HSOA Journal of Virology & Antivirals

Research Article

MHC genes in Echinodermata (Invertebrates)

Michel Leclerc[1*], Ariane Jolly[2] and Pierre de la Grange[2]

[1]Department of Cell Biology, Developmental Biology, Immunology, University of Orléans, Orléans, France

[2]Research and Development, GenospliceTechnology, Paris, France

Abstract

For the first time MHC Class II gene was described in Echinodermata, so in Invertebrates. For the present time MHC Class I gene was not found in a significant manner (e-value too weak) but further studies are necessary to conclude about its existence in Echinodermata.

Introduction

As C.A Janeway wrote in 2001: "The function of MHC molecules is to bind peptide fragments derived from pathogens and display them on the cell surface for recognition by the appropriate T cells [1]. The consequences are almost always deleterious to the pathogen-virus-infected cells are killed, macrophages are activated to kill bacteria living in their intracellular vesicles, and B cells are activated to produce antibodies that eliminate or neutralize extracellular pathogens. Thus, there is strong selective pressure in favor of any pathogen that has mutated in such a way that it escapes presentation by an MHC molecule.

Two separate properties of the MHC make it difficult for pathogens to evade immune responses in this way. First, the MHC is polygenic: it contains several different MHC class I and MHC class II genes, so that every individual possesses a set of MHC molecules with different ranges of peptide-binding specificities. Second, the MHC is highly polymorphic; that is, there are multiple variants of each gene within the population as a whole. The MHC genes are, in fact, the most polymorphic genes knownBecause of the polygeny of the MHC, every person will express at least three different antigen-presenting MHC class I molecules and three (or sometimes four) MHC class II molecules on his or her cells. In fact, the number of different MHC molecules expressed on the cells of most people is greater because of the extreme polymorphism of the MHC and the codominant expression of MHC gene products.

The term polymorphism comes from the Greek poly, meaning many, and morphe, meaning shape or structure. As used here, it means within-species variation at a gene locus, and thus in its protein product; the variant genes that can occupy the locus are termed alleles. There are more than 200 alleles of some human MHC class I and class II genes, each allele being present at a relatively high frequency in the population. So there is only a small chance that the corresponding MHC locus on both the homologous chromosomes of an individual will have the same allele; most individuals will be heterozygous at MHC loci. The particular combination of MHC alleles found on a single chromosome is known as an MHC haplotype. Expression of MHC alleles is codominant, with the protein products of both the alleles at a locus being expressed in the cell, and both gene products being able to present antigens to T cells. The extensive polymorphism at each locus thus has the potential to double the number of different MHC molecules expressed in an individual and thereby increases the diversity already available through polygeny.

In addition to the highly polymorphic 'classical' MHC class I and class II genes, there are many genes encoding MHC class I-type molecules that show little polymorphism; most of these have yet to be assigned a function. They are linked to the class I region of the MHC and their exact number varies greatly between species and even between members of the same species. These genes have been termed MHC class IB genes; like MHC class I genes, they encode β2-microglobulin-associated cell-surface molecules. Their expression on cells is variable, both in the amount expressed at the cell surface and in the tissue distribution"

In human, the main function of major histocompatibility complex (MHC) Class II molecules, is to present processed antigens which are derived primarily, from exogenous sources.

Constitutive expression of MHC Class II molecules, is also confined to professional antigen- presenting cells (APC) of the immune system [2].

Since we have discovered the IPA (Invertebrate Primitive Antibody), to acquire a better understanding of the invertebrate immune system, it seemed useful to look for MHC genes (HLA-DRB1 gene) (HLA-C gene) in invertebrates with Ophiocomina nigra (Ophuirids), Antedon bifida (Crinoïds) as model of studies [3-6]. On the other hand we'll have a look on a MHC Class I gene (HLA-C gene) corresponding to a molecule which is a heterodimer consisted of a heavy chain and a light one (beta-2 microglobulin).

Materials and Methods

Animals

Ophiocomina nigra (Ophuirid) Antedon bifida(Crinoid) were obtained at the station of Biologie Marine of Roscoff, France.

***Corresponding author:** Michel Leclerc, Department of Cell Biology, Developmental Biology, Immunology, University of Orléans, Orléans, France; Tel: + 504 0238410209; E-mail: mleclerc45@gmail.com

Citation: Leclerc M, Jolly A, Grange P (2019) MHC genes in Echinodermata (Invertebrates). J Virol Antiviral 2: 003.

Received: June 01, 2019; **Accepted:** June 18, 2019; **Published:** June 25, 2019

Obtention of ophuirid and crinoid mRNA

Digestive coeca were excised from their bodies and mRNA were obtained from Uptizol (Interchim) then quality controls were operated [7].

Sequencing

Sequencing was made on Illumina Next Seq 500 with paired-end: 2. 75 bp. Transcriptome was assembled from RNA-Seq fastq files using Trinity v2.1.1 with default parameters [8]. A BLAST database was created with the assembled transcripts using makeblastdb application from ncbi-blast+ (v2.2.31+). The sequences of transcripts of interest were then blasted against this database using blastn application from ncbi-blast+ with parameter word size 7 [9].

Results

MHC gene Class II appears in the genome of Ophiocomina nigra and Antedon bifida one, in a significant manner. The transcriptomes are given in the following tables, with the sequences just after.First Ophiocomina nigra results show the"HLA-DRB1" transcriptome which possesses a short sequence but a specific one (Table 1).

We find the transcriptome called HLA-DRB1 Antedon bifida with the following e-value, identity, bit score. The sequence in 5'-3' shows also a short one as for the ophuirid: Ophiocomina nigra but remains highly specific (Table 2).

MHC ClassI gene was not found, at least in a significant manner (the e-value was not significative)

Conclusion

It is obvious that MHC classII gene(HLA-DRB1 gene) exist in Echinodermata, at least in Echinodermata which possess a sophisticated immune system as Asterids, Ophuirids, and Crinoïds. It would be interesting also to study MHC system in Echinodermata which present only innate immune response as Echinids, Holothurids [10]. The HLA-DRB1 gene is a part of a family of genes called the human leukocyte antigen (HLA) complex.

The protein encoded by this gene belongs to the HLA class II beta chain paralogues. The class II molecule is a heterodimer consisting of an alpha (DRA) and a beta chain (DRB), both anchored in the membrane. It plays a central role in the immune system by presenting peptides derived from extracellular proteins to T helper cells. Class II molecules are constitutively expressed in professional antigen presenting cells (APC: B lymphocytes, dendritic cells, macrophages) and could be induced in non-professional APCs. DRB1 is expressed at a level five times higher than its paralogues DRB3, DRB4 and DRB5. DRB1 is present in all individuals. Allelic variants of DRB1 are linked with either none or one of the genes DRB3, DRB4 and DRB5. There are 4 related pseudogenes: DRB2, DRB6, DRB7, DRB8 and DRB9.

We try now to look for MHC class I genes in Ophuirids and Crinoïds. The HLA-C gene (we looked for) belongs also to the HLA complex: it helps the immune system to distinguish the body own proteins from proteins made by foreign invaders such as viruses and bacteria [11-13].

Although all efforts to find in Invertebrates a Major Histocompatibility Complex System have been unsuccessful, we find today, for the first time, a MHC class II gene (HLA-DRB1 gene) in Echinodermata: It's of great novelty. It's a fundamental discovery in the domain of Comparative Immunology.

Query ID	Quer Name	Subject ID	Identity (%)	Length	Mismatch	Gapopen	Query cover (%)	E-value	Bitscore
NM_002124.3	HLA-DRB1	TRINITY_DN4807_c1_g1_i1	90,77	65,00	3	2	5,00	1,00E-15	84,20
>TRINITY_DN4807_c1_g1_i1									
5'CATATAGTTTAGGGGGTTATAAAAAAATGACTCCGGTTACTGACATATTTGGGACCCCAACTGTCCAAAGAAAATTATAGCCCCTATAAATTATAATTTATTA-ATTTTTGTTTTCTCTTGTATAGGGACCAGAGCCAATCCCACTGGAAGTTAGGGCACGAGCAGTCAAAGACCAATTTTAAATGTAAAAAAAAAAAAAAAAAAAAATAAAAAAT-TAAAAAAAAAAAAAAAAAAATAAAAAATTAAAAAAAAAAAAAAAAAAAATAAA3'									

Table 1: First Ophiocomina nigra results.

Query ID	Quer Name	Subject ID	Identity (%)	Length	Mismatch	Gapopen	Query cover (%)	E-value	Bitscore
NM_002124.3	HLA-DRB1	TRINITY_DN20232_c5_g3_i1	83,05	59	9	1	5,00	4,00E-06	52,80
>TRINITY_DN20232_c5_g3_i1									
5'GCATGCCTGTAATCCCAGCTACTTGGGAGGCTGAGGCAGGAGAATCACTTGAACCCAGGAGGCAGAGGTTGTGGTGAGCCGAGATCATGCCATCGCACTCCAGCCTGGG-CAATAAGAGCGAAACTCCGGTCTCAAACAAACAAACAAAAAACAAAACAAAAACAAACAAAAAACAAAACAAAAACAAACAAAAAACAAAACAAA3'									

Table 2: Second Ophiocomina nigra results.

References

1. Janeway CA, Travers P, Walport M, Shlomchik MJ (2001) Immunobiology New York Garland Sciences ed.
2. Holling TM, Schooten E, Elsen PJ (2004) Function and regulation of MHC class II molecules in T lymphocytes: of mice and men. Hum.Immunol 65: 282-289.
3. Leclerc M (2018) The complement system in Echinodermata includes the Lectin Pathway. Arch Immunol Allergy 1: 1-2.
4. Leclerc M (2016) Evidence of Fab gene in an Invertebrate: Ophiocomina nigra (Echinodermata). E.C Microbiol 3: 539-541.
5. Leclerc M (2016) Evidence of Fc receptor gene in an Invertebrate: Ophiocomina nigra (Echinodermata). E.C Microbiol 4: 759-760.
6. Leclerc M, Letourneur F, DavoultD, Jolly A, Grange P, et al. (2018) Evidence of immune genes in the crinoïd: Antedon bifida. Evidence of aA.bifidaIGKappa gene, Fc receptor gene. Int. J.Vaccine Res 3: 1-2.
7. Vincent N,Osteras M,Otten P, Leclerc M (2014) A new gene in A. Rubens A sea star IGKappa gene. Meta Gene 2: 320-22.
8. Grabherr MG, Haas BJ, Yassour M, Levin JZ, Thompson DA, et al. (2011) Full-length transcriptome assembly from RNA-seq data without a reference genome. Nat Biotechnol 29: 644-652.
9. Altschul SF, Gish W, Miller W, Myers EW, Lipman DJ et al. (1990) Basic local Alignment search tool. J Mol Biol 215: 403-410.
10. Leclerc M, Jolly A, Grange P (2018) Evidence of complement genes in the crinoïd A. Bifida. Comparisons with other Echinodermata. Int. J Biotech and Bioeng 5: 17-18.
11. Hiby SE, Walker JJ, O'shaughnessy KM, Redman CW, Carrington M, et al (2004) Combinations of material KIR and fetal HLA-C genes influence the risk of pre-eclampsis and reproductive success. J Exp. Med 200: 957-965.
12. Khakoo SI, Thio CL, Martin MP, Brooks CR, Gao X, et al. (2004) HLA and NK cell inhibitory receptor genes in resolving hepatitis C virus infection. Science 305: 872-874.
13. Nair RP, Stuart PE, Nistor I, Hiremagalore R, Chia NVC, et al. (2006) Sequence and haplotype analysis supports HLA-C as the psoriasis susceptibility 1 gene. Am J Hum Genet 78: 827-851.

Journal of Anesthesia & Clinical Care

Journal of Addiction & Addictive Disorders

Advances in Microbiology Research

Advances in Industrial Biotechnology

Journal of Agronomy & Agricultural Science

Journal of AIDS Clinical Research & STDs

Journal of Alcoholism, Drug Abuse & Substance Dependence

Journal of Allergy Disorders & Therapy

Journal of Alternative, Complementary & Integrative Medicine

Journal of Alzheimer's & Neurodegenerative Diseases

Journal of Angiology & Vascular Surgery

Journal of Animal Research & Veterinary Science

Archives of Zoological Studies

Archives of Urology

Journal of Atmospheric & Earth-Sciences

Journal of Aquaculture & Fisheries

Journal of Biotech Research & Biochemistry

Journal of Brain & Neuroscience Research

Journal of Cancer Biology & Treatment

Journal of Cardiology: Study & Research

Journal of Cell Biology & Cell Metabolism

Journal of Clinical Dermatology & Therapy

Journal of Clinical Immunology & Immunotherapy

Journal of Clinical Studies & Medical Case Reports

Journal of Community Medicine & Public Health Care

Current Trends: Medical & Biological Engineering

Journal of Cytology & Tissue Biology

Journal of Dentistry: Oral Health & Cosmesis

Journal of Diabetes & Metabolic Disorders

Journal of Dairy Research & Technology

Journal of Emergency Medicine Trauma & Surgical Care

Journal of Environmental Science: Current Research

Journal of Food Science & Nutrition

Journal of Forensic, Legal & Investigative Sciences

Journal of Gastroenterology & Hepatology Research

Journal of Gerontology & Geriatric Medicine

Journal of Genetics & Genomic Sciences

Journal of Hematology, Blood Transfusion & Disorders

Journal of Human Endocrinology

Journal of Hospice & Palliative Medical Care

Journal of Internal Medicine & Primary Healthcare

Journal of Infectious & Non Infectious Diseases

Journal of Light & Laser: Current Trends

Journal of Modern Chemical Sciences

Journal of Medicine: Study & Research

Journal of Nanotechnology: Nanomedicine & Nanobiotechnology

Journal of Neonatology & Clinical Pediatrics

Journal of Nephrology & Renal Therapy

Journal of Non Invasive Vascular Investigation

Journal of Nuclear Medicine, Radiology & Radiation Therapy

Journal of Obesity & Weight Loss

Journal of Orthopedic Research & Physiotherapy

Journal of Otolaryngology, Head & Neck Surgery

Journal of Protein Research & Bioinformatics

Journal of Pathology Clinical & Medical Research

Journal of Pharmacology, Pharmaceutics & Pharmacovigilance

Journal of Physical Medicine, Rehabilitation & Disabilities

Journal of Plant Science: Current Research

Journal of Psychiatry, Depression & Anxiety

Journal of Pulmonary Medicine & Respiratory Research

Journal of Practical & Professional Nursing

Journal of Reproductive Medicine, Gynaecology & Obstetrics

Journal of Stem Cells Research, Development & Therapy

Journal of Surgery: Current Trends & Innovations

Journal of Toxicology: Current Research

Journal of Translational Science and Research

Trends in Anatomy & Physiology

Journal of Vaccines Research & Vaccination

Journal of Virology & Antivirals

Archives of Surgery and Surgical Education

Sports Medicine and Injury Care Journal

International Journal of Case Reports and Therapeutic Studies

Submit Your Manuscript: http://www.heraldopenaccess.us/Online-Submission.php

Herald Scholarly Open Access, 2561 Cornelia Rd, #205, Herndon, VA 20171, USA.
Tel: +1 202-499-9679; E-mail: info@heraldsopenaccess.us
http://www.heraldopenaccess.us/