JUMP: A tag-based database search program for peptide identification by mass spectrometry

Xusheng Wang
St. Jude Children’s Research Hospital, USA

Database search programs are essential tools for identifying peptides by mass spectrometry (MS) in shotgun proteomics. Simultaneously achieving high sensitivity and specificity during database search is crucial for improving proteome coverage. Here we present JUMP, a new hybrid database search program that generates amino acid tags and ranks peptide spectrum matches (PSMs) by an integrated score from the tags and pattern matching. In a typical run of liquid chromatography coupled with high resolution tandem MS, more than 95% of MS/MS spectra can generate at least one tag, whereas the remaining spectra are usually too poor to derive genuine PSMs. To enhance search sensitivity, the JUMP program enables the use of tags as short as one amino acid. Using the target-decoy strategy, we compared the performance of JUMP, SEQUEST and Mascot, and demonstrated that JUMP scores had better specificity to distinguish target from decoy PSMs, resulting in ~30% more PSMs than the other programs at ~1% false discovery rate. JUMP also permits the analysis of multiple co-fragmented peptides from “mixture spectra” to further increase PSMs by ~20%. In addition, JUMP-derived tags allow partial de novo sequencing and facilitate the assignment of modified residues unambiguously. We tested the JUMP to process 195,282 MS/MS spectra from a single 6 hour run, identifying 86,633 PSMs, 36,741 peptides and 4,318 proteins. In summary, JUMP is an effective database search algorithm complementary to current search engines.

Biography

Xusheng Wang has completed his PhD from University of California, Davis and Zhejiang University in China and postdoctoral studies from University of Tennessee Health Science Center. He is the research scientist, St. Jude Children’s Research Hospital. He has published more than 30 papers in reputed journals and serving as two editorial board members.

xusheng.wang@stjude.org