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The *Asterias Rubens* Complement System: Comparisons with Lower Vertebrates

Michel Leclerc[1] and Nicolas Kresdorn[2]

[1]*Rue Isabelle, Romée 45640 Sandillon, France*
[2]*GenXPro, Frankfurt, Germany*

Abstract

Seven complement components have been discovered in 2013, when compared to mouse genome. Another component: the C6 component was found in sea star, when compared to rainbow trout genome:"Oncorhynchus mykiss"

Keywords: Invertebrate innate; Adaptative immunity

Introduction

We have recently described the" Sea star complement Evidence" [1]. We remarked that C6 and C7 components were missing in sea star transcriptome when compared to mouse one.

An extensive study allowed us to research these components in less evolved animals (phylogenetically speaking) than mouse. Genomic features of the rainbow trout: *Oncorhynchus mykiss* have helped us, in this study.

At this point, we were attempting to determine how many similar complement components might be present in *Asterias rubens* (Invertebrate) and in *Oncorhynchus mykiss* (Vertebrate).

Materials and Methods

Sea stars *Asterias rubens* were obtained from the Biology Institute (Gothenbugh University)

Immunizations, genomic studies were already described [1]. After ligation of adapters for Illumina's GSII sequencing system, the cDNA was sequenced on the Illumina GSII platform sequencing.

1.100 bp from one side of the approximately 200 bp fragments. Sequences were assembled using Velvet (Zerbino and Birney [2].

Results

Three complement components: C1r, C4, C1 inhibitor of the classical activation pathway have been fully sequenced in rainbow trout [3].

C6 was discovered in trout in 2006 [4].

Sea star C1q subunits A, B, C, were sequenced in *A. rubens* [1].

C2, C4B, and C3 which is central in mammals to both the classical and alternative pathways, C9,

C5, C8 were also sequenced [1] in *Asterias rubens*

As for C6, it was shown as following, when compared to *Oncorhynchus mykiss* genome:

One contig (Contig11285|m.9708) could be annotated via BLASTX to *Oncorhynchus mykiss* "Complement component C6" from the Trembl database, with an e-value of 3.75e-13. On an aligned region of 113 amino acids, 37 positive and 56 identical amino acids were found.

5'GACAAATTCGACACTTACAAAAAGCATCTCAACCCGAGTAGGAAGGAATCTCTTTTAGTT

GCAGTAAATTTTGAATTTGTATAATTCAGTATTTTGTGCTCCCTTTGGTATCAGTTTAGA

TCCACACAACCTGTGAAAAACTTCAGTACTTACTAGATTTCGCCAACGCAACGGTAAACG

AGTCATTTGATTTTGACCATCATCAACTGAAGCAACGCACGTAATACACACAACAAACGG

AACATTTTGTGTGTAGTTTCCAGCGATTCGAGAAGCAAATCAAAGACAAGATGTCTTTAC

CCAGTGATGTTGAAACAGACTCCGTCATGGATAGTCCAGCAGAGATTCATATGAACATGA

ATAAGCTACAATCTAAACTTCCCAGCGTTACTCAAGACGAGAGATTTGACTCCGGAATTG

ACTCGTTACGTTCTGTTGATTCGGCGTACTGCTTGAGCTTCGAAAGGGAATCGAGCCTGG

CTTCGATAAATGAGAAGACGTCTCTCACATCACACCTGCAACAGCTCCATCTTTCACATG

AAACAAGAACAGAAACCGAGAAGACTGAAACGACAGTAGAAGACATCGATGAAGCTTATC

ATGATGAGTGTACTATGTCTGAAACACTCGACAATTTGGAAGAAACTGCAAGAATTGTGG

AATATCCTGAACAAAGATGCACGGGACGTCTTACAGATGATGCCTTCGACCAAGACCAAG

AGGGAGATACGCCCCTTCATCTTGCTATTATTCATAAGGAAGTGGACTTCGCAGAAAAAT

TCATCATCTTTGTTGCAGATCCTGAGTTACTGAACATCAGCAATGATCTTATGCAGACTC

CTTTACACCTTAGCGTATTAACAAGGCAACAAGATATCT-

***Corresponding author:** Michel Leclerc, Immunologie des Invertébrés Université d'Orléans 45100, Orleans Cedex 2, France, Tel: 0238410209; E-mail: mleclerc45@gmail.com

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GTCGTGTTCTCGTCTTGGGCA

ATGCCCAAATCGACTGCACCGACCGAAACGGCGACACTCCTCTTCATATTGCATGCAGAC

TGAGAGATGAGGGCTGTATCAGAGCTCTGACTGAAGGAATATCTCCACTCGAGCGTAAGA

GAGGGATGGTTCCACAGAATAGAGCAAGTGGGGTACAACAGCTTCCACAGAATCTTGAAC

TCAGAAACTTTGAAGGCTACACATGCATCCATATTGCAGGATTCGCTTGTAGCGTCGATC

AGTTGGAGTACCTTGTGCAGCTAGGCGGCGACATAAATGCCCCGGATGGAAAGAGCGGAA

GGACCATTCTCCACTACGCTGTAGAGGCGGGTGACTTTTCTCTTTGTCAGTACCTCATTG

CGAACTTGGGTGCCAATGTTAATGCGTTGACCTTTGACCAGTGCACACCC3'

C7 was not found.

Discussion and Conclusion

The sea star *A. rubens*, although considered to be more primitive than lower vertebrates (as trout) seems to have evolved much more sophisticated immune defense mechanisms.

We find much more complement components in the sea star than in trout: 8 out of 9, when compared to mouse. How do we explain these differences between trout and *A. rubens*? Phylogenetically speaking the sea star could be situated in "an evolutive cul de sac"and might evolved more quickly than rainbow trout, in term of innate immunity. As for adaptative immunity, rainbow trout is more evolved than Asterias rubens which presents an "invertebrate primitive antibody" in response to antigenic injury [5,6]. This review has described a rather rich catalogue of immune factors in sea star and trout that serve as potent molecules in the defense of these animals against environmental threats. Taken together one cannot come away with any conclusion other than sea stars have developed a very impressive set of mechanisms to deal with environmental threats. The same logic would apply to an explanation of why the sea star *A. rubens* has evolved the ability to develop innate and adaptative immunity. Further studies are bound to unravel the mystery and add to the above information to give a clearly picture of the sequence of events.

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