**Comparative genome analyses reveal distinct structure in the saltwater crocodile MHC**

PLOS ONE

Weerachai Jaratlerdsiri1, Janine Deakin2,3, Ricardo Godinez M.4,14, Xueyan Shan5, Daniel G. Peterson6, Sylvain Marthey7, Eric Lyons8, Fiona M. McCarthy9, Sally R. Isberg1,10, Damien P. Higgins1, Amanda Y. Chong1, John St John11, Travis C. Glenn12, David A. Ray5,6,13, Jaime Gongora1,\*

*1 Faculty of Veterinary Science, University of Sydney, Sydney, New South Wales 2006, Australia*

*2 Evolution Ecology and Genetics, Research School of Biology, Australian National University, Canberra, Australian Capital Territory 2601, Australia*

*3 Institute for Applied Ecology, University of Canberra, Canberra, Australian Capital Territory 2601, Australia*

*4 Department of Organismic and Evolutionary Biology, Harvard University, Cambridge, Massachusetts 02138, United States of America*

*5 Department of Biochemistry, Molecular Biology, Entomology and Plant Pathology, Mississippi State University, Mississippi State, Mississippi 39762, United States of America*

*6 Institute for Genomics, Biocomputing and Biotechnology (IGBB), Mississippi State University, Mississippi State, Mississippi 39762, United States of America*

*7 Animal Genetics and Integrative Biology, INRA, UMR 1313 Jouy-en-Josas 78352, France*

*8 School of Plant Science, University of Arizona, Tucson, Arizona 85721, United States of America*

*9 School of Animal and Comparative Biomedical Sciences, University of Arizona, Tucson, Arizona 85721, United States of America*

*10 Center for Crocodile Research, P.O. Box 329, Noonamah, Northern Territory 0837, Australia*

*11 Department of Biomolecular Engineering, University of California, Santa Cruz, California 95064, United States of America*

*12 Department of Environmental Health Science, University of Georgia, Athens, Georgia 30602, United States of America*

*13 Current Address: Department of Biological Sciences, Texas Tech University, Lubbock, Texas 79409, United States of America*

*14 Department of Genetics, Harvard Medical School, 77 Louis Pasteur Ave., Boston, Massachusetts 02115, United States of America*

\* Corresponding author: Phone: +61-2 9036 9348. Fax: +61-2 9351 3957. E-mail: [jaime.gongora@sydney.edu.au](mailto:jaime.gongora@sydney.edu.au)

**Table S3.** List of GenBank sequences (MHC class I and II variants) used for the current phylogenetic analyses

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Dataset** | **Class** | **Species** | **Variant name** | **Accession**  **no.** |
| MHC class I | Reptilia | *Crocodylus porosus* (saltwater crocodile) | *Crpo01* | HQ158304 |
| exons 3 and 4 |  |  | *Crpo05* | HQ158308 |
| [1] |  | *Crocodylus acutus* (American crocodile) | *Crac04* | HQ158328 |
|  |  |  | *Crac05* | HQ158329 |
|  |  | *Crocodylus palustris* (mugger crocodile) | *Crpa01* | HQ158330 |
|  |  |  | *Crpa02* | HQ158331 |
|  |  |  | *Crpa03* | HQ158332 |
|  |  | *Crocodylus siamensis* (Siamese crocodile) | *Crsi02* | HQ158334 |
|  |  | *Crocodylus jonsoni* (freshwater crocodile) | *Crjo01* | HQ158348 |
|  |  | *Crocodylus mindorensis* (Philippine crocodile) | *Crmi02* | HQ158355 |
|  |  |  | *Crmi03* | HQ158356 |
|  |  | *Mecistops cataphractus* (African slender- snouted | *Meca01* | HQ158366 |
|  |  | crocodile) | *Meca02* | HQ158367 |
|  |  | *Alligator mississippiensis* (American alligator) | *Almi01* | HQ158319 |
|  |  | *Alligator sinensis* (Chinese alligator) | *Alsi01* | HQ158339 |
|  |  |  | *Alsi03* | HQ158341 |
|  |  | *Caiman crocodylus* (spectacled caiman) | *Cacr01* | HQ158335 |
|  |  |  | *Cacr02* | HQ158336 |
|  |  | *Caiman latirostris* (broad-snouted caiman) | *Cala02* | HQ158361 |
|  |  |  | *Cala03* | HQ158362 |
|  |  |  | *Cala05* | HQ158364 |
|  |  | *Melanosuchus niger* (black caiman) | *Meni02* | HQ158358 |
|  |  | *Sphenodon punctatus* (tuatara) | *Sppu-U\*01* | DQ145788 |
|  |  |  | *Sppu-U\*02* | DQ145789 |
|  | Aves | *Gallus gallus* (chicken) | *BFa1* | AL023516 |
|  |  |  | *BFa2* |  |
|  |  | *Coturnix japonica* (quail) | *Coja-B1* | AB078884 |
|  |  |  | *Coja-D1* |  |
|  |  |  | *Coja-D2* |  |
|  |  |  | *Coja-E* |  |
|  |  | *Anas platyrhynchos* (mallard) | *Anpl-UAA* | AY885227 |
|  |  |  | *Anpl-UBA* |  |
|  |  |  | *Anpl-UDA* |  |
|  | Osteichthyes (outgroup) | *Oncorhynchus mykiss* (rainbow trout) | *Onmy-UBA* | AF287487 |
|  |  |  |  |  |
|  |  |  |  |  |
| (Cont.) |  |  |  |  |
|  |  |  |  |  |
| **Dataset** | **Class** | **Species** | **Variant name** | **Accession**  **no.** |
| MHC class IIA | Reptilia | *Crocodylus niloticus* (Nile crocodile) | *Crni-DA01* | GU126929 |
| exons 2 and 3 |  | *Crocodylus acutus* (American crocodile) | *Crac-DA01* | GU126934 |
| [2] |  | *Crocodylus palustris* (mugger crocodile) | *Crpa-DA01* | GU126942 |
|  |  | *Crocodylus siamensis* (Siamese crocodile) | *Crsi-DA01* | GU126944 |
|  |  | *Crocodylus rhombifer* (Cuban crocodile) | *Crrh-DA01* | GU126951 |
|  |  | *Crocodylus jonsoni* (freshwater crocodile) | *Crjo-DA01* | GU126954 |
|  |  | *Crocodylus novaeguineae* (New Guinea crocodile) | *Crno-DA02* | GU126953 |
|  |  | *Crocodylus moreletii* (Morelet's crocodile) | *Crmo-DA02* | GU126938 |
|  |  | *Crocodylus mindorensis* (Philippine crocodile) | *Crmi-DA01* | GU126950 |
|  |  | *Osteolaemus tetraspis* (Dwarf crocodile) | *Oste-DA02* | GU126936 |
|  |  | *Mecistops cataphractus* (African slender- snouted | *Meca-DA01* | GU126931 |
|  |  | crocodile) |  |  |
|  |  | *Paleosuchus palpebrosus* (Cuvier's dwarf caiman) | *Papa-DA01* | GU126941 |
|  |  | *Caiman yacare* (Yacare caiman) | *Caya-DA01* | GU126955 |
|  |  | *Caiman latirostris* (broad-snouted caiman) | *Cala-DA01* | GU126948 |
|  |  | *Melanosuchus niger* (black caiman) | *Meni-DA01* | GU126939 |
|  |  | *Caiman crocodilus* (caiman) | *Cacr-A* | AF256650 |
|  | Aves | *Gallus gallus* (chicken) | *Gaga-BLA* | AY357253 |
|  |  | *Anas platyrhynchos* (mallard) | *Anpl-DRA* | AY905539 |
|  | Mammalia | *Felis catus* (domestic cat) | *Feca-DRA* | EU915361 |
|  |  | *Zalophus californianus* (sea lion) | *Zaca-DRA* | AY491455 |
|  |  | *Sus scrofa* (pig) | *SLA-DRA\*01* | DQ883224 |
|  |  | *Capra hircus* (goat) | *Cahi-DRA* | AB008754 |
|  |  | *Ovis aries* (sheep) | *Ovar-DRA* | FM986335 |
|  |  | *Macaca fascicularis* (macaque) | *Mafa-DRA* | AB306651 |
|  |  | *Macaca mulatta* (rhesus monkey) | *Mamu-DRA* | NM\_001134298 |
|  |  | *Mus musculus* (mouse) | *H2-Ea* | BC106107 |
|  |  | *Homo sapiens* (human) | *HLA-DRA* | NM\_019111 |
|  |  |  | *HLA-DQA1* | NM\_002122 |
|  |  |  | *HLA-DOA* | NM\_002119 |
|  |  |  | *HLA-DPA1* | NM\_033554 |
|  | Osteichthyes (outgroup) | *Oncorhynchus mykiss* (rainbow trout) | *Onmy-DAA* | FR688130 |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| (Cont.) |  |  |  |  |
|  |  |  |  |  |
| **Dataset** | **Class** | **Species** | **Variant name** | **Accession**  **no.** |
| MHC class IIB | Reptilia | *Crocodylus porosus* (saltwater crocodile) | *Crpo-DB01* | GU126912 |
| exon 3 |  |  | *Crpo-DB04* | GU126915 |
| [2] |  |  | *Crpo-DB08* | GU126919 |
|  |  | *Crocodylus niloticus* (Nile crocodile) | *Crni-DB02* | GU126822 |
|  |  |  | *Crni-DB03* | GU126823 |
|  |  |  | *Crni-DB05* | GU126825 |
|  |  | *Crocodylus intermedius* (Orinoco crocodile) | *Crin-DB01* | GU126890 |
|  |  |  | *Crin-DB04* | GU126893 |
|  |  |  | *Crin-DB06* | GU126895 |
|  |  | *Crocodylus acutus* (American crocodile) | *Crac-DB01* | GU126827 |
|  |  |  | *Crac-DB02* | GU126828 |
|  |  |  | *Crac-DB03* | GU126829 |
|  |  |  | *Crac-DB06* | GU126832 |
|  |  | *Crocodylus palustris* (mugger crocodile) | *Crpa-DB01* | GU126833 |
|  |  |  | *Crpa-DB03* | GU126835 |
|  |  | *Crocodylus siamensis* (Siamese crocodile) | *Crsi-DB02* | GU126846 |
|  |  |  | *Crsi-DB03* | GU126847 |
|  |  | *Crocodylus rhombifer* (Cuban crocodile) | *Crrh-DB01* | GU126896 |
|  |  |  | *Crrh-DB05* | GU126900 |
|  |  | *Crocodylus jonsoni* (freshwater crocodile) | *Crjo-DB01* | GU126804 |
|  |  |  | *Crjo-DB02* | GU126805 |
|  |  |  | *Crjo-DB03* | GU126806 |
|  |  |  | *Crjo-DB04* | GU126807 |
|  |  | *Crocodylus novaeguineae* (New Guinea | *Crno-DB01* | GU126909 |
|  |  | crocodile) | *Crno-DB03* | GU126911 |
|  |  | *Crocodylus moreletii* (Morelet's crocodile) | *Crmo-DB02* | GU126921 |
|  |  |  | *Crmo-DB04* | GU126923 |
|  |  | *Crocodylus mindorensis* (Philippine crocodile) | *Crmi-DB02* | GU126810 |
|  |  |  | *Crmi-DB03* | GU126811 |
|  |  | *Osteolaemus tetraspis* (Dwarf crocodile) | *Oste-DB01* | GU126836 |
|  |  |  | *Oste-DB05* | GU126840 |
|  |  |  | *Oste-DB06* | GU126841 |
|  |  | *Mecistops cataphractus* (African slender- snouted | *Meca-DB01* | GU126849 |
|  |  | crocodile) | *Meca-DB03* | GU126851 |
|  |  |  | *Meca-DB07* | GU126855 |
|  |  | *Paleosuchus palpebrosus* (Cuvier's dwarf caiman) | *Papa-DB02* | GU126858 |
|  |  |  |  |  |
| (Cont.) |  |  |  |  |
|  |  |  |  |  |
| **Dataset** | **Class** | **Species** | **Variant name** | **Accession**  **no.** |
| MHC class IIB |  | *Alligator mississippiensis* (American alligator) | *Almi-DB01* | GU126813 |
| exon 3 |  |  | *Almi-DB03* | GU126815 |
| [2] |  |  | *Almi-DB04* | GU126816 |
|  |  |  | *Almi-DB05* | GU126817 |
|  |  | *Alligator sinensis* (Chinese alligator) | *Alsi-DB01* | GU126880 |
|  |  |  | *Alsi-DB04* | GU126883 |
|  |  | *Caiman yacare* (Yacare caiman) | *Caya-DB01* | GU126903 |
|  |  |  | *Caya-DB02* | GU126904 |
|  |  |  | *Caya-DB03* | GU126905 |
|  |  |  | *Caya-DB05* | GU126907 |
|  |  | *Caiman crocodylus* (spectacled caiman) | *Cacr-DB02* | GU126865 |
|  |  |  | *Cacr-DB04* | GU126867 |
|  |  | *Caiman latirostris* (broad-snouted caiman) | *Cala-DB01* | GU126871 |
|  |  |  | *Cala-DB03* | GU126873 |
|  |  |  | *Cala-DB07* | GU126877 |
|  |  | *Melanosuchus niger* (black caiman) | *Meni-DB03* | GU126888 |
|  |  | *Sphenodon punctatus* (tuatara ) | *Sppu-DAB\*03* | DQ124235 |
|  |  |  | *Sppu-DAB\*05* | DQ124237 |
|  |  |  | *Sppu-DAB\*06* | DQ124238 |
|  | Aves | *Gallus gallus* (chicken) | *BLB1* | AL023516 |
|  |  |  | *BLB2* |  |
|  |  | *Coturnix japonica* (quail) | *Coja-DAB1* | AB078884 |
|  |  |  | *Coja-DBB1* |  |
|  |  |  | *Coja-DCB1* |  |
|  |  |  | *Coja-DDB1* |  |
|  |  |  | *Coja-DEB1* |  |
|  |  |  | *Coja-DFB1* |  |
|  |  |  | *Coja-DGB1* |  |
|  |  | *Phasianus colchicus* (pheasant) | *Phco-DAB1* | AJ224349 |
|  |  |  | *Phco-DAB2* | AJ224348 |
|  | Osteichthyes (outgroup) | *Oncorhynchus mykiss* (rainbow trout) | *Onmy-DAB* | OMU20944 |

**References**

1. Jaratlerdsiri W, Isberg SR, Higgins DP, Ho SY, Salomonsen J, et al. (2014) Evolution of MHC class I in the Order Crocodylia. Immunogenetics 66: 53-65.

2. Jaratlerdsiri W, Isberg SR, Higgins DP, Miles LG, Gongora J (2014) Selection and trans-species polymorphism of Major Histocompatibility Complex class II genes in the Order Crocodylia. PLOS ONE 9: e87534.