

## Supplementary Table S2. Discovery phage display screening results for isolating SEP-specific scFvs.

Two naïve phage display Discovery libraries (AXL40 and AXL41) were independently screened against five SEP-containing peptides spanning the exon 2/4 splice junction of CENP-A-ΔExon3, as per Fig. 1B. 88 single clones from each of the 10 screens were expressed as secretory scFvs and tested in cell supernatant ELISAs against the corresponding SEP and NAT peptides as well as NeutrAvidin alone. “# of Hits” was determined by OD450 ≥ 0.2 against the peptide with ≥ 2-fold signal over NeutrAvidin. “# of SEP-Specific Hits” was determined by three criteria: (1) OD450 ≥ 0.2 against the SEP peptide with ≥ 2-fold signal over NeutrAvidin, (2) < 5-fold signal against the NAT peptide over NeutrAvidin, and (3) ≥ 2-fold signal against the SEP peptide over the NAT peptide. A subset of SEP-specific hits was sequenced and unique clones were identified both within and between screens. A subset of unique scFvs were purified and tested in antigen and/or scFv titration ELISAs against the corresponding SEP and NAT peptides. Clones with ≥ 5-fold background-corrected signal against the SEP peptide over the NAT peptide for at least two titration points were classified as SEP-specific (two examples are shown in Fig. 2A-B, left).

### Discovery Screening Results

	Discovery Screen #	ELISA Antigen Name	# of Hits (out of 88)	# of SEP-Specific Hits	% of SEP Hits that are SEP-Specific	# of SEP-Specific Hits Sequenced	# of Unique SEP-Specific Hits (within screen)	% Unique	# of Uniques Found in Other Screens [Screen #]	# of Uniques Tested in scFv Protein ELISA	# of SEP-Specific scFvs in Titration ELISA
AXL40	p3494	SEP1	74	21	28%	4	3	75%	0	3	3
		NAT1	57								
	p3495	SEP2	74	15	20%	1	1	100%	0	1	1
		NAT1	59								
	p3496	SEP3	67	25	37%	20	13	65%	3 [p3497 & p3498 (x2), p3498 (x1)]	9	2
		NAT2	48								
p3497	SEP4	81	24	30%	22	6	27%	2 [p3496 & p3498 (x2)]	4	1	
	NAT2	59									
p3498	SEP5	57	25	44%	19	6	32%	3 [p3496 & p3497 (x2), p3496 (x1)]	3	1	
	NAT2	30									
AXL41	p3500	SEP1	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		NAT1	2								
	p3501	SEP2	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		NAT1	0								
	p3502	SEP3	71	64	90%	57	32	56%	1 [p3504 (x1)]	16	2
		NAT2	10								
p3503	SEP4	46	44	96%	27	11	41%	0	1	0	
	NAT2	3									
p3504	SEP5	22	12	55%	4	3	75%	1 [p3502 (x1)]	0	N/A	
	NAT2	12									