Supplementary Methods

Phage panning

For initial negative selection mouse Laminin (10 mL at 25 ug/ml concentration) from Roche was incubated overnight at 37 C. 10^{12} cfu of phage were incubated for one hour at 37° C in pre-warmed Incubation Medium (DMEM supplemented with 0.1% BSA). Incubation Medium (10 ml) and a total volume of five washes of Washing Buffer (DPBS supplemented with 1% BSA and 0.05% Tween-20) were collected and eluted phage were amplified in *E. coli* K12 ER2738 as described in the standard protocol of New England Biolabs.(*1*)

In the case of NSC panning, after an overnight incubation in 10 ml of □FGF supplemented (10 ng/ml) neural basal media, cells were washed with pre-warmed Incubation Medium. 10^{12} cfu of the negatively selected phage library were diluted in 10 ml Incubation Medium and pipetted onto the adhering NSCs.

After neutralization, eluted and internalized phage were titered by infection of Escherichia coli to monitor the selection. Internalized and eluted phage were amplified separately for another round of selection. Three rounds of positive selection were performed. At round numbers two and three, the biopannings of internalized and eluted phage were performed in different cell cultures (but with identical culture conditions) by collecting the phage of interest (*i.e.* internalized phage from libraries of internalized phage). After the third round of biopanning, phage plaques were randomly picked out from the titer plates and sequenced.

Peptides synthesis and purification

Peptides were synthesized on a 0.1 mmol scale with standard fluorenylmethoxycarbonyl solid-phase techniques using a CEM Liberty automated microwave peptide synthesizer. MBHA rink amide resin (0.5 mmol/g substitution) was used to produce C-terminal amides; activation was performed with 0.5 M HOBt/HBTU in DMF. Peptides, where stated, were acetylated using 20% acethic anhydride solution in DMF. Peptides were then cleaved from the resin and deprotected with 9 ml of 95% trifluoroacetic acid (TFA), 2,5% water and 2,5% triisopropylsilane. The cleaved peptides were precipitated, washed several times with cold diethyl ether and dissolved in 20-25% of acetonitrile solution prior to be lyophilized and stored at -20 °C. Crude peptides were analyzed and purified by reverse phase HPLC using a Waters system equipped with an analitycal and semi-preparative BioBasic C4 (Thermo Scientific, UK). Eluents were 0,1% (v/v) TFA in water (Buffer A) and 0,1% (v/v) TFA in acetonitrile (Buffer B). Starting conditions were 10% buffer A and 90% buffer B and the gradient developed with a linear increase in buffer B. In 15 minutes gradient went to 65% buffer B. Identity of the peptides was confirmed with MALDI-TOF mass spectrometry. After purification, 0,1 M HCl exchange was performed at a volume of 1:1 in order to extract residual TFA. Then, peptides were lyophilized again.

Circular Dichroism (CD) analysis

CD spectra were obtained on Aviv 62SD spectrometer using a 1 mm quarz cuvette. SAPeptide solutions were dissolved in water at 1% w/v and diluted at a final concentration of 0.2 mg/ml. The spectra were collected between 190 and 260 nm: 3 accumulations were averaged for each sample. Spectra were then blanked to the water

spectra. The data pitch of the spectra was 0.2 nm and the scanning mode was continuous with a scanning speed of 10nm/min. β-sheet content of SAPeptide solutions were obtained via deconvolution (CDNN vv 2.1 software).

AFM sample preparation

Samples were dissolved in distilled water (GIBCO), at a concentration of 1% w/v one day prior imaging. The day after peptide solutions were diluted (in a ratio of 1:50), 2 ml of these solutions were placed on mica muscovite substrates and kept at room temperature for 2 minutes. The mica surfaces were then rinsed with distilled water to remove loosely bound peptides and solution was let to evaporate for 30 minutes.

***In vitro* tests**

Initially, cells were cultured with basal medium supplemented with βFGF (10 ng/ml), added to enhance neuronal progeny differentiation. At 3 days *in vitro* (DIV), βFGF medium was replaced with Leukemia Inhibitory Factor (LIF, Chemicon) (20 ng/ml) and Brain Derived Neurotrophic Factor (BDNF, Peprotech) (20 ng/ml). Fresh medium was added every three days.

For cell viability test, after calibrating the linear response between the cell number and absorbance values, proliferated cell populations were quantified (n=5) by using a Vmax microplate reader (Molecular Devices) at 490 nm wavelength. Values, reported as means ± standard error of the mean, were blanked to their respective controls consisting of same substrates and cell culture media without cells.

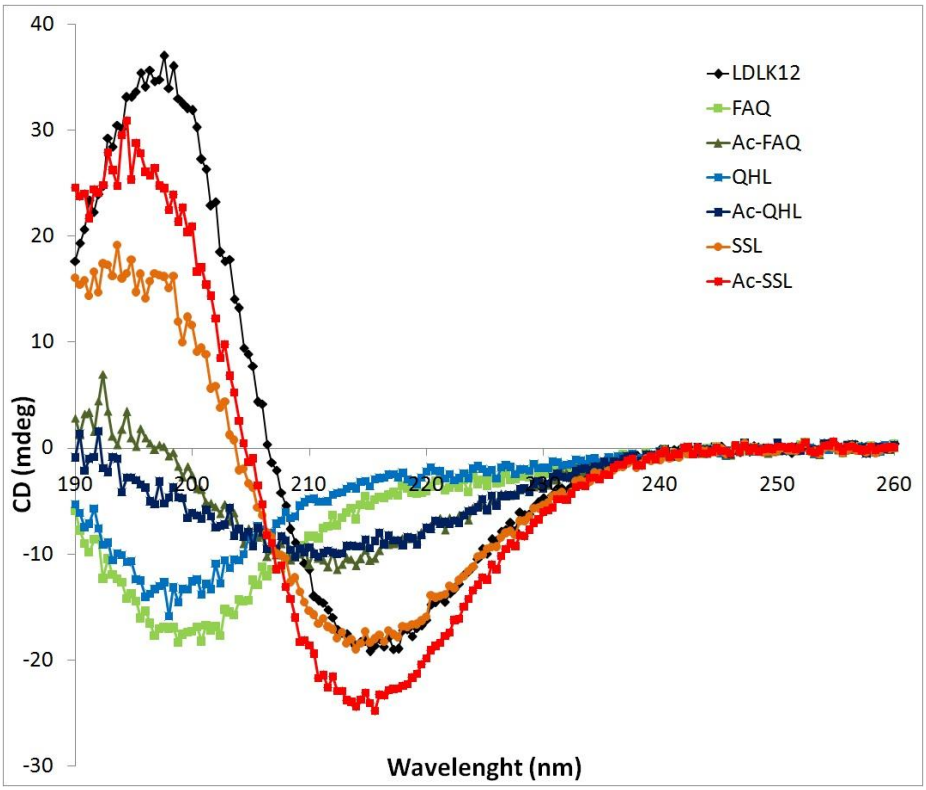

Figure S-1. Secondary structure characterization of LDLK12, FAQ, Ac-FAQ, QHL, Ac-QHL, SSL and Ac-SSL SAPeptides (see methods for details).

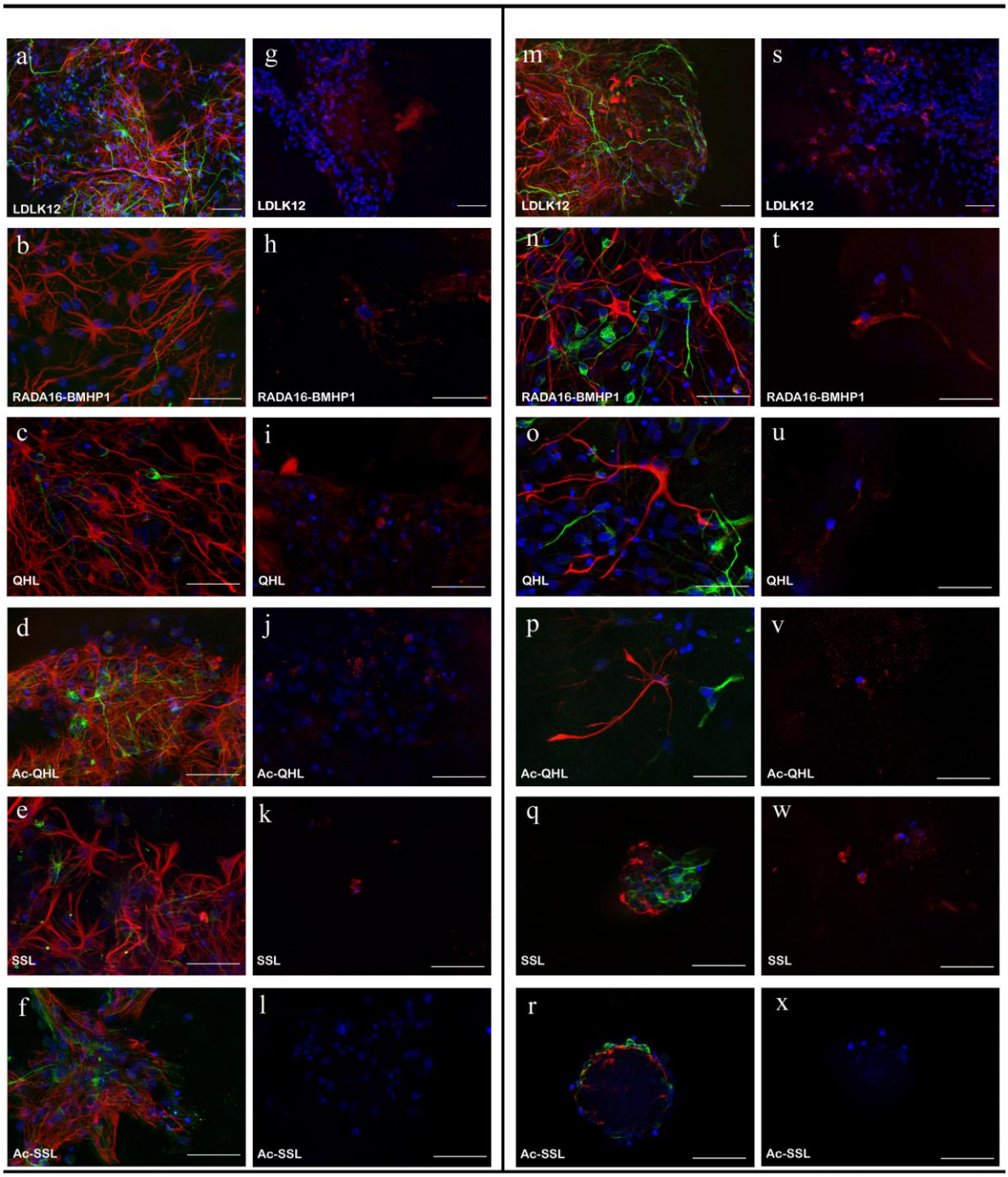

Figure S-2. Neural differentiation of murine (a-l) and human (m-x) NSCs on LDLK12, RADA16-BMHP1, QHL, Ac-QHL, SSL and Ac-SSL SAPeptides. βIIITubulin positive neurons (in green a-f and m-r) and GFAP positive astrocytes (in red a-f and m-r) were detected in every tested compound. GalC/O4 double positive oligodendrocytes (in red g-l

and s-x) were not detected on Ac-SSL. Nuclei are visualized with DAPI (in blue). Scale bars = 50 μm.

Table S-1. Statistical significances of the quantified differentiation of both mouse and human neural stem cells.

Mouse neural stem cells: Beta III Tubulin	
Statistical comparison	**Statistical significance**
Cultrex vs RADA16-BMHP1	p < 0,0001
Cultrex vs FAQ	p < 0,0001
Cultrex vs Ac-FAQ	p < 0,0001
Cultrex vs QHL	p < 0,0001
Cultrex vs Ac-QHL	p < 0,0001
Cultrex vs SSL	p < 0,0001
Cultrex vs Ac-SSL	p < 0,0001
LDLK12 vs RADA16-BMHP1	p < 0,0001
LDLK12 vs FAQ	p < 0,0001
LDLK12 vs Ac-FAQ	p < 0,0001
LDLK12 vs QHL	p < 0,0001
LDLK12 vs Ac-QHL	p < 0,0001
LDLK12 vs SSL	p < 0,005
LDLK12 vs Ac-SSL	p < 0,0001
FAQ vs RADA16-BMHP1	p < 0,0001
Ac-FAQ vs RADA16-BMHP1	p < 0,0001
FAQ vs QHL	p < 0,0001
FAQ vs Ac-QHL	p < 0,0001
Ac-FAQ vs QHL	p < 0,0001
Ac-FAQ vs Ac-QHL	p < 0,0001
FAQ vs SSL	p < 0,0001
Ac-FAQ vs SSL	p < 0,0001
FAQ vs Ac-SSL	p < 0,0001
Ac-FAQ vs Ac-SSL	p < 0,0001

Mouse neural stem cells: GFAP	
Statistical comparison	**Statistical significance**
Cultrex vs RADA16-BMHP1	p < 0,005
Cultrex vs FAQ	p < 0,0001
Cultrex vs Ac-FAQ	p < 0,0001
Cultrex vs Ac-QHL	p < 0,05
Cultrex vs SSL	p < 0,005
Cultrex vs Ac-SSL	p < 0,0001
LDLK12 vs RADA16-BMHP1	p < 0,005
LDLK12 vs FAQ	p < 0,0001
LDLK12 vs Ac-FAQ	p < 0,0001
LDLK12 vs Ac-QHL	p < 0,05
LDLK12 vs SSL	p < 0,005
LDLK12 vs Ac-SSL	p < 0,0001
FAQ vs RADA16-BMHP1	p < 0,0001
FAQ vs QHL	p < 0,0001
FAQ vs Ac-QHL	p < 0,0001
FAQ vs SSL	p < 0,0001
FAQ vs Ac-SSL	p < 0,0001
Ac-FAQ vs RADA16-BMHP1	p < 0,0001
Ac-FAQ vs QHL	p < 0,0001
Ac-FAQ vs Ac-QHL	p < 0,0001

Ac-FAQ vs SSL	p < 0,0001
Ac-FAQ vs Ac-SSL	p < 0,0001

Mouse neural stem cells: GalC/O4	
Statistical comparison	**Statistical significance**
Cultrex vs RADA16-BMHP1	p < 0,005
Cultrex vs FAQ	p < 0,0001
Cultrex vs Ac-FAQ	p < 0,0001
Cultrex vs Ac-QHL	p < 0,005
Cultrex vs SSL	p < 0,05
Cultrex vs Ac-SSL	p < 0,0001
LDLK12 vs FAQ	p < 0,005
LDLK12 vs Ac-FAQ	p < 0,005
LDLK12 vs Ac-QHL	p < 0,005
LDLK12 vs SSL	p < 0,05
LDLK12 vs Ac-SSL	p < 0,0001
FAQ vs RADA16-BMHP1	p < 0,005
FAQ vs Ac-FAQ	p < 0,005
Ac-FAQ vs RADA16-BMHP1	p < 0,0001

Human neural stem cells: Beta III Tubulin	
Statistical comparison	**Statistical significance**
Cultrex vs LDLK12	p < 0,05
Cultrex vs FAQ	p < 0,0001
Cultrex vs Ac-FAQ	p < 0,0001
Cultrex vs SSL	p < 0,0001
Cultrex vs Ac-SSL	p < 0,0001
LDLK12 vs RADA16-BMHP1	p < 0,05
LDLK12 vs FAQ	p < 0,0001
LDLK12 vs Ac-FAQ	p < 0,0001
LDLK12 vs QHL	p < 0,05
LDLK12 vs Ac-QHL	p < 0,05
LDLK12 vs Ac-SSL	p < 0,005
FAQ vs RADA16-BMHP1	p < 0,0001
Ac-FAQ vs RADA16-BMHP1	p < 0,005
FAQ vs QHL	p < 0,0001
Ac-FAQ vs QHL	p < 0,005
FAQ vs Ac-QHL	p < 0,005
FAQ vs SSL	p < 0,0001
Ac-FAQ vs SSL	p < 0,0001
FAQ vs Ac-SSL	p < 0,0001
Ac-FAQ vs Ac-SSL	p < 0,0001

Human neural stem cells: GFAP	
Statistical comparison	**Statistical significance**
Cultrex vs LDLK12	p < 0,05
Cultrex vs FAQ	p < 0,05
Cultrex vs SSL	p < 0,05
Cultrex vs Ac-SSL	p < 0,0001
LDLK12 vs RADA16-BMHP1	p < 0,05
LDLK12 vs FAQ	p < 0,05
LDLK12 vs Ac-FAQ	p < 0,05
LDLK12 vs QHL	p < 0,05
LDLK12 vs Ac-QHL	p < 0,05
FAQ vs RADA16-BMHP1	p < 0,05
FAQ vs QHL	p < 0,05
Ac-FAQ vs QHL	p < 0,05
FAQ vs Ac-QHL	p < 0,05
FAQ vs SSL	p < 0,05
Ac-FAQ vs SSL	p < 0,05
FAQ vs Ac-SSL	p < 0,0001
Ac-FAQ vs Ac-SSL	p < 0,005

Human neural stem cells: GalC/O4	
Statistical comparison	**Statistical significance**
Cultrex vs FAQ	p < 0,0001
Cultrex vs Ac-FAQ	p < 0,0001
Cultrex vs SSL	p < 0,0001
Cultrex vs Ac-SSL	p < 0,0001
LDLK12 vs FAQ	p < 0,0001
LDLK12 vs Ac-FAQ	p < 0,0001
LDLK12 vs SSL	p < 0,0001
LDLK12 vs Ac-SSL	p < 0,0001
FAQ vs RADA16-BMHP1	p < 0,05
Ac-FAQ vs RADA16-BMHP1	p < 0,05
FAQ vs QHL	p < 0,0001
Ac-FAQ vs QHL	p < 0,0001
FAQ vs Ac-QHL	p < 0,0001
Ac-FAQ vs Ac-QHL	p < 0,0001
FAQ vs SSL	p < 0,0001
Ac-FAQ vs SSL	p < 0,0001
FAQ vs Ac-SSL	p < 0,0001
Ac-FAQ vs Ac-SSL	p < 0,0001

REFERENCES

1. Kay, B. K., Kasanov, J., and Yamabhai, M. (2001) Screening phage-displayed combinatorial peptide libraries, *Methods 24*, 240-246.