

Nucleotide sequence of *Clostridium botulinum* C1 neurotoxin

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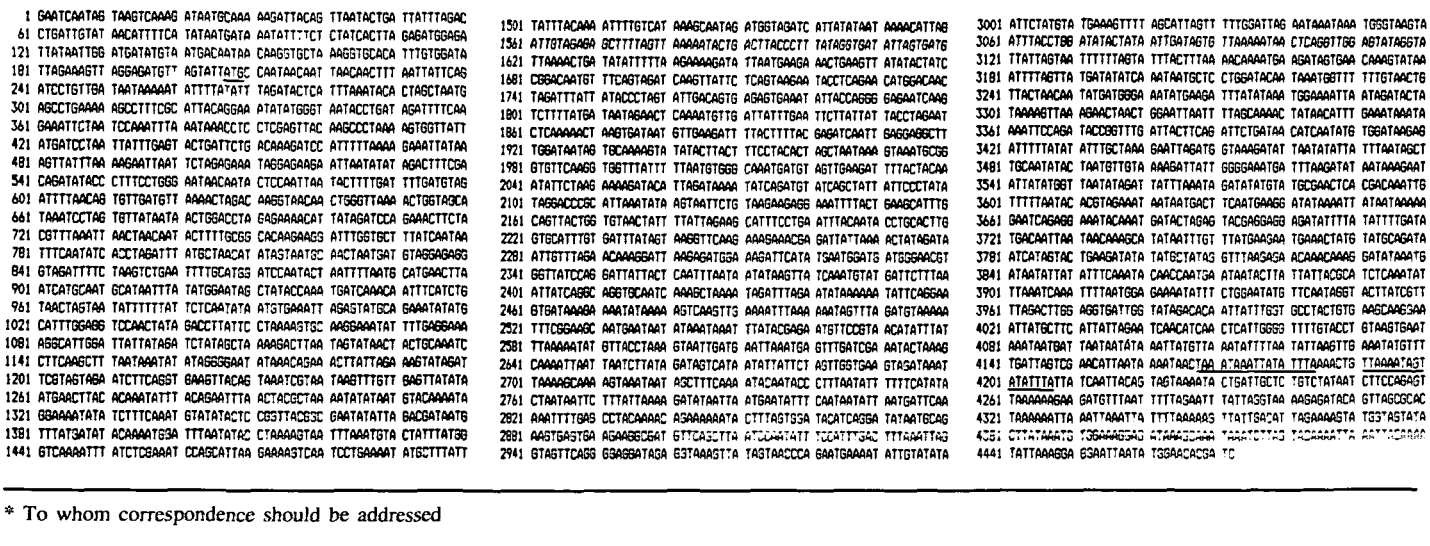
Clostridium botulinum neurotoxins consist of seven serologically distinct types: A, B, C1, D, E, F, and G. All of these are synthesized as single-chain polypeptides of about 150 kDa which are generally nicked after secretion to yield N-terminal light (≈50 kDa) and C-terminal heavy (≈100 kDa) chains connected by a single disulfide bond. *C. botulinum* C1 neurotoxin is encoded by a bacteriophage (1, 2).

C. botulinum C1 neurotoxin DNA sequence shown below was derived from cloned C phage DNA fragments the sizes of which were less than 2.0 kb. The initial clone containing a C1.neurotoxin coding DNA was identified using a mixed 29-mer probe [5′-GA(T/C)CCIGTIGA(T/C)AA(T/C)AA(A/G)AA(T/C)AT-ICTITA-3′] which corresponds to Asp^{12} to Tyr^{21} of the partial amino acid sequence published previously (3). Potential biohazards associated with the experiments described had been approved by the French National Control Committee.

The complete C1 DNA sequence shows a single open reading frame which begins with an ATG at position 207 and encodes for 1291 amino acids (MR 148,698 Da). Before the ATG a Shine-Dalgarno sequence can be localized from position 191 to 196. Cys^{437} and Cys^{453} are probably involved in a disulfide bridge linking the light and heavy chains. A candidate transcription terminator ($\Delta G = -6.2$ kCal.mol^{-1}) is underlined. *C. botulinum* C1 neurotoxin exhibits no similarity with exoenzyme C3 which is also encoded by *C. botulinum* C and D phages (4), in particular the C1 neurotoxin lacks a leader sequence which was found in exoenzyme C3.



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