

**Text S1:**

**A: AnAPN1:**

Optimized Sequence: % C+G = 49.19

GGATCCGGTACCCTCGAGACAGAACGTTATCGTCTGCCGACCACCAGTATTCCGA  
TTCATTATGATCTGCATCTGCGCACCGAAATTCATCGTAATGAACGTACCTTTACC  
GGCACCGTTGGTATTTCAGCTGCAAGTTGTTTCAGGCAACCGATAAACTGGTGATGC  
ATAATCGTGGTCTGGTTATGAGCAGCGCAAAAGTTAGCAGCCTGCCGAATGGTGT  
TACAGGTGCACCGACCCTGATTGGTGATGTTTCAGTATAGCACCGATAACACCTTT  
GAACATATTACCTTTACAAGCCCGACCATTCTGCAACCGGGTACATATCTGCTGG  
AAGTTGCATTTTCAGGGTCGTCTGGCAACCAATGATGATGGTTTTTATGTTAGCAG  
CTATGTGGCCGATAATGGTGAACGTCGTTATCTGTAAGATATCCTGCAGAAGCTT

**B: Pfs45/48:**

Optimized Sequence: % C+G = 41.63

GGATCCGGTACCCTCGAGAATAATGATTTCTATAATCCGAGCGCACTGAACAGCG  
AAATTAGCGGTTTTATTGGCTACAAATGCAACTTTAGCAATGAAGGCGTGCATAA  
TCTGAAACCGGATATGCGTGAACGTCGTAGCATTTTTTGTAATATCCACAGCTAC  
TTCATCTATGATAAAATCCGCCTGATCATCCCGAAAAAAGCAGCAGCCCTGAGT  
TTAAAATCCTGCCGAAAAATGCTTCCAGAAAGTGTATACCGATTATGAAAATCG  
CGTGGAACCGGATATTAGCGAACTGGGTCTGATTGAATATGAGATCGAAGAAAA  
TGATACCAACCCGAACTATAACGAACGCACCATTACCATTAGCCCGTTTAGCCCG  
AAAGATATTGAATTTTTCTGCTTCTGCGACAACACCGAAAAAGTGATTAGCAGCA  
TTGAAGGTCGTAGCGCAATGGTTCATGTTTCGTGTTCTGAAATATCCGCACAACAT  
TCTGTTTACCAATCTGACCAATGACCTGTTTACATATCTGCCGAAAACCTATAACG  
AGAGCAATTTTGTAGCAACGTTCTGGAAGTGGAAGTGAATGATGGTGAAGTGT  
TGTTCTGGCATGTGAGCTGATCAACAAAAAATGTTTTCAAGAAGGCAAAGAAAA  
AGCCCTGTATAAAAGCAACAAAATCATCTATCATAACAACTGACCATCTTTAAA  
GCACCGTTTTACGTGACCAGCAAAGATGTTAATACCGAGTGTACCTGCAAATTCA  
AAAACAACAACCTATAAAATCGTGCTGAAACCGAAATATGAAAAAAGTTATCC  
ACGGCTGCAACTTCAGCAGCAATGTTAGCAGCAAACATACCTTTACCGATAGCCT  
GGATATTAGCCTGGTTGATGATAGCGCACATATTAGCTGTAATGTTTCATCTGAGC  
GAGCCGAAATATAACCATCTGGTGGGTCTGAATTGTCCGGGTGATATTATCCCGG  
ATTGTTTTTTTCAGGTTTATCAGCCGGAAGCGAAGAACTGGAACCGAGCAATAT  
TGTTTATCTGGATAGCCAGATTAATATCGGCGACATCGAGTATTATGAAGATGCC  
GAAGGTGACGACAAAATCAAACCTGTTTGGTATTGTTGGCAGCATTCCGAAAACCA  
CCAGTTTTACCTGTATCTGCAAAAAAGACAAAAAAGCGCCTATATGACCGTGAC  
CATTGATAGCTGAGATATCCTGCAGAAGCTT

**Text S2:**

**A: AnAPN1:**

Molecular Weight 18331.50 Daltons; 163 Amino Acids; 15 Strongly Basic (+) Amino Acids (K, R); 18 Strongly Acidic (-) Amino Acids (D,E); 47 Hydrophobic Amino Acids (A, I, L, F, W, V); 48 Polar Amino Acids (N, C, Q, S, T, Y); 6.726 Isoelectric Point ; -1.239 Charge at pH 7.0.

MASRGSHHHHHHIEGRRDRGPEFELGTLETERYRLPTTSIPIHYDLHLRTEIHRNERTF  
TGTVGIQLQVVQATDKLVMHNRGLVMSSAKVSSLPNGVTGAPTLIGDVQYSTDTTF  
EHITFTSPTILQPGTYLLEVAFAQGRLATNDDGFYVSSYVADNGERRYL

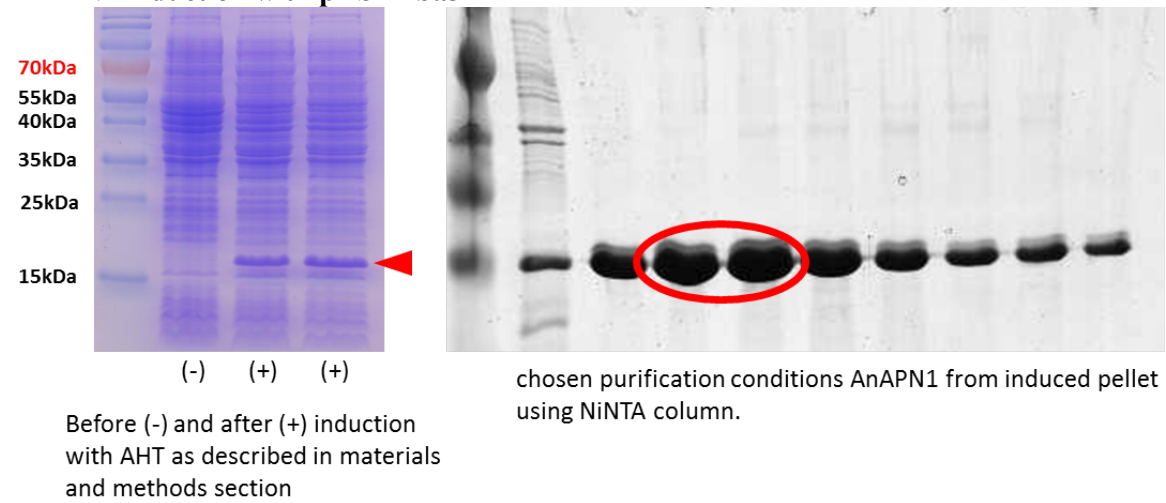
**B: Pfs48/45:**

Molecular Weight 49425.90 Daltons; 429 Amino Acids; 49 Strongly Basic (+) Amino Acids (K, R); 62 Strongly Acidic (-) Amino Acids (D, E); 125 Hydrophobic Amino Acids (A, I, L, F, W, V); 136 Polar Amino Acids (N, C, Q, S, T, Y); 5.874 Isoelectric Point ; -10.835 Charge at PH 7.0.

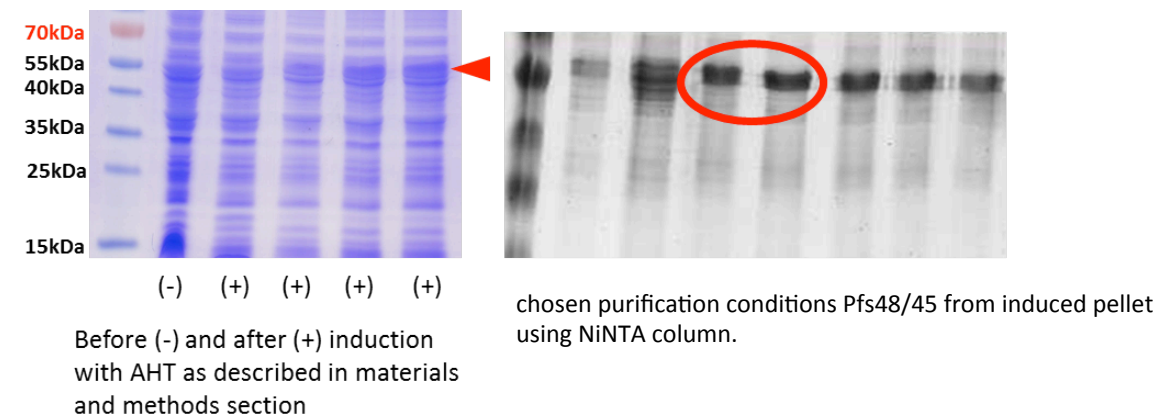
MASRGSHHHHHHIEGRRDRGPEFELGTLENDFYNPSALNSEISGFIGYKCNFSNEGV  
HNLKPDMRERRSIFCNIHSYFIYDKIRLIIPKKSSSPEFKILPEKCFQKVYTDYENRVET  
DISELGLIEYEIEENDTNPNYNERTTITISPFSPKDIEFFCFCDNTEKVISSIEGRSAMVHVR  
VLKYPHNILFTNLTNDLFTYLPKTYNESNFVSNVLEVELNDGELFVLACELINKKCFQ  
EGKEKALYKSNKIIYHNKLTIFKAPFYVTSKDVNTECTCKFKNNNYKIVLKPKEYEKK  
VIHGCNFSNVSSKHTFTDSLDISLVDDSAHISCNVHLSEPKYNHLVGLNCPGDIIPDC  
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KDKKSAYMTVTIDS

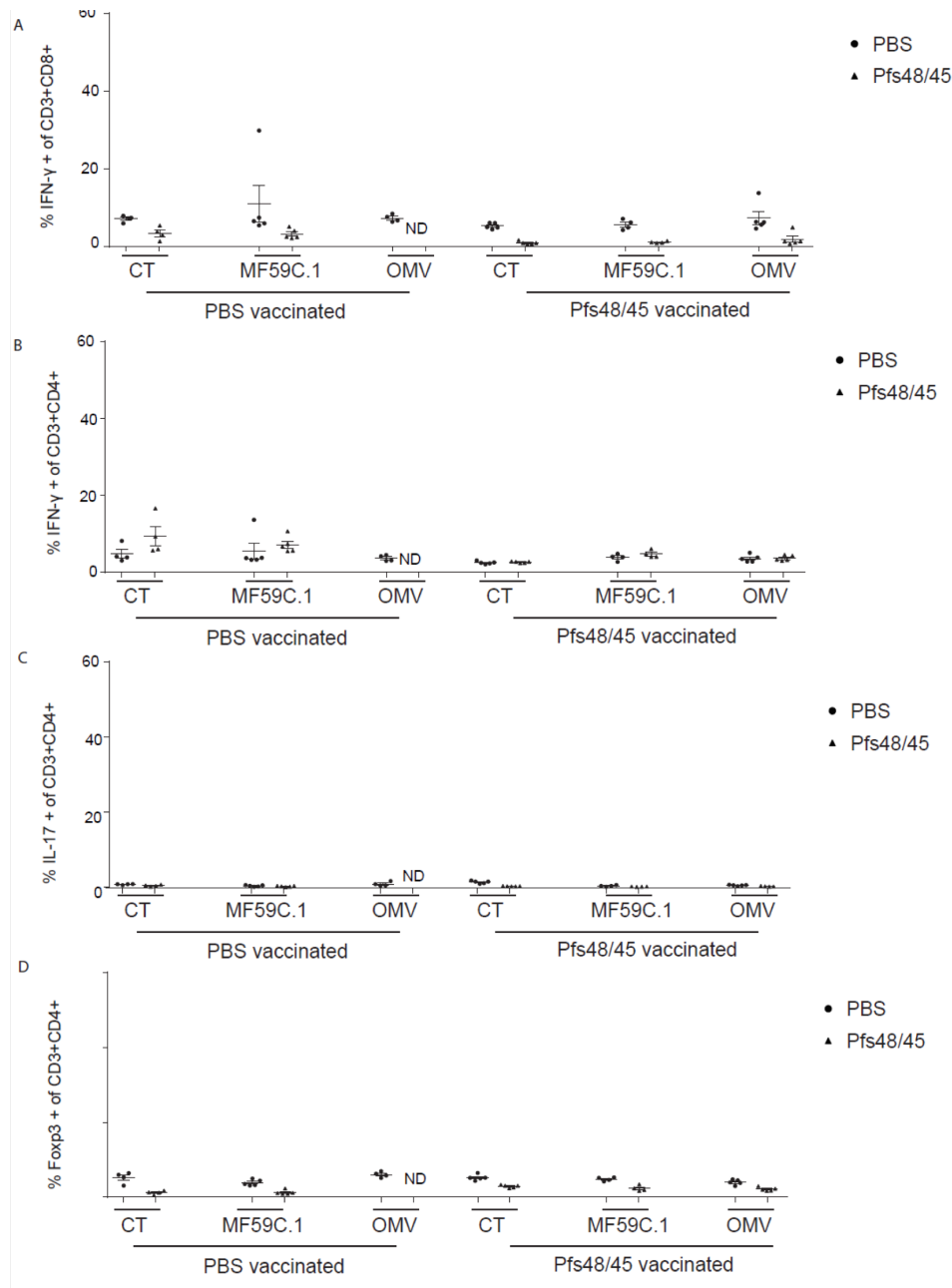
**Text S3:**

**AnAPN1 induction with pASK-iba37+**



**Pfs48/45 induction with pASK-iba37+**





**Figure S4. Characterization of the cellular response to Pfs48/45 vaccination.** Each dot or triangle represents an individual mouse. Each PBS vaccination consisted of four mice and each Pfs48/45 vaccination group of five mice. (A) Percentage of IFN- $\gamma$  secreting CD3 and CD8 double positive cells. (B) percentage of IFN- $\gamma$  secreting CD3 and CD4 double positive cells. (C) Percentage of IL-17 secreting CD3 and CD4 double positive cells. (D) Percentage of Foxp3 positive CD3 and CD4 double positive cells. Abbreviations: OMV = bacterial outer membrane vesicles; CT = cholera toxin, ND = not determined.