Toxin-Antitoxin systems present in the superintegron of *Vibrio cholerae* strain N16961

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Bacterial Toxin-Antitoxin (TA) systems are composed of closely linked genes, which encode a stable toxin and its cognate labile antitoxin. Toxin can inhibit cell growth or viability but in favorable conditions antitoxin protects the host from toxin's deleterious effects.
Some TA systems are also known as selfish elements because of their maintenance at the expense of their host. So they may play a role in the stabilization of plasmids or genomic islands, such as superintegrons, by post-segregation killing (PSK) of the cell that loses these genes and suffers the stable toxin's destructive effect.
TA loci are also found in bacterial chromosomes but the function of chromosomally encoded TA loci is not so clear yet and is still open to debate.
We are working on TA loci of V. cholerae genome and interestingly all these loci are carried by superintegron in case of V. cholerae N16961. We have shown that all these TA systems are functional both in E. coli and V. cholerae. Moreover we have made all possible cross-interactions between these toxins and antitoxins and we have found that they are strictly specific in terms of their interactions i.e. only the adjacent antitoxin is able to combat the toxin, antitoxins belonging to the same family of TA systems are unable to combat the other toxins of that family. This evidence is really important regarding the ability of chromosomal TA systems to stabilize genomic islands.
We have characterized 10 TA systems of V. cholerae N16961 belonging to well defined TA families and in addition to that we have identified 3 TA systems of totally different type. We were not able to identify these 3 TA systems by simple comparison but we did that by genetic approaches.
To see the action of these toxins, either it is bacteriostatic or bactericidal; we have realized the Live/Dead assays for all toxins, after induction of the toxin genes cloned under an inducible promoter. We here show that there are certain families which are bactericidal (ParD/E) and certain others are bacteriostatic i.e. they induce a growth arrest but cells are able to revive if the toxin expression is not continued for a prolonged period of time.
The above results will help us to carry out the deletion of these TA systems from the superintegron of V. cholerae N16961, and to see their effect on its stability.