Common Markers of Bone and Soft Tissue Tumors

Bone Tumor	Immunohistochemical Markers	Molecular Markers
Osteosarcoma	SATB2, MDM2 (in low-grade)	RB1, TP53, CDK4, MDM2 (low-grade)
Ewing Sarcoma	CD99 (strong, diffuse), FLI1	EWSR1-FLI1 (85%), EWSR1-ERG (10%)
Chondrosarcoma	S100	IDH1/IDH2 mutations (central chondrosarcoma), EXT1/EXT2 mutations (peripheral chondrosarcoma)
Giant Cell Tumor of Bone (GCTB)	H3.3G34W (specific)	H3F3A G34W mutation (majority of cases)
Chordoma	Brachyury (specific), S100, keratin	Loss of CDKN2A, T (Brachyury) amplification
Osteoid Osteoma	SATB2	No recurrent molecular alterations
Osteoblastoma	SATB2	FOS gene rearrangements (specific)
Chondroblastoma	H3. 3 K36M	H3F3B K36M mutation (specific)
Fibrous Dysplasia	SMA, SATB2	GNAS1 mutations (GNAS R201H or R201C)
Adamantinoma	Cytokeratins , EMA	Associated with recurrent chromosomal changes, including gains of chromosome 7, 8, 12, and 19
Plasmacytoma/Multiple Myeloma	CD138, MUM1, kappa/lambda light chain restriction	IGH rearrangements, MYC alterations, RAS mutations
Langerhans Cell Histiocytosis (LCH)	CD1a, Langerin (CD207), S100	BRAF V600E mutation (50-60% cases), MAP2K1 mutations
Metastatic Carcinoma to Bone	CK7, CK20, TTF1 (lung), PSA (prostate), GATA3 (breast, urothelial), etc.	Depends on primary tumor site (e.g., TP53, EGFR, ALK in lung cancer)

Soft Tissue Tumor	Immunohistochemical Markers	Molecular Markers
Liposarcoma (Well-Differentiated/Dedifferentiated)	MDM2, CDK4, S100	MDM2/CDK4 amplification (12q13-15)
Myxoid/Round Cell Liposarcoma	S100 (variable), DDIT3	FUS-DDIT3 (95%), EWSR1-DDIT3 (rare)
Pleomorphic Liposarcoma	S100, MDM2 (negative)	Complex karyotype, no specific translocations
Leiomyosarcoma	SMA, Desmin	TP53, RB1, ATRX mutations

Undifferentiated Pleomorphic Sarcoma (UPS)	No specific marker. Diagnosis of exclusion.	Complex karyotype, no specific translocation
Rhabdomyosarcoma (Alveolar)	MyoD1, Myogenin, Desmin	PAX3-FOXO1 (70%), PAX7-FOXO1 (20%)
Rhabdomyosarcoma (Embryonal)	MyoD1, Myogenin, Desmin	Loss of heterozygosity at 11p15, mutations in TP53, NRAS, FGFR4
Synovial Sarcoma	TLE1, EMA	SS18-SSX1 (most common), SS18-SSX2
Epithelioid Sarcoma	EMA, CK, CD34	SMARCB1 (INI1) loss
Clear Cell Sarcoma	S100, HMB45, MelanA, SOX10 (like melanoma)	EWSR1-ATF1 fusion
Alveolar Soft Part Sarcoma	TFE3, PAS-positive crystals	ASPSCR1-TFE3 fusion
Dermatofibrosarcoma Protuberans (DFSP)	CD34 (strong, diffuse)	COL1A1-PDGFB fusion
Malignant Peripheral Nerve Sheath Tumor (MPNST)	S100 (focal or absent), SOX10 (variable), H3K27me3 loss (high-grade)	NF1 mutations, SUZ12/EED loss
Solitary Fibrous Tumor	STAT6 (specific), CD34	NAB2-STAT6 fusion
Myxofibrosarcoma	CD34 (variable)	Complex karyotype, no specific translocation
Desmoid-Type Fibromatosis	β-catenin (nuclear), SMA (variable)	CTNNB1 mutations (common), APC mutations (rare, Gardner syndrome)
Angiosarcoma	CD31, ERG, FLI1	MYC amplification (post-radiation cases), PTPRB, KDR mutations
Ewing-Like Sarcoma (BCOR-CCNB3, CIC-rearranged)	BCOR-CCNB3: BCOR, SATB2; CIC-rearranged: WT1, ETV4	BCOR-CCNB3 fusion, CIC-DUX4 fusion