u>GPQG</u> ^P <u>PSG</u> <u>AP</u> ^P <u>GPQG</u> ^P <u>P</u> <u>TGV</u> <u>TGP</u> ^P <u>KGARGAQ</u> <u>GP</u> ^P <u>PGATGF</u> ^P <u>PPG</u>	900
Human	<u>ADGQ</u> ^P <u>PGA</u> ^P <u>KGE</u> <u>QGEAGQ</u> ^P <u>KGDA</u> <u>GAP</u> ^P <u>GPQG</u> ^P <u>PSG</u> <u>AP</u> ^P <u>GPQG</u> ^P <u>P</u> <u>TGV</u> <u>TGP</u> ^P <u>KGARGAQ</u> <u>GP</u> ^P <u>PGATGF</u> ^P <u>PPG</u>	
Bovine	<u>AAGR</u> <u>VGP</u> ^P <u>PPGS</u> <u>DGD</u> ^N <u>PP</u> ^N <u>PPGPP</u> <u>GPSG</u> <u>KDGP</u> ^P <u>KG</u> <u>ARGDSG</u> ^P <u>PPGR</u> <u>AGD</u> ^P <u>PG</u> ^P <u>LQ</u> ^P <u>GPA</u> <u>GP</u> ^P <u>PGE</u> ^P <u>KG</u> ^P <u>EP</u> ^P <u>PG</u>	960
Human	<u>AAGR</u> <u>VGP</u> ^P <u>PPGS</u> <u>NGN</u> ^P <u>PP</u> ^P <u>PPGPP</u> <u>GPSG</u> <u>KDGP</u> ^P <u>KG</u> <u>ARGDSG</u> ^P <u>PPGR</u> <u>AGE</u> ^P <u>PG</u> ^P <u>LQ</u> ^P <u>GPA</u> <u>GP</u> ^P <u>PGE</u> ^P <u>KG</u> ^P <u>EP</u> ^P <u>PG</u>	
Bovine	<u>DDG</u> <u>PSG</u> <u>PDGP</u> <u>PG</u> ^P <u>POGLAGQR</u> <u>GIVGL</u> ^P <u>PG</u> ^P <u>QRG</u> <u>ERGF</u> ^P <u>PGL</u> ^P <u>P</u> <u>G</u> <u>SGE</u> ^P <u>PG</u> ^P <u>KQ</u> ^P <u>GAP</u> <u>GASGDRG</u> ^P <u>PPG</u>	1020
Human	<u>DDG</u> <u>PSGA</u> <u>EGP</u> <u>PG</u> ^P <u>POGLAGQR</u> <u>GIVGL</u> ^P <u>PG</u> ^P <u>QRG</u> <u>ERGF</u> ^P <u>PGL</u> ^P <u>P</u> <u>G</u> <u>SGE</u> ^P <u>PG</u> ^P <u>KQ</u> ^P <u>GAP</u> <u>GASGDRG</u> ^P <u>PPG</u>	
Bovine	<u>PV</u> <u>GP</u> ^P <u>PGLTGP</u> <u>AGE</u> ^P <u>PG</u> ^P <u>REGSP</u> <u>GAD</u> <u>GP</u> ^P <u>PRDG</u> <u>AAGV</u> ^P <u>KG</u> ^P <u>DRGE</u> <u>TGAVGAP</u> ^P <u>GP</u> ^P <u>AP</u> <u>G</u> ^P <u>PP</u> ^P <u>GS</u> ^P <u>PP</u> <u>PAG</u>	1080
Human	<u>PV</u> <u>GP</u> ^P <u>PGLTGP</u> <u>AGE</u> ^P <u>PG</u> ^P <u>REGSP</u> <u>GAD</u> <u>GP</u> ^P <u>PRDG</u> <u>AAGV</u> ^P <u>KG</u> ^P <u>DRGE</u> <u>TGAVGAP</u> ^P <u>GP</u> ^P <u>AP</u> <u>G</u> ^P <u>PP</u> ^P <u>GS</u> ^P <u>PP</u> <u>PAG</u>	
Bovine	<u>PIG</u> <u>KQ</u> <u>DRGE</u> <u>AGA</u> <u>Q</u> ^P <u>PM</u> ^P <u>GPA</u> <u>GP</u> ^P <u>PAGARGMPG</u> <u>POG</u> ^P <u>PRGD</u> ^P <u>KGE</u> <u>TGEAGERGLK</u> <u>GHR</u> <u>G</u> ^P <u>FTGLQ</u>	1140
Human	<u>PTG</u> <u>KQ</u> <u>DRGE</u> <u>AGA</u> <u>Q</u> ^P <u>PM</u> ^P <u>GPS</u> <u>GP</u> ^P <u>PAGARGIQG</u> <u>POG</u> ^P <u>PRGD</u> ^P <u>KGE</u> <u>AGE</u> ^P <u>PERGLK</u> <u>GHR</u> <u>G</u> ^P <u>FTGLQ</u>	
Bovine	<u>LP</u> <u>GP</u> ^P <u>PP</u> ^P <u>GPSGD</u> <u>QGASGPAGPS</u> <u>GPR</u> <u>GP</u> ^P <u>PP</u> ^P <u>VG</u> <u>PSG</u> <u>KD</u> ^P <u>GANGI</u> <u>PG</u> ^P <u>PIG</u> ^P <u>PP</u> ^P <u>GPR</u> <u>GRS</u> <u>ET</u> ^P <u>GPAG</u>	1200
Human	<u>LP</u> <u>GP</u> ^P <u>PP</u> ^P <u>GPSGD</u> <u>QGASGPAGPS</u> <u>GPR</u> <u>GP</u> ^P <u>PP</u> ^P <u>VG</u> <u>PSG</u> <u>KD</u> ^P <u>GANGI</u> <u>PG</u> ^P <u>PIG</u> ^P <u>PP</u> ^P <u>GPR</u> <u>GRS</u> <u>ET</u> ^P <u>GPAG</u>	
Bovine	<u>PPGN</u> <u>PG</u> ^P <u>PP</u> ^P <u>GP</u> <u>PG</u> ^P <u>PP</u> ^P <u>GP</u> <u>IDM</u> <u>SAFAG</u> <u>L</u> ^P <u>Q</u> ^P <u>RE</u> <u>KGP</u> <u>D</u> ^P <u>PL</u> ^P <u>Q</u> ^P <u>YMR</u> <u>ADEA</u> <u>A</u> ^P <u>GN</u> ^P <u>L</u> ^P <u>RQ</u> <u>HD</u>	1260
Human	<u>PPGN</u> <u>PG</u> ^P <u>PP</u> ^P <u>GP</u> <u>PG</u> ^P <u>PP</u> ^P <u>GP</u> <u>IDM</u> <u>SAFAG</u> <u>L</u> ^P <u>G</u> ^P <u>PRE</u> <u>KGP</u> <u>D</u> ^P <u>PL</u> ^P <u>Q</u> ^P <u>YMR</u> <u>ADQA</u> <u>A</u> ^P <u>G</u> ^P <u>GL</u> ^P <u>RQ</u> <u>HD</u>	

- Identified amino acids are underlined. Hydroxylated proline or lysine residues are bold while unmodified forms are not. If modified and unmodified were detected, additional letters P or K would be added in the upper line of the sequence. Glc-Gal or Gal modified lysines are represented.
- Reference: Van den Steen, P. E.; Proost, P.; Brand, D. D.; Kang, A. H.; Van Damme, J.; Opdenakker, G., Generation of glycosylated remnant epitopes from human collagen type II by gelatinase B. *Biochemistry*. **2004**, 43, (33), 10809-16