

Title: Sex steroids and steroidogenesis-related genes in the sea cucumber, *Holothuria scabra* and their potential role in gonad maturation

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Figure S1

A	<i>Oncorhynchus mykiss</i>	VAR-QSTQGDMLQMLKIPLVKGAL KET LRLHPVAVSLQRYITEIIVQNIYHPCGTLVQ
	<i>Rattus norvegicus</i>	AAR-RQAQGDMAKMVQLVPLLKASIKETLRLLHPISVTLQRYIVNDLVLRNYIKPAKTLVQ
	<i>Homo sapiens</i>	AAR-HQAQGDMATMLQLVPLLKASIKETLRLLHPISVTLQRYIVNDLVLRDYMIPAKTLVQ
	<i>Macaca mulatta</i>	AAR-RQAQGDMATMLQLVPLLKASIKETLRLLHPISVTLQRYIVNDLVLRGYMIPAKTLVQ
	<i>Capitella teleta</i>	KIV-PQDERITPEVLSKMKYTKACKLKEFRLFPITFATSRVMIHEIEILGGYHIPKGTHCQ
	<i>Octopus vulgaris</i>	KIV-GPGEELTPAKLTSIPLVKACKLEALRIYPTIFATSRVTNKDIEVCGYHIPAGTHVQ
	<i>Lottia gigantea</i>	TVL-PNKEDVTPQALSCLPYVKAVLKEFTRKYPTITFATSRFLENLEVGGYNIPAGTHVQ
	<i>Mizuhopecten yessoensis</i>	NVL-PYKEAITPETLNKLPYIKAVIKETFRLYPTIFATSRFVQKDIEVGGYNIPAGTHVQ
	<i>Crassostrea virginica</i>	RVL-PNKETITPEKLSQLQYKAVVKEFTRLYPTIFATTRYLAEDTEVAGYIPAGTHVQ
	<i>Crassostrea gigas</i>	LVL-PNNEAITPEKLSQLQYKAVVKEFTRLYPTFTTSRYLEEDLEIGGYNIPAGTHVQ
	<i>Daphnia pulex</i>	SVIGPKGSPITSNALNNLPYLKACIKESFRLMPAANANARITDKDLVLSGYIPKGLSVV
	<i>Daphnia magna</i>	SVVGPKGSTATASALNSLPYLKACIKESFRLMPAANANARITDKDLVLSGYIIPKGLTVA
	<i>Branchiostoma floridae</i>	EVV-PPGQPIDDRVLNKMSYLRAVFKETSRLYPTIFFNARTLTRDVLSGYHVPKATQII
	<i>Branchiostoma belcheri</i>	EVV-PPGQPIDDKILNRMHYLRVAVKETFRVYPTVGNRLTRDRIIVLSGYVVPARTVIF
	<i>Saccoglossus kowalevskii</i>	SVL-ANSQEMTLESQNIPLYKACVKEFTHRMMPITDGTTRIPDKDILVSGHFIPAKTVVR
	<i>Acanthaster planci</i>	RVL-PAGTPATAEALQITPYLKAVVKEFTRVFPVVGTSRYSNDIDAVRGYIPANTLVR
	<i>Strongylocentrotus purpuratus</i>	QAL-PPGTKITAQSLQNLPLYLKACIKETVRVFTPDGTRIPSRREIALAGYRIPDITIVR
	<i>Holothuria scabra</i>	RVL-PPGTPITPEALQMLPLYKAFVKESTRLPFTVGTSTRLDITDITLSGYNIIPANTIIIR
	<i>Apostichopus japonicus</i>	RVL-SPDEPVPTEVLOMLPLYKACVKEFARLFTTIDGTSRILDKNITLSGYNIPANSIIR
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B	<i>Branchiostoma belcheri</i>	VDTTLRGHRIPQGTWIMPNLWAVHHDPDTWGDPPDVF R PERFLDENGK-PIPKPP-----
	<i>Branchiostoma floridae</i>	VDTTLRGYQIPKGTWVVPNLWALHRDPDTWGDPPDVF R PERFLDENGK-PVPKPA-----
	<i>Saccoglossus kowalevskii</i>	VDSSIGGYLIPKNTWVMVNLWAVQMDKHMNDNPQ F RPERFLDKDGS-LKAKQD-----
	<i>Acanthaster planci</i>	EDTTLAGYDIPKGTVMVIDILALHNDTKEWNEPEK F KPERFLDDNGQLLSKLPE-----
	<i>Strongylocentrotus purpuratus</i>	RDTEFGGYHIPKGTVVFINTHSMHYDPQEWQDQ F KPERFLDHGDSGT-VREHPP-----
	<i>Holothuria scabra</i>	TDVTFRGYHIPKGTWVLPNIYSHHFDKLLWGDPENFPR E HFDETGGS-VROHPE-----
	<i>Apostichopus japonicus</i>	ADVELGGYTIPOKTDWLVNIIYSHHYDEKLWDDPK F TFEHLDES G K-VRLHPE-----
	<i>Lottia gigantea</i>	CDTTLGEYEQKGTTLINTHALHMDPETHGDPEV F RPERFLDEDEGS-LAPKTM-----
	<i>Mizuhopecten yessoensis</i>	NDSKLYEYDIPKGTVMVINHNLHNDPKHMKDPS F DPK R FLDSDGN-LAPKPV-----
	<i>Crassostrea gigas</i>	CDSQVGGYDIPKGTTLINYNALHNDPKQMKDPE F DP R FLDENGKMKPTKPD-----
	<i>Crassostrea virginica</i>	CDSQVGGYDIPKGTTLINYNALHNDPKQMPDPT F KDPSRYLDENGKLESTKPA-----
	<i>Orbicella faveolata</i>	CDTTLGGYDVPKDPTMLINTWAMHHDKEWEP E VFN P ERFLDKEGFGSSERKVSAAAGV
	<i>Pocillopora damicornis</i>	CDTTLGGYDVPKDPTMLISNIWAMHHDKNEWQNP E VFDP S RFLLDKDGKLLGSEK R FSAAGV
	<i>Stylophora pistillata</i>	CDTTLGGYDVPKDPTMLISNIWAMHHDKEWLN P EV F DP S RFLLDKDGKLLGSEK R FSAAGV
	<i>Xenopus laevis</i>	QESSIAEYTIPOQARVVINHLWSLHHDPNWEN E EP F N P ERFLDENGNHVS P SQ-----
	<i>Danio rerio</i>	QDSSVGEYTIYQKGTVVINHLWSLHHDKEWKN P EL F DP R FLNEEGDGLCC P SG-----
	<i>Sus scrofa</i>	LDSSIGEFTTDKDDVNNLMALHMHKEWLN R DP L F M PERFLDPTGTQLIS P SL-----
	<i>Homo sapiens</i>	VDSSIGEFAVDKQTEVITNLHMHHEWLNQD F M P ERFLNPAGTQLIS P SV-----
	<i>Rattus norvegicus</i>	VDSSIGEFTVPKDTWVNNLMALHHDENE D QD P F M PERFLDPTGSLIT P TQ-----
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C	<i>Mizuhopecten yessoensis</i>	-----SRLDREAKNDVTIGNIRIPKGMIIINPVGAIHMDPEYVPEPE K F D PER F T P E
	<i>Crassostrea virginica</i>	-----TRTNRCNSEEIVIDGVKIPKNIELVFI F AIHRDPNYVPEPE K F D PER F T P E
	<i>Crassostrea gigas</i>	-----TRINRSLNDEMIDINGIKIPKETELTFPVFAIHRDPEFWEPE K F D PER F T P E
	<i>Mytilus edulis</i>	-----PRINRRAKSDITVNGMFIPOKTDVITIPISALHNRNPYVPEPE K F D PER F T D E
	<i>Oryzias latipes</i>	-----ARLERVAKATVEVNLVIPKDMVMVPTWPIQRDP E LVPEPE K F P ER F SK E
	<i>Mus musculus</i>	-----TRLERVCKDVELVNGVYIPKGSVMVIPS Y ALHHD P QHMDPEEF Q PER F SK E
	<i>Sus scrofa</i>	-----ARLERACKDVEIHGVFPKGTVVVPVFLHRDPDLWPEEF R PER F SK K
	<i>Macaca fuscata</i>	-----MRLERVCKDVEINGIFIPKGVVMVIPS Y ALHHD P KYVPEPE K FL P ER F N K
	<i>Saccoglossus kowalevskii</i>	-----SRFNRECNQDVNINGINIPKGMTVS P SYV I HHD P DNYP D E K F I PER F T K E
	<i>Holothuria scabra</i>	-----SVADRVCTEDITINDVKFSKGDSIFYNIYLSLHDSRYWED P K F DPER F SK E
	<i>Apostichopus japonicus</i>	TS E TGAHHVGADRVQDSVTVGD F HEKGM D IFYNIIGIHYDPDYNWED P K F DPER F T K E
	<i>Acanthaster planci</i>	-----VIFDRCNMEITITVDGLTIEKGNNVFSVLWTLHYDE F WNP N PT K F D PER F SK E
	<i>Strongylocentrotus purpuratus</i>	-----VMGDRCSETHVNGLTIEKVQFLYSIYIQDPTLWPEPE K F D PS R FT K E
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	<i>Mizuhopecten yessoensis</i>	AKANRDPFV F M F PGAGPRNCV G MRLLALLAMKIAIVRIQLQNYRPVSPKTEIPINN V SKMGN
	<i>Crassostrea virginica</i>	NKANRHPYV V LPFGHGPRNCIGQRLAAMEAKCAIYVILQHYRFVTC E ETPLKLNKEAL
	<i>Crassostrea gigas</i>	NKANRHPYV V LPFGHGPRNCIGQRLAAMEAKCAIYVILQHYRFVTC E ETPLKLNKEAL
	<i>Mytilus edulis</i>	NKATRPMYS V LPFGLGPRVCIGMRLLAIETKALYSTVQNF K VVSGKTEIP M PLE K FI
	<i>Oryzias latipes</i>	TKETFDPT Y MPFGAGPRNCIGMRFAVLSMKLALVELIQQYS V SVCKETEIP F ELDIQGL
	<i>Mus musculus</i>	NKGSIDPYV V LPFGIGPRNCIGMRFAVLMNMKLAVTKLVQNF S FQ P CQ E TQ I PLKLSRQGI
	<i>Sus scrofa</i>	NKDTINPY T YLPFGTGRNCIGMRFAVLMNMKLALVKVLQNF S FK P CK E TQ I PLKLTQGL
	<i>Macaca fuscata</i>	NNNDIDPY I YTPFGSGPRNCIGMRFAVLMNMKLAIIRLVQNF S FK P CK E TQ I PLKLRLLGL
	<i>Saccoglossus kowalevskii</i>	EKEKRHPY A IPFGAGPRNCIGMRFAVLEAKIGLVRVLQ K TFEP C A E TEIP V FG Q LI
	<i>Holothuria scabra</i>	NKDKIHP F AYLPFGTGRNCIGMRFAVLVKTLARV V Q K FE P CE K TQ I PV L G K RSI
	<i>Apostichopus japonicus</i>	ATEKRHP F AYLPFGTGRNCIGMRFAVLLVLMKAIVR M V T Q F EP C EQ T Q I PK F G K RSV
	<i>Acanthaster planci</i>	NKASIK P CTY M PF G GRNCIGMRFAVLL E SKMALVRVLQ K YR F DV S SE T EP T L G K T G F
	<i>Strongylocentrotus purpuratus</i>	NRANRHP F AI P FGAGPRNCIGMRFAVLEIKMAVRILQ K YR F V S PK T DI P V K GT G NT
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Figure S2

A

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Neodiprion lecontei ----PGIVLGGCGFIGRNLVEYLLDNEL--VSYYRVVDKV-PPQTAWLNKKHQRIFEH
Holothuria scabra ----SRVLILGGTGFIGRHMVKYLLQNEL--TTKIRVVDKT-PIEMAWMNEEHK----
Ixodes scapularis ----YRFLVLGGTGFIGRHLVDFLKHNLL--ATKIRVVDKV-PPQMGWLNANHKVVFED
Aedes aegypti ----EVILITGGAGFLGQHILRTLQERDP-KVREIRVVDLK-PYE---NILGHI---DT
Danio rerio ----LTYVITGGCGFLGQHLLRVLLEKKK-NVKEIRLFDKNVFPs---LQSEST---ED
Oryzias latipes ----DVCVVTGACGFLGKRLVRLLEEEE--TAEIRLLDKHVPQQVLQSLQEDCR---GG
Mus musculus ----WSCLVTGAGGFLGQRIVQLLMQEKD--LEEIRVLDFKFRPETREQFFNLD---TN
Rattus norvegicus ----WSCLVTGAGGFLGQRIVQLLVQEKD--LKEVRVLDFKFRPETREFFNLTG---TS
Homo sapiens ----WSCLVTGAGGFLGQRIVRLVVEEKE--LKEIRALDKAFRPELREEFSKLQ---NR
Ovis aries ----WSCLVTGGGGFLGRRRIICLLVEEKD--LQEIRVLDFKFRPEVREEFSKLQ---SK
Crassostrea angulata ----CTVTVTGGAGFLGQHVIQHLQLSAP-WVTEIRVFDLI-PFS---RSLDYT---PR
Crassostrea gigas ----CTVLVTGASGFLGQHVKTLHEKAADFVTTYLVLFDKD-TFV---QKLDYK---PK
Tropilaelaps mercedesae GARTTDTVLVTGSSGCLGQHIVKLLQEHDS-TCKNIRLFDVK-PYK---NLLNHA---VQ
Daphnia magna ----EVVLVTGGQGFLGQHIIIRLLQQDPK--VAEIRVIDKK-MFTNRIGFEEKK-----
Apostichopus japonicus ----VTILVTGGAGFLGQHIVKELMEQEVFPVKEIRSFDIQ-PFKWHHGLHPSK---NS
Octopus vulgaris ----QVCVVTGGSGLGQHIVHLLQTKCD-DVREVRTFDIR-PIK---KFLEYE---DN
Mizuhopecten yessoensis ----EVVMVTGGAGFLGQHIIHGLQEKAS-HVSEIRVLDIR-PYS---NKLGHR---ES
Saccoglossus kowalevskii ----DVILVTGASGFVGQHVVKLLMERCR-DVREVRADFIR-PFKWIKELRVTE---TY
Strongylocentrotus purpuratus ----EVVMVTGASGFLGQHILKQLLEQGEFLIKEVRTFDLQ-PFTWCPELEVHN---PT
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Ooceraea biroi EIAKTTQ--DLEVGVLINNAGASYDHPFLFTNVSEELARILQLNVAGVTGVARAVLPGM
Penaeus vannamei ALSATQEKLGKPTLLVNSAGISRRSS--FLEMSEEFMKVVVDNLKGTFLVSQLVCNAM
Branchiostoma belcheri LLTDVTQKFSCAPCIAVNCAGITKDEF--LLKMDNRMFDQVIKVNKGTFLITQAVGRAM
Branchiostoma floridae LLTDVTQKFSCAPCITVNCAGITKDEF--LLKMDNRMFDQVIKVNKGTFLITQAVGRAM
Mizuhopecten yessoensis LIGQLKDKFSAPVPTVTNSAGITRDKL--MLKMSEEDFDEVIRVNLKGTFLVNLQAVGRAL
Crassostrea gigas LLDKIKEKYSSAPHVAVNSAGITRDRT--MMKLTEEDFDKVVVNKGTWLLNKAVGKAM
Miniopterus natalensis ARARVT---EGRVDVLVCNAGRGLHGP--LEAHSADAVGSVLDVNLVGMVQMLQAFLPDM
Carassius auratus AKRNIT---EGRIDILVCNAGVGLMGP--LEAQSLEDAIHAVLDVNLMTLRTIQTFLPDM
Danio rerio AQRNVS---EGRIDILVCNAGVGLMGP--LETHSLDTIRAIMDVNLGTIRTIQTFLPDM
Nanorana parkeri TIEKIK---EQRVDILVCNAGVGLMGP--LECHTYDTMKKIFDVNLFGTIGTIQAFPLPM
Xenopus laevis TTKKIK---EQRVDILVCNAGVGLMGP--LECHSYESMKKLFDVNLFGTISTIQAFPLPM
Strongylocentrotus purpuratus AVKDVFTK-HKRIDILVNNAGHGSSGY--IELVTDQQMRLFDVNFVGVHLIQEVLPIIM
Acanthaster planci VAGEILKE-NGRIDVLVNNAGYGEVDA--IDQLSLEACQAMMDTNFNGTVRTTRAVLPAM
Holothuria scabra -----EGKVDILINNAGYGQSGS--FEHVSLEKCRALFETNFFGAVHLTQQFIPSM
Apostichopus japonicus FAEDILES-EGRVDILINNAGYGQAAT--LENASLEKSRQLFETNFFGAMHLLTQKFIPSM
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Ooceraea biroi --MERKKGVLINVSSLAAPSPYLSVYASAKAYIIKLSADLATEAAP-RGVTVCQVLP
Penaeus vannamei IERGEAKGGSVVNIASLAGRNGLAMNCQYAAATKGGVMAFTKSCAKELAK-TGIRMNCILP
Branchiostoma belcheri VE-GKVPNGSIINMASIVGKVGNLGQCNYAASKAGVEGLTRTSAKELAK-FGIRCNAILP
Branchiostoma floridae VE-GKIQNGSIINMASIVGKVGNLGQCNYAASKAGVEGLTRTSAKELAK-FGIRCNAILP
Mizuhopecten yessoensis VE-SKAKSGSIINISSISGKVGNVGQTNYAASKAGVVGTLTKVAKEMGR-FGIRVNAIPL
Crassostrea gigas L--TNKVQGSIVNISSLVGKTGNIGQTNYAASKAGVIGITKSMKEMGK-FNIRVNAVLP
Miniopterus natalensis ---KRRRSGRILVTGSMGGLMGLPFNAVYCASKFAVEGLCESLAVLLPP-FGIHVSLEIC
Carassius auratus ---KRRRHGRILVTGSMGGLQGLPFNEVYCASKFAVEGACESLAILLQH-FNIHVSLEIC
Danio rerio ---KKRRHGRILVTGSMGGLQGLPFNEVYCASKFAIEGACESLAILLQH-FNIHVSLEIC
Nanorana parkeri ---KQRRSGHIIISGSVGLQGIPIFNDVYCASKFAVEGFCESLAIVLQH-FNVHVSLEIC
Xenopus laevis ---KQRKSGRVIISSSVGLQGIPIFNDIYCASKFAVEGLCESLAIALQH-FNIHVSLEIC
Strongylocentrotus purpuratus ---KKQRSGRIISSVSGGITAWPFGEIYAASKFALEGFTESLSIGYRP-FNIWSSCQP
Acanthaster planci ---KRQKSGRIINVSSIVAVWALPFNTIYAATKFAVEGFTEAIAVTLKRAYNIRMSLVEP
Holothuria scabra ---KKRKSGHILFISSTVTFGIPFCEIYTASKCAVDGVAEALAPSLAL-FNIKVTLICP
Apostichopus japonicus ---KRKSGHIIIFISSTVTFGIPFCEVYTASKCALNGLAETLAPQLAL-FNVKVSIVCP
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S1. List of genes and their amino acid sequences found in *H. scabra* involved in the steroidogenesis pathway. P; Partial sequence, F; Full-length sequence.

Steroidogenic-related genes	Transcripts	Length (aa)	BLAST hit and species	E-value	Accession numbers	Sequences
steroidogenic activator						
steroidogenic acute regulatory protein (StAR)	contig_2100	F/381	steroidogenic acute regulatory protein, mitochondrial-like [Strongylocentrotus purpuratus]	7.00E-69	XP_011660912.1	MADTEQKVEETPAAEPPKPAEEKKPVENGKEETEEAVADGDA KTEEAKEEGGEAKEEEAVENHENGKEGEEEEETPAPSLEAP TENPFTDEDVQQLLDMESGEEGWKVKKEKGVLVYRKAENKS SPLIKGVLEYSIGIPTEKILEFYTDFFVRRKWNKKTINIEVLD EKDDFKIIHSIFKMPGTGCDNRDAVQCTMVRSEEDGSRHVILY KSCNHPSPKPPKSPFPIRADVQLMGAVIRPKEGEGVTTVTFTI NQVNLKGWMPKAFVNVKTVGFPVALYDDLTLYWKKITEPPKS PEKKDKKNKEKNGEENGEAGEEEKNDEKKEEEEEENKEADVE TEKKDEGAAAEAGAAEAGGAPVGEVGGGKLDITADIPAADEE EAK
StAR-related lipid transfer protein	contig_1443	F/184	stAR-related lipid transfer protein [Strongylocentrotus purpuratus]	2.00E-91	XP_789877.3	KEVKVLYKKSTFDGHIYRAECVIDSPAENVIRYILPSPRGL RGKWDKTVKESEVIEKIDEDLIVGRSATHSVAMGLISSRDEV DLITVRRYPPEESIICITNSKSIQRKDCPPKDGFGVGVNYHGGT FCTPVEGEPPDKCYVNVIVQTDLSGMLPKSVVESALPTNLIDF FRDLDEALKDNNLNCT
steroid receptor RNA activator 1	contig_22299	F/238	steroid receptor RNA activator 1 [Oryzteropus afer]	1.00E-24	XP_007937187.1	MADKFSGSGARGWNPMPMLQSAISGQNNSSQPKKQLTQRVT HILPENGPSPPKTDGLKPTEQIPLSAPRPKMPENLPPPPPS ELMKPKETEKGEETTSIGTSSGIPEDLLPTLEEVLSKLLSTLE KCQGLKARVCDVVKRKLNI FEKCMDDDKLSNPVKIQMGKLA TAITDRKYEEANRLHLGLMMNHVSEVSSWMVGIRLIQEAKG ILPEETDTTAQSVDSKQEAPSILIPVTS
androgen-induced gene 1 protein	contig_55776	F/233	androgen-induced gene 1 protein isoform X1 [Strongylocentrotus purpuratus]	2.00E-64	XP_793283.4	ASLFVTTPLHFLLFYHYATTYWFYLTDTKERMYYAARLYTFGG EFKYLTITWMLLQLFYFFWCCVTDLISASASETSVGKAHAV RDWFLAAIVFPITGLVVTTFWAIYSIDRELIFPEALDKFFPS WLNHALHTYVLPDLLVDMLLVNHKYPSPRAGMAGTLAFGFSY LIWVLFGLGFAKDIWVYPFFKVLHGIYFPLFFGVMSLVFLFY IIEKTNALLGGYRKEVSTEKMD

steroid hormone receptor

steroid hormone receptor 3	contig_4954	F/547	steroid hormone receptor 3 [Strongylocentrotus purpuratus]	0.00E+00	NP_001020384.1	MKLPPSKRWSSFHPPHSHCASPSTSPPHYPRSPPLHSLSSPR HVPPLLVPVPGIFQSCSQNKSPVGDPIYFVKSPHSTVIESSYPL TLSPYGHGTLSSPGSLSSLSQPPASLGVSRSAGFLPSPGSIG SGGVMLSPFSAGPTPRPGSTRFPFPPHLSVQTHHMLHDSIE TDSRLAKPSGRGSAGLDSQGHSDSNSEDEALMLCSICSDK ATGLHYGIITCEGCKGFFKRTVQNKRIYTCVGTGNCEVTKAQ RNRCCQYCRFQKCLTMGMLEAVREDRMPGGRNTGLSYKCKPK NYDKLRKKFQQLMAQQAQMNKNRAEKAAIKAAAREANKQGGE NKS KDPTAGSDKRKPEIRQLKPQTAQLVEVLQOTESAVLKI ANKDWREQLKIPSTLELSEFVRLQCMLEQLVFHLVQVVKHL PFFTQLSAVEHTYILKTKWLELLLLCTVTQAMHFRQKSLGSS GNTTNEVGLSFELCAHQNLTLQECMNKTLDLQLDMDVFRE EMGDVVEKITKLAASFRTLDIKRNEYLLKVIIVLLNQANGSH S
steroid hormone receptor spshr2	contig_61406	F/135	steroid hormone receptor spshr2 [Strongylocentrotus purpuratus]	2.00E-57	NP_001116968.1	VKLREDDGTSQGLSQIQAIAAFAPQRPVELCVVCGDKASGR HYGAISCEGCKGFFKRSIRKSLGYTCRGSKECQIIKHNRNRC QYCRLOKCLAMGMSDLQCERSPLKPREKTPDKVVPARTGLFD QGILLNIQP
orphan steroid hormone receptor 2-like	contig_15452	F/316	orphan steroid hormone receptor 2-like [Saccoglossus kowalevskii]	6.00E-122	XP_002739506.2	IRKDIRSPLAATPTFGTDKVPARTGLFDQGILLNIQPNTTST VQPTQTTDTTTLTLASVVTSLASMKGNTEVDGAAGDAQ MVISNGETSTVTVTSPQETSSQISKAFDTLAKALNPADGDG TNSSTSGSEQTLTLSSGGSANNSTEQPLIELEGPMPLTDHTQF KLTTSPMPQYLVNHYICESASRLFLSMHWARSIPAFQALS PDCHTVMVQKCWSELFTLGLAQCAQSMALSTILTAIVNHLQT SLQQDKLTADRVRKAVMEHIWKLQEFVSATSCLCIDQVEFAYL KTIVLFSPDHPGLVNPQVERF
membrane-associated progesterone receptor component	contig_13885	F/175	membrane-associated progesterone receptor component 1 [Strongylocentrotus purpuratus]	7.00E-75	XP_783332.1	MAAVELLKELFLNPINVALLSVCVFLLYKIFAGGRRKPEPPK QPQLPRMKRRDFTLQDLKKYNGVDDERILIAVNGQVFDVTRG KNFYGPDGPYGFIFGGHDASRALATFSLDKDSLPEEYDLSL NAEQMGSVREWHMQFEKYDYVVGKLLKPGEAPTDYSDEESNA EGDKKDS

estrogen-related receptor-like (ERR)	contig_41919	P/205	steroid hormone receptor ERR2-like [Lingula anatina]	3.00E-41	XP_013405267.1	MTSEQAPPQORDAVDLCVRQQTDSSTNNRSQYEGSTRNVR LCLVCSDTATGCHYSVITCEGCKGFFKRTVQKQNLNYTCREGS EGCVIDKLNRRNVQYCRFQKCLQVGMKTEAVREDRMPGGLPK AKRAKVSRRDHGKDRPPSDPEIGTSQQLTRVAEEVDWQSVLKP ILDAGPDLVPDTESLNSDTCSLNEMMKVGYMELNMII
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steroidogenic enzymes

17-beta-hydroxysteroid dehydrogenase type 1	contig_13797	P/212	estradiol 17-beta-dehydrogenase 1 [Miniopterus natalensis]	6.00E-31	XP_016057672.1	LSREGKVDILINNAGYQSGSFEHVSLEKCRALFETNFFGAV HLTQQFIPSMKKRKSGHILFISSTVSTFGIPFCEIYTASKCA VDGVAEALAPSLALFNKVTLICPGPVETNFAPNIIMFGQDE NDEETMDIKNQYLKNNLQQIIGENLQKRDEVAIVKEATEAEK PNLRYTTEKDLQDAKNKLVDTTGNCAIEFLNNSYFKGVKLN SQ
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17-beta-hydroxysteroid dehydrogenase type 2	contig_63395	P/170	estradiol 17-beta-dehydrogenase 2-like [Elephantulus edwardii]	1.00E-41	XP_006888866.1	SCSNRLVTIQMDVTKEDSIQNAVKEVKEKLGQRDLWALVNN GILYMGEAEILSIKFNMMMDVNFMGAVRLTQAFPLMRQSQ GRVVSCLSLGSDVAIPFFGVYCAKALSKSFMVLRLEMLKW NVLVSTIHPVGYKTALLGKENLKNKLEAVYHDMESPLKEDYG PH
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17-beta-hydroxysteroid dehydrogenase type 4	contig_19638	F/738	17 beta hydroxysteroid dehydrogenase 4 [Salmo trutta fario]	0.00E+00	ACN66287.1	MNQGPQEDSNMLRFADRVAVVTGAGGGLGREYALLFASRGAS VVVNDLGGDTKGGGKSSAAADKVVQEIIRDKGGKAVPNYDSVE DGEKIIETALKNFGRVDILVNNAGILRDRSFARTSDQDWDLI HRVHLRGSFLVSRAAWPHMKQNYGRIIMTASAGIYGNFGQ SNYSAAKLGLLGLSNTLAIEGRKNNILCNTIAPLAISRMTE ILPDEMCKMLKPVNVAPLVAYLCHEDSDETGGLEFVGGGWMG KLRWQRANGAVCLSAEGGFSPESVKNWDKITDFDDGIFPAS VVESMTSIVNSIRDAQSSANPSDPPSSSDNPDAIGHKLPTN HFAFTNRDCMLYNLGVGVSTEQPDYLFELNEDFCVLPTF GVIPAFSALQSLSGSVFGLSGVNPARIHGEQFLEIVKPIP TSGTLRNEAVVTDVLDKKSGAVILMDINSYDENDELVVRNQY STFAVSGGGFGGKRSSDKAIPVTKPDRAPDATMSEKTSIDQ AALYRLNGDYNPLHIDPSFAAMGGFDTPIHLGLCTFGYAGR VLKTFCDNDVTKFKAIKVRFSGVVLPQGQTIQTDMMWKEGNRIL FNSKVAETGKDCITGAYVDLFEQAQSQQTSSSGSLKSDLVF SEIGKHLAADSSLYKKVDGIIAYKITSGGAPAKTWTLLDLKTP PGSVYEGDPKGGKADATVTIDDEDFADVAGSGSKNAQTILFQSG KLKASGNIMLLMKMGSLMQRPSKM
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17-beta-hydroxysteroid dehydrogenase type 12	contig_36373, 34365	F/331	estradiol 17-beta-dehydrogenase 12 [Saccoglossus kowalevskii]	9.00E-54	XP_002733503.1	MEDKQLFGRFNTVLAGLGALCALVAAKTAHFLLSIKMFVL RLGTNPKKYGTWAAVTGATDGIGKAYAEQLASKGLNVLLSR TESKLETVASEIRSKYNVETKIIAVDFTGGAEIYSDIAAKLE GLEVGVLVNNVGMSSYSPQFCELPAAEKLIPLSLINVNCLSL TMMTNIVLPSMLSRKKGLIINVASAAGCLPSPLLSIYSGTKA YVDFFSRLNTEYASKGIVVQSVLPFFVVSXMSKIRKSSLT PTATSYVKSALATVGMETRTFGCFMHNLLQGAAGTSTFPESIVK FVVMVMLLGARKRTMKKEEQKREKQKDGKSTNPKKDI
17-beta-hydroxysteroid dehydrogenase type 13	contig_27928	P/280	17-beta-hydroxysteroid dehydrogenase 13-like [Saccoglossus kowalevskii]	3.00E-85	XP_002732320.1	MNFILDFLVDFVILILKLNWYFLEVVSIFVAPPRKSVEGQV VLVTGAGHGIGRVMKKFAEQKAKVVIWDINEAGNSRTAKEI QTLGGEVHSYTVDSNKKDKVYDAAARVKKDVGVKVDILVNNAG ILNGELLLELTDNQIQRVMDINVMHFWTIRAFPLPMISSNK GHVVTISSASGYFGKNFLVDYTASKFAVTGLDEALEVELIKN YNNPDVHLTIIVHPFVIQTGLVHGFTSRFMPMVDEEYAGEAIV DGVLRNRRKVFIKDLRFSIIVKYIFPH
17-beta-hydroxysteroid dehydrogenase type 14	contig_13478	P/162	17-beta-hydroxysteroid dehydrogenase 14-like [Plutella xylostella]	3.00E-70	XP_011558998.1	PLLVTGDISKEEDNVNLVKKTVDDHYGQLDILVNNAGILKLN IETTKLEDFDEMMNVNRSIFQLTQLAVPHLLKTKGNVNNIS SVNGLRSFANVLAYCVSKSAVDQMTSCIALEADRGVRVNSV NPGVVVTELQKRGGLDDEKYAAFLERSKQTHALGRP
3-beta-hydroxysteroid dehydrogenase	contig_33425	P/54	3-beta-hydroxysteroid dehydrogenase, putative [Ixodes scapularis]	6.00E-13	XP_002407062.1	MSSDWIGSRVLILGGTGFIGRHMVKYLLQNELITTKIRVVDKT PIEMAWMNEEHK
steroid 17-alpha-hydroxylase/17,20 lyase	contig_19734	P/379	steroid 17-alpha-hydroxylase/17,20 lyase [Strongylocentrotus purpuratus]	1.00E-117	XP_789963.1	TPTWKLHRKLTYSAFRNLATGNNDRFRERLVFTMTARVAKILE SKGDEEFDPKRIVSLAVYNFIAQMVFGKQYELDDPELLEWQK LSEEGIEVVGNGLLADFFPIFSYIPTPGMRGLKDLVVRYYKL IDKELDRHKAYYNPRDEPKDFIEMLYHARQTMIDEGEEGIDQ ISESHIRQTVMDIFSAGTDTSTFTMHWAIACMVDFPEVQEKV QKEIDEVIGRDRNPRMNDRGSPYTECALYEVFRFSSIAPIA LPHATTITDVTFRGYHIPKGTWVLPNIYSMHFDKKLWGDPENF RPEHFMDETGSVRQHPEGFLPFSTGRRVCLGESVAKAELFLI FTWLFQNFTRKPKAGKEEVMYARVDKSELNPKLSYDIIVSK R

inactive hydroxysteroid dehydrogenase-like protein	contig_48833	P/108	inactive hydroxysteroid dehydrogenase- like protein 1- like [Saccoglossus kowalevskii]	8.00E-39	XP_002733500.1	NINVGAAATMTSIVLPKMVERKKGAIVNISASASIFPNQLA VYAACKTYLDFFSRALQVECRKTGIFVQSLMPSYVATKMTDI SIQGGKKMSLLMPSASEYARHAVS
hydroxysteroid dehydrogenase protein 2	contig_6984	F/415	hydroxysteroid dehydrogenase protein 2 [Daphnia magna]	3.00E-165	KZS05818.1	MAGQLAGKTLFISGASRGIGLAIAERAARDGANIVIAAKTAT PHPKLPGTIIYTAAESIEKAGGRCLPCVVDIRDESARKAAVNE TVAKFGGIDVLVNNASAINLSGTEALDMKRYDLMQSNARGT YLCSKVCVPHLKKSSNPILNLSPPLLMDAKWFKNHVAYTMA KYGMSMCVGLMAEEFKEVGIAVNALWPKTAIYTAAMEMLGGG EHKASCRADICADAAYSIIITKDSRSFTGNFCVDEILRKD GVTDFEKYACQPGHPLQPDFFLDPDNDPTFQGDVSIYSEG GGSKSTPGLGSEVKGMFDLIQNQLNEKVVQATGAVFQFELAG QKGTWHLDLKSGAGAAGPGASSGEPDVIFKMDSKDFVIMFK GELKATSAFMSGKLIKIGDIGKAMKLEKLMGNVKS KM
estrogen sulfotransferase type 1	contig_63795	P/93	estrogen sulfotransferase [Strongylocentrotus purpuratus]	5.00E-11	XP_003726411.2	VIATYSKSGTHWIYEIVQLIRANGYFDKIDRSQMLASTIEMF NIPEMRRPTYEIVHEQKSPRVITTHLPWQFLPKQLTEQKKKGK IVYLNRNPK
estrogen sulfotransferase type 2	contig_71705	P/88	estrogen sulfotransferase- like [Strongylocentrotus purpuratus] □	2.00E-21	XP_793921.2	LSQPETLDALQTFEVRDDVYIVTYPKSGTHWIGEIVALVME DGVVEKVNRELMATALEITLAPSPERVKQSTPGYKIYEKLPS PRLM
NAD(P) dependent steroid dehydrogenase-like	contig_64252	P/136	NAD(P) dependent steroid dehydrogenase- like [Apostichopus japonicus]	2.00E-69	PIK44317.1	FTYVENVVHGHILAEELKPKSRVTGRAYNITNGEPVPFWDF IGRVLTGLNYSAPKISLPFALVFYIALFLQFLCNILKPIIEI NPSLTAPKVTLSATVHYYSIKNANKDLGYQPIVSLDEGLQKT LESFQDLKRS
cytochrome P450 4V2 isoform 1	contig_68628	P/216	cytochrome P450 4V2 [Strongylocentrotus purpuratus]	7.00E-86	XP_799260.2	RRLAFLDLLIEVQKQDPSFTDEGIQEEVDTFMFEGHDTVSTS LTMAMYLIGIHPEVQKKIQEELEKVFNGDRERHVTYEDLQQL EYLSVMKESQRFSLSTVPIVGRDLAEDTKIGGIDVPGAHVA LGIYSLHRDPNQFPKPKDFDPDRFLPSNSEGQHNFAFIPFSG GHRNCIGQKFAVMEQKVILATLLRRIEIKSLQKIDEMRFATE LVLRPV

cytochrome P450 4V2 isoform 2	contig_41285	P/202	putative cytochrome P450 4V2 [Apostichopus japonicus]	8.00E-97	PIK50796.1	GAQTGNNKEYVQAIAMSDLIQERQKYPWLWIDALYGLLPSSG KKHNRYLEILHKMTKSVIYERLGEKHQMNGTKETSKASNNNGS VDKRRKMAFLDLLLEVHEEDSTFTIDDVREEVDTFMFEGHDT TAAAIISWVLFMLGHHPEVQEKVHKELDEVFGSDKDRYVTS IQKLQYLGCVIKETLRMYPSPVPLIGRQLEEDAVL
cytochrome P450 10	contig_59906, 27680	P/364	PREDICTED: cytochrome P450 10 [Strongylocentrotus purpuratus]	7.00E-67	XP_003727902.1	THVHIIEPYDVRELIRLEGVTPRRITLDPLVAYRKLKRKNIG TSNLQGEWRRLRQPFNHLMFKPGQINTYIPKVEECTNDFCT LMRELRTQDGEVPDYMRQVQRWTLTADIVLNTRIGCVDRKY PSKLAERAINSAMHFTTGLGDLMSFPLYKFGIYTETWKNFA TAQDFFFEFVQPYVQDAMESMKKDDERATKLGSEYFRMERDA TFLESLLAMHMDKDLEAISDLLNDLLGAIDTISSMFAFVVY NLSRNPDCQERVYGEINRVLPPTGPITPEALQMLPYLKAFVK ESTRLFPVTDGTSRILDTDITLSGYNIPANTIIRIHSVAGLM SEYVPEPELFPKPERWLRSSDSSIMASP
cytochrome P450 3A24	contig_4256	P/464	putative cytochrome P450 3A24 [Apostichopus japonicus]	0.00E+00	PIK42887.1	FHKFIKQGFVQALQGMRRERHGPYIYIGSTPATILADADIL KEVLIRNFSHFNRRGTKIDDYPLNKALTRLEGARWKFVRNT ITPAFSASKMKPISVLTNRCCDNLIVHMKTLIATNPEFEVKG VYGNMTMDTIAQSAFGLIDSQSNPNPSPFVKHAMAIMNMKLT SPRILMAFWFPQLAPIFNYPFRIGMIPNIHKQFFIDVTSKAVS LRKDPKNKRLDILQLMVDAQENPDKSESEEIPDLAGYKEKDE MKKELTTEELMAQAVVFFLAGFETTNIALSFMVSYLLATHPEI QEKLYQEIQDVSSSAESFSYDVVNKMEYLDMMVSEALRLYPP GSVADRVCTEDITINDVKFSKGDSIFYNISLHHSRYWEDP QKFDPERFSKENKDKIHPFAYLPFGTGPRNCIGMRFAVLVVK TALARVVQKFKFEPCEKTQIPVKLGKRSIMPEIGITLRVIER E

S2. List of amino acid sequences and their accession number for gene characterization and phylogenetic tree analysis.

StAR

>Hsc_StAR[*Holothuria scabra*]

MADTEQKVEETPAAEEPKKPAEEEEKPVENGEEKTEEAVADGDAKTEEAKEEGGEAKEEEAVENHENGKEGEEEEEEETPAPSLEAPTENPF
TDEDVQQLLDMESGEEGWKVKKEKKGVLYRKAENSSPLIKGVLEYSGIPTKILEFYTD FEVRRKWNKKTINIEVLDEKDDFKIIHS
IFKMPTGCDNRDAVQCTMVRSEEDGSRHVILYKSCNHPSKPPKSFPIRADVQLMGAVIRPKEGEEGVTTVTFINQVNLKGWMPKAFVN
KVTVGFPVALYDDLTLYWKKITEPPKSPEKKDKKNKEKNGEENGEAGEEEKNDEKKEEEEEENKEADVETEEKDEGAAAEGAAEAAGEG
APVGEEDGGKLDTADIPAADEEEAK

>Hsa_StAR[*Homo sapiens*; AAB88174.1]

MLLATFKLCAGSSYRHMNRNMKGLRQQAVMAISQELNRRALGGPTPSTWINQVRRRSSLLGSRL EETLYSDQELAYLQQGEEAMQKALGI
LSNQEGWKESQQDNGDKVMSKVVPDVGKVFRLVVVDQPMERLYEELVERMEAMGEWNPVNKEIKVLQKIGKDTFITHELAAEAAGNL
VGPRDFVSVRCAKRRGSTCVLAGMATDFGNMPEQKGVIRAEHGPTCMVLHPLAGSPSKTKLTWLLSIDLKGWLPKSIINQVLSQTQVDF
ANHLLRKRLESHPAPEARC

>Rno_StAR[*Rattus norvegicus*; AAU84904.1]

MFLATFKLCAGSSYRHMNRNMKGLRHQAVLAIGQELNRRALGDPSPGWMGQVRRRSSLLGSQLEATLYSDQELSYIQQGEEAMQKALGIL
NNQEGWKESQQENGDEVLSKVVPGVGKVFRLVLLDQPMDRLYEELVDRMEAMGEWNPVNKEIKVLKKIGKDTVITHELRAAAAGNLV
GPRDFVSVRCTKRRGSTCVLAGMATHFGEMPEQSGVIRAEHGPTCMVLHPLAGSPSKTKLTWLLSIDLKGWLPKTIINQVLSQTQIEFA
SHLLRKRLESSPASEAQC

>Atr_StAR[*Acipenser transmontanus*; ACI23577.1]

MLPATFKLCAGISYRHLRNMTGLQKTAVVAINHELKRFAGPGPSNWISQVRRKSSLLSSRIEEKPYSEVEMSYLKQGEEALQKSI SILS
DQDNWKTEIVAANGDKVLSKVLPDIGKVFKEVLVDQYPDRLYGELVDNMEQM GDWNPVNKQVKILQRIQD TMVTHEMAAETAGNIVG
PRDFVSVRCAKRRGSTCFLAGMSTRYTGMPEQKGFIRAENGPTCIVLRPNAEDPTKTKFTWLLSIDLKGWLPKTIINQVLSQTQMDFAQ
HLRDRMETIALPC

>Xla_StAR[*Xenopus laevis*; AAG28595.1]

RPGRLLPATFKLCAGISYRHLRNMTGLRRTAAVALTHELEKLALVGPGPGKWINQIRRKSI LLSSRLEEKTLNDVEMSYIKQGEEALKK
SLNILGDQDGWKTEIVMENGDKVLSKVLPDIGKVFKEAVVEKPLDNVY GELVDNMEKMGEWNPVNKEVKILQKIGKDTVITHEKAAET
PGNIVGARDFVSVRCSKRRGSTCILAGMSTRFGGMPEQKGFVRGENGPTCMVLRPLAEDVSKTKLTWLLSIDLKGWLPKSIINQVLSQT
QVDFAKHLRSRMASSTALSLC

>Dre_StAR[*Danio rerio*; AAG28593.1]

MLPATFKLCAGISYRHMNRMTGLRKNAMIAIHHELNLKLSGPGASTWINHIRRRSSLLSSPIAEETYSEADQCYVQQGQEALQKSISILE
DQDGWQTEIESINGEKVMSKVLPGIGKVFKEVLTLEQQTGDLDELVDNMEQMGEWNPVVKQVKILQKIGQETMITHEISAETPGNVVG
PRDFVNVRHAKRRGSTCFLAGMSTQHPGMPEQKGFVRAENGPTCIVMRPSADDPNKTFTWLLSLDLKGWIPKTVINRVLSQTQVDFVN
HLRDRMASGGGIDAAIAC

>Sko_StAR[*Saccoglossus kowalevskii*; XP_002740722.1]

MSDETQTAVVTEPKPEENTEAPPKEDKPADEAKVSDATKKDAVAAAPVLVAPTESPFGEDDFEHILQIEASEGAENGWESAKKSDAVKI
FRKKDKNSEINLIKSYLTLPGIPADKAMELLTNYEERKKWKDGHKIDVLDEKSDFCILYSVFKMPAACTGRDFVIASTKRSDENKRHI
ILYKDCVHPDKPPNNSLIRGETIVNGFIVRQDENDEKSSRLTVLQQLEMKGWIPKFLNLRLTLARPIGIRDDL NAYWKEINKPKENGPT
DKKEEKKEEGEAEKTEDKEEEPKEENTEEKKE

>Apl_StAR[*Acanthaster planci*; XP_022091858.1]

MSETEQKPQTEEQPQEGDAPAEATEDQPAKEEQTEGTGEVGADGEAAKEEGGAEQAASAEKEESKPAVAAQEASPPSLEAPQENPFSED
DLEQILQLEASEGEDKGWEKSKKIKGVTVFKKPEKNGVPLIKAYMEFSGIPCDKVLEFFTD AELRKKWSRKT PNYEILEERDDFKIVYT
VIKMPMACDDRDIVQCMQVRSDEEQKRHVILYKSCNHPNKP PGKGPIRADVGIMGLVIRPKDGETSTKVTWLSQIGLKGWALKMIVSR
VTVGYPVSLCDDLQQYWKKTTAPKEPEKKEENETPKEEKTDENAEPKQEEGKTEEAAGDAPVENNVAAAPVTADDEDI PAADEEEKGEEK
AGEEA

>Spu_StAR[*Strongylocentrotus purpuratus*; XP_011660912.1]

MDFTGIPVDKVLEFFTDPEQRRKWNKKSPTFEVLEEKEDFKVVYTVFKMPTACDDRDVVQCCVRSDEEPIRHTILYKSCNHPSKPPTS
KGHIRADVGVMGIVIRPKEGDEVATHVTWVGQVNLKGWMPKMMVNKVTVGYPVSLYDDINTYWKKLTGQDKKEKKDGKAEGEENKEEE
GEAKPDEEVPAENGAEPEKAEEKAEKAEETNAEEKKEEAASEDKPASDEKPAEEGAATETAETAE

>Aja_StAR[*Apostichopus japonicas*; PIK39463.1]

MPTGCDNRDAVQCTMVRSEEDGSRHVILYKSCNHPNKP PKKSFP I RADVQLMGAIIRPKEGEEGVTTVT FVNQVNLKGWMPKAFVNKIT
VGFPVALYDDLTLYWKKITEPPKSPEKKEKKNKEKNGEENG EAAEEEEKEDKKEDGGEDEENKDADV KTEKKEEAD EKP AEGATEEAAA
AAEGAPVGE GDGGKLD TADIPAADEEEEA K

>Pva_StAR[*Penaeus vannamei*; XP_027225582.1]

MNRLGQLPSLGTSGSINATPADFLLANYVSGMQINGRMSTVRRFFCLFVTFDLLFTCLFWIICILINGENLVKALEEEVEHYSIKTSIF
DIVMTAAIRFTVLLL FYALLHINHWWLVALTTAGSCAF LIAKTL LYT WQTENS RPF EVM LV LISFLIAWAEAWFIDFRVLPQEARARSI
LEAAAGSSEHMENDPLLPQLERVRDYLSHYTETV GDFYSPMESPLGSDDDDDGFTRTDYRKLSPEEKQM QASGYDALQKAWETVNSPGW
KVEKETSHGDTVSSKVGPKGSKIYKLVGMVEVEPKTLFNEMLNFENIPTWNKAITLGRVVQ TID SCTDVVYQVAAEGPGGVVSARDFV

NVRHWKKIGDCWVSANVSVVHKDEPPQKSIVRGENGPGCWVFSVPVAGAPKKCSFQWLLDSDLKGIWIPQYVIDQALTFAMTDFLQCLRNY
APHISASKCERY SAR

>Pmo_StAR[*Penaeus monodon*; ALO17561.1]

MNRLGHLPSLGASGSINATPADFLLANYVSGMQINGRMSTVRRFFCLFVTFDLLFTCLFWIICILINGENLVKALEEEVEHYSIKTSIF
DIVMTAAVRFTVLLLLFYALLHINHWWLVALTTAGSCAFLIAKTLTYTWQTENSRPFVMLVLISFLIAWAEAWFIDFRVLPQEARARSI
LEAAAGSSEHMENDPLLPQLERVRDYLSHYTETIGDFYSPMESPLGSDDDDDGFTRTDYRKLSPEEKQMQASGYEALQKAWETVNSPGW
KVEKETSHGDTVSSKVGPKGSKIYKLVGTVEVDPKTLFNEMLNFENIPTWNKAITLGRVVQTIDSCD VVYQVAAEGPGGVVSARDFV
NVRHWKKIGDSWVSANISVVHKDEPPQKSIVRGENGPGCWVFSVPEGALKKCSFQWLLDSDLKGIWIPQYVIDQALTFAMTDFLQCLRNH
APYIAASKSERY SAR

>Dpu_StAR[*Daphnia pulex*; EFX88733.1]

MSKESRNRSDQAREVAEIFISNSADHSSQSLTRHHTINTMPNYIHESYHNEDYLRETL SAGSPRDGRISAVRRFFCLFVTFDFLFTTL
MWIICLVISGENIQQMLIDQIVHYTIHGS LFDIVMASAGRFVILL LFYALLCINHWWVIAITTAGSCGFLIIKVFFFEWAKATNYTLDV
FLVLSSFVLSWGEAWFLDFRVLPQESLARDFFRAISSDDERAPLLQNQAPSVRSHNLDDFYSPIDSPQGMYSLFFPDEELARKAKEAYE
EALSTINS DGWKVEKQTPEGDVVHSKFIRRNHKIFRLTGTVEIPPKLLFDELDRNIENVP SWNP TLIECRNLKTVNDKVSVS YQLAAEG
GGGI ISSRDFINLRYCENREGVYICAGTSVVF PDMPAQKGYVRGENGPGCWVMTPI PNEPNKCVFQWLLDTNLKGIWIPQSI IDTALSFA
MCDYIRYVRTFADNLRQEGKF

>Ofu_StAR[*Ostrinia furnacalis*; XP_028156947.1]

MGGAGWARGEARVADDSDFTLKNLLSSENGWTLEYERDGVK VWAEDAAHGALRTVKVVAEFSDVEPDALYDVLHDPEYRSVWDTHMLA
AEDAGHINVNNDVGYIAMSCPAPLKNRDFVLQRSWLDTGDEKMILNHSVFHKDYPPRKG YVRALSLLTG FVVTRRPEGGSWLGYVSRSD
PRGALPAWL VNRVTAQLAPRLVNQLHMAARKYPGWKSLTDLPYHKPWRHPEQVPPYRISLADCVDPDAPPVPEEPKPDTSKGKLEVPQA
KEIESHSVEDLGDISSEFSVEVEEDLSELTLDSTKKKGKFKLVKSMKNRRKSVQVAKSADNLMEGKPEEKQEKKKGFKFHRRFSLSRG
RED

>Vta_StAR[*Vanessa tameamea*; XP_026484400.1]

MGGAGWTREARVADDTDFTLKHLLGSDDGWNLEYEKDGVK VWAEDAAHGALRTVKVVAEFEDVEPDALYDVLHDPEYRSVWDTHMLAA
EDAGHINVNNDVGYIAMSCPAPLKNRDFVLQRSWLDTGDEKMILNHSVFHKDYPPRKG FVRALSLLTG FVVRRRES PGSWLGYVSRSDP
RGALPAWL VNRVTAQLAPRLVNQLHTAARRYPGWKALTDTPYYKPWRHPEQVPPYRINLEDCIDPDAPPPPEPKPNTSKTKLEVPQVK
ETESH SIEDLGDISSEFSVEVEEFSELSLDPTKKKGKFKLVKSMKNRRKSVQVAKSADSLVDGKSSEEKHEKRKSFKFHRRFSLSRGR
ED

>Cgi_StAR|*Crassostrea gigas*; XP_011434195.2|

MPIMSINASTSDMRDVSSSRQDKARQAGTALYGSIHNQAVEPRMENESYTYVYGPERISTHRYSPCSTVSSVRRTFCLIALFDLCFCFI
LWVIYTQLTGSETVWEAFEQQVANYQFQTSLFDTVMVAALRFILIELGYALFRLNHHWVIAISTSLTCIFLITKVFLFEFSHDGKAENP
LSYILLTSTFILTWIETWFLDFKVLPTTEKKILLRGTHGEANERSGLLGRAEEGGRNVVHDDDDKDRYYSPAGSDDEGEDRYRSLPPSRSH
SRKDHEYLKIANETMDMLFELVREGGWITERESQGDMVQSAYIKKLKRKIFKLECTLDISPHELWKDTIDNVNDSPSWNPTLLESKTLL
VVDEKTDISYNIAAEAAGGLVSARDFINLRHWGERDQTFFFIAVNKATFPDMPPQKKYVRGESGPCGLVFNRVTGQPNRCKLQWFLNTNL
KGWIPQAVIDQGLTGVLMDYCKYLRQHIQEIKGRSFS

>Mye_StAR|*Mizuhopecten yessoensis*; XP_021369546.1|

MSINTNEADMVRTSTNRGHASKTAAQAIYGSLSSSSSVSAANGSVGHIGRTDNRMCWFPPDSGKMSPVRRRTFCLFVTFDLILTFILWVI
YTQLIGDSSVWEAFTKQLAGFTIYSSLFDTVMMLAAMRFSFLLGYALFRLDHHWVIALTTFTLCGYLLAKSFLFDFKENNNNPLSYVVL
IISFVLAWAETWFLDFKVIPVEKKHRDRVNRDHHYASERSRLIGDSEQGVMSGEDNEYYSPLVTPDGSDDEGEHRRGGFQTPRRGHSRQE
QDFVKQARETMDITLEMLNLEDGWKYQAGNDLEQGVVHSMFFKQYNRKVFRLQAIMNLEPKRIWEELAYGTNSSPQWNPTLTECRTLET
IDDNTEISYSIAAEAAGGLVTSRDFVNVRCWGVDRDGVFLSCASGTTYPDMPPQKKYVRGENGPGLILKAMKDDPNKCELTWFLNSSLK
GWIPQSAVEQGLSGFLLDYLYLSQRLEEIRNQEGS

>Aca_StAR|*Aplysia californica*; XP_005099198.1|

MPAAPIMSINDVSPLPASSSAREEQAKVAGHVIYNSVHGAADNTRIPPPVSAPVLPSFSDPDMGGPSGPAPLTASLAADPMSEGRMSS
VRRTFCLFVLFDLILMFILWVIYAQLIGDTGYKAFFEKEVQNYTFASSLFDSVMLSAVRFTFLLLAYALYRSGHWWVAFTTALTTCGVLI
AKIFLFDFFEGSKSNNNPLSYCIIIIISFVLAWVETWFLDFKVLPEKKLMSRLAASTGRGYGSTYTSQGYRTFSNDDMQSVITEDNQFYS
PLDSPEGSDTESDVKESRGAVGGAVAARGLSRQENDYVRLARHSWEVLWTYITSPESDWKSESGSSIEAGVVHSSKKVKGVGKVFRLLTTL
IEWSPKATYEAVNFQPETQPQWNSALKESQVLQMVDDNTDILYNIAAEVAGGVITSRDFVSLRTWQOREGMYISAGMGVNHDPKPPQKA
YVRGKNGVGGWVYKPVEGEPNKCLFLWFMNTDIGGWFPQRLIDVNMAKVLMDFNRLQAHVRELKSSRSEP

>Ovu_StAR|*Octopus vulgaris*; XP_029633644.1|

MSIERSIHGLVKQKKQPEEASTTVYARAISEHSATSMSNFATTSVEAEVGAEGPDGKMSPVRRRTFCLIAFTFDIIFTVVIWIIYTQILSA
SKTDSYKNEVLNYDIHYSMFDIVMSAAVRVLLILAYALFRIRHWWVIAIATFLTCTFLIAKCLVFDFNYASNSLTYYALLLVSFVICWI
ETWFLDFKVLPEQKRYLLRTLIPAVSERTPLLRGNPNPENPDAISTTDEFHSPIDSPASSDEEPMEGTNKYSQAVNRQTLIDKTPMDLSY
LKLKGESWEQVYSLYKSESNNWVFQCGKDATEGCVLSKKSHVGNKIFFLQAVLNIISAKELWEDLVFRTEDLSTWNPTILDSKLIKPLSEN
CDISYYVAAPGAKGLVKSRDFVVVRKWGKRKGLYFSTGMSVKFPNIPPVDKCVRGENGAGGYLVEPLSTEPNKCKFYWFCNTNLKGMLP
QKLVDALGGMQLDYLKHLRHHVEQLRQYKV

CYP10,CYP11

>Hsc_CYP10 [*Holothuria scabra*]

THVHIIEPYDVRELIRLEGVTPRRITLDPLVAYRKLRKRNI GTSNLQGEWRRLRQPFNHLMFKPGQINTYIPKVEECTNDFCTLMREL
RTQDGEVPDYMVRQVQRWTLET LADIVLNTRIGCVDKYPSKLAERAIN SAMHFTTGLGDLMYSFPLYKFGIYTETWKNFATAQDFFFEFV
QPYVQDAMESMKKDDERATKLGSEYFRMERDATFLESLLAMHMDKDLEAISDLLNDLLLG AIDTISSMFAFVVYNLSRNPDCQERVYGE
INRVLPPGTPITPEALQMLPYLKAFVKESTRLFPTVDGTSRILDTDITLSGYNIPANTIIRIHSVAGLMSEYVPEPELFKPERWLRSSD
SSIMASP

>Hsa_CYP11 [*Homo sapiens*; AAA52162.1]

MLAKGLPPRSVLVKGYQTFLSAPREGLGRLRVPTGEGAGISTRSPRPFNEIPSPGDNGWLNLYHFWRETGTHKVHLHHVQNFQKYGPIY
REKLGNVESVYVIDPEDVALLFKSEGNPERFLIPPWVAYHQYYQRP IGVLLKKSAAWKKDRVALNQEVMAPEATKNFLPLLDVSRDF
VSVLHRRRIKKAGSGNYSGDISDDLFRFAFESITNVI FGERQGMLEEVVNPEAQRFIDAIYQMFHTSV PMLNLPDLFRLFRTKTWKDHV
AAWDVIFSKADIYTQNFYWELRQKGSVHHDYRGMLYRLLGDSKMSFEDIKANVTEMLAGGVDTTSM TLQWHLYEMARNLKVQDMLRAEV
LAARHQAQGDMATMLQLVPLLKASIKETLRLHPISVTLQRYLVNDLVLRDYMIPAKTLVQVAIYALGREPTFFFDPENFDPTRWLSKDK
NITYFRNLGFGWGVQRQCLGRRIAELEMTIFLINMLENFRVEIQHLSDVGTTFNLILMPEKPI SFTFWPFNQEATQQ

>Mmu_CYP11 [*Macaca mulatta*; EHH27471.1]

MLAKGLPPRSVLVKGCQTFLSAPKERLGHLRVPTSEGAGISTRSPRPFNEIPSPGDNGWLNLYHFWRETGTHKVHLHHVQNFQKYGPIY
REKLGNVESVYVIDPEDVALLFKSEGNPERFLIPPWVAYHQYYQRP IGVLLKKSAAWKKDRVALNQEVMAPEETKNFLPLLDVSRDF
VSVLHRRRIKKAGSGNFSGDISDDLFRFAFESITNVI FGERQGMLEEVVNPEAQRFIDAIYQMFHTSV PMLNLPDLFRLFRTKTWKDHV
AAWDVIFSKADMYTENFWELRQKGNVHHDYRGILYRLLGDSKMSFEDIKANVTEMLAGGVDTTSM TLQWHLYEMARNLKVQDMLRAEV
LAARRQAQGDMATMLQLVPLLKASIKETLRLHPISVTLQRYLVNDLVLRGYMIPAKTLVQVAIYALGREPTFFFDPENFDPTRWLSKDK
NITYFRNLGFGWGVQRQCLGRRIAELEMTIFLINMLENFRVEIQHLSDVGTTFNLILMPEKPI SFTFWPFNQEATQE

>Rno_CYP11 [*Rattus norvegicus*; NP_058982.1]

MLAKGLCLRSVLVKSCQPFLSPVWQGPGLATGNGAGISSTNSPRSFNEIPSPGDNGWINLYHFLRENGTHRIHYHHMQNFQKYGPIYRE
KLGNMESVYILDPKDAATLFSCEGNPERYLVPWPVAYHQYYQRP IGVLFKSSDAWRKDRIVLNQEVMAPDSIKNFVPLLEGVAQDFIK
VLHRRRIKQQNSGKFSGDISDDLFRFAFESITSVVFGERLGMLEEIVDPESQRFIDAVYQMFHTSV PMLNMPDLFRLFRTKTWKDHAAA
WDVIFSKADEYTTQNFYWDLRQKRDFSKYPGVLYSLLGGNKL PFKNIQANITEMLAGGVDTTSM TLQWNLYEMAHLNKLQVEMLRAEVLAA
RRQAQGDMAKMVQLVPLLKASIKETLRLHPISVTLQRYIVNDLVLRNYKIPAKTLVQVASYAMGRESSFFPNPNKFDPTRWLEKSQNTT
HFRYLGFGWGVQRQCLGRRIAELEMTIFLINVLENFRIEVQSIRDVGTKFNLILMPEKPIFFNFQPLKQDLGSTMPRKGD TV

>Omy_CYP11 [*Oncorhynchus mykiss*; AAB25804.1]

MMVSWSVCRSSLALPACGLPSARHNSSMPVVRQALSPDNSSTVQNFSEIPGLWRNGLANLYSFWKLDGFRNIHRVMVHNFNTFGPIYRE
KIGYYDSVNI IKPEMPAILFKAEGHYPKRLTVEAWTSYRDYRNRKYGVLLKNGEDWRSNRVILNREVISPVLGNFVPLLDEVGQDFVA
RVHKKIERSGQDKWTTDLSQLFKYALESVGSVLYGERLGLMLDYLINPEAQHFIDCISLMFKTTSPLYIPPAMLRVGAKIWRDHVEA
WDGIFNQADRCIQNIYRTMRQDTNTHGKYPGVLASLLMLDKLSIEDIKASVTELMAGGVDTTSITLLWTLYELARHPDLQEELRAEVAV
ARQSTQGDMLQMLKMIPLVKGALKETLRLHPVAVSLQRYITEEIVIQNYHIPCGTLVQLGLYAMGRDPDVFPPEKYLP SRWLRTENQY
FRSLGFGFGPRQCLGRRIAETEMQLFLIHMLENFRVDKQRQVEVHSTFELILLPEKPILLTLKPLKSGQ

>Bfl_CYP10 [*Branchiostoma floridae*; XP_002596632.1]

KTYGKIYREKLGPGREMVFVCDPRDIGTVFRSDGRLPQRPPVNSLATYRKMRKKPLGLGNLMGEDWHRVRSSVNKEMMRPKSVGAYATM
QDDVSREMAEQIQTVVRKGDSSGQVDNFMNLMHKWGLESLSLVILGKRLDCLTDQLAEDSDAQRMISAVLEFFLYFGKLEMSLPLYKY
FNTPAWKRFVRALDTMNRYAICPIQERILTELSKLEPPQETDFLSNLLSQKDMTLD EAVMMAIELLTGAFESTANTLAFNLYCLAKNP
AAQQKLYEEILEVVP PGQPIDDRVLNKMSYLRVFKETSRLYPTIFFNARTLTRDVVLSGYHVP AKTQIIMANNVISTLPEYYPDPEAY
IPERWLRTESSAANVQAFALLPFGYGARMCVGRFLPVKNRSVS

>Bbe_CYP10 [*Branchiostoma belcheri*; XP_019631487.1]

MSLLLKVVRVQGSWFRAGIISVAPRTTTTTATVRSQSTGEEPEGSVAYESSARPFEIIPGPKGLPLIGTALDYSFPGQFFPIKTKLME
SFKERTKTYGNIYREKIGPMDLVVISDPKEIERVFRNEGRYPERRPLVSVQIYREAKKL PAGLANLTGEEWQVRVSSVQKDMMRPKTVG
AYAALQDDVT RDLDVIRALTGKEESSGGQIHNFINYVYRWALEAISVVLDKRLGSLTLD DLEPGSDAQLMINGVNDFFRA FVKLELAA
FGLHRYISTPTWRRFEKAIDQWHYVAAKLLKEKLARSTTEDGKPAESD TDFLHSLLSREDVT FEEAMMAVDLLAAGIDTTGNTLMFNL
FCLAKNPEAQEKLYREIVEVVP PGQTIDDKILNRMHYLRVVKETFRVYPTVGNNLRTLDRDIVLSGYVVPARTVIFMANDVISSLPEY
YPEPEKFKPERWLRDDGASGGIQPFAMLPFGYGPRMCIGRRFAEQELHLGLIRIVQNFHV GWSGEDMKQENRFINAPDRDSFVFRERF

>Sko_CYP10 [*Saccoglossus kowalevskii*; XP_006825134.1]

MFSLRQVKLI SECARFQQQAMFIASRCAMATSAALDISDDDNII SEEMVVKKFEDIPGPRGLPFIGSLLDYTIGPYQLDKLHLAAIERF
REYGPIFKETIGENTFINIIEASDVETLFRSSGKNPARPPMAPLQYIRELRKRNI GLASLQGEWARVRKPVQQVMLKPKNVQSYIPIV
DEVTTTEFTESIKRLRREDGEVDNYQNEVYKWALECVGTALGTRLGCMERNIQSGSDTQKMITATLGF FDTMRDLTF SMPLYKFGIYNK
TWKQFEKHHETFYKIAEKHIKKALDKLRLSREGRLEESKECSLLSYLLSKKSLSS EIAMVPVDIMQGGVDTTSHTAIFIMYQLATN
PDAQEKLHQEVD SVLANSQEMTLES LNIPYLKACVKETHRMMPTIDGTTRIPDKDIVLSGFHIPAKTVVRTHCIAGLMHEYFDEPHVF
KPERWLRVSSEEIDHLLLLPYGGGTRMCIGRRFAEQELHILIAKLIKNFRIEWHHGPMQQLFRLANAPDVPAQFKFVDREQ

>Spu_CYP10 [*Strongylocentrotus purpuratus*; XP_003727902.1]

MLPASVGRTSACRMASMAQQIILHRHVGTMVTSEHLEDAKPYDEIPGPKGV PFFGSLFDYTGLGPYKLDKLHEATVDRFRNFGPIFKETL
AGVTHVHIIDPTDVRELFERNESPKRTPIDAMVKYRRTKR RHIGMANTEGEEWQRLRPVQHLLMKPQSVYAYIPI MEECADDFTLM
KETQDIESQEVPEFNHKMQRWTLESVCAIVFDTRMGCLNTGLDNNPEALDMIVSVSNFFDSLKDLTFSFPFWKFGITTKAWTKFTEAQD

YFFGMSKKYATIALDRMKS AVGTSTQSESEGT FLECLLARDFDIDSLCDLMNDLMIAAVETTASTLAFNLYCLAKNPEVQERVFQEIN
QAIPPGTKITAQSLQNLPLYLKACIKETVRVFPTVDGNTNRIPSREIALAGYRIPDITVRIHCIAGLMEEYFPSPEKFKPERWLRGDAEC
ENIDPYLILPFGYGSRMCTGRRMAEQDLYIMLIKIVQNFKIEWHHEEDMELIFRLTNVPDRPAQFRFVSRT

>Apl_CYP10|*Acanthaster planci*; XP_022096144.1|

MFSASQSSTMFQLAKAAVGSRPVQLYLCRMTCTSSPANAAQAGVCPMANNQDMTEATADVALASAPQPRTGSVTGPNALSTARPYEEVP
GPKGLPVLGTLLDYTKLGDYSLEKMHEAIVDRFKKYGPYKENIAGAEAVHILDPKDVADLFRNEGRTPRRIIMEPMAFYRKIRKKNAG
IANLQGEQWRKWSALQHIMLKPKSVADWIPNMEACANDFIEMMAARRDDKGEVPDYLGQIHKWALESSFSIVFGKRIGCLDPSTDNTN
DAAKLISSTNDFFTGLCNLTFGFPLYKYGIRTKKWSKFANAQDLLYNTAVKYIHQYIEEMNNRDATSPADGQKDIDGEQATVIDYLLRR
GTLEFEDLCTLTNDLLAAIDTTSNLMAFCLYCLAKNPEVQERLHEEVNRVLPAGTPATAEALQTIPLYKAVVKETTRVFPPVDGTSRY
SNDDIAVRGYRIPANTLVRVHCLSGQMPQYFKEHHKFKPERWIRGHKEFEDIDPFLVLPFGTGSRMCLGRRLAEQEVYLLLARLVQRFT
IEWHHEDLDYLFRLTNVPSRPLELTFNDRA

>Aja_CYP10|*Apostichopus japonicus*; PIK42398.1|

MISDLLNDLLLGAIDTTSSTFSFIIYNLAKNPECQEKVYEEISRVLSPDEPVTPEVLQMLPYLKACVKESARLFPTIDGTSRILDKNIT
LSGYNIPANSIIRIHAVAGMMSEYVPEPEKQPERWLRAADRSILANPYLTITFGVGFAVWGNDLSLNSKSTRDLSSFCKISASNGTEK
ISLWTLRLPVDQAVQCNQRSLTGHEL

>Dpu_CYP10|*Daphnia pulex*; EFX79019.1|

MKDPRISKIIDPTCETDNVKTFFEEVPGLRVLPPIIGTTWGGFFPHIGDGIPISRMLELQKLRFKQFGYIWRDIVPGRPPIVYTADPEDVEK
LFKTEGKHPVRPGMETIKAYRAQRIQDFSSAGILLSSGEEWWNTRSKAQHTFLKPKNVTHYITELSEIADDFVNRIRLIRPENNEMTPD
FLNEMYRWALETVGVVGLNTRLGCLQQDLAPDSEAQKMIDAANFSFSAINLEHKFPFWKFFVTPMLRKLYDAQDFFTETTIKYINQTV
EALKGSSFDSYLSIIEQLLVNGMDPSDVTMTMVIDMLMAGVDTSANTS AFLIYYLAKNPKQEKLR EEIFSVIGPKGSPITSNALNNLPY
LKACIKESFRLMPAANANARITDKDLVLSGYSIPKGS LVVALHQLMSHLDENFPDAQKFIPERWIKGDAQESKTHHPYVVMFPFGSGTRM
CIGRKLAELEIDQLIIKLLQNFKIEYHHEDMSCFMRVTNMPDQPLLKFIDL

>Dma_CYP10|*Daphnia magna*; KZS08529.1|

MSKRMSATEFDNAKPFQVPGRLVLPPIIGTTWGMFPHIGDGIPISRMLELQKLRFKQFGYIWRDIVPGRPPIVYTARPEDVEKLFKTEG
KHPVRPGMDTIKAYRAQRIKDFTSAGILLSSGDAWWQTRSKTQQTFLKPKNATHYIPVLNDIAEDFIDRIRLIRPENNEMKPDFINDMY
RWALESVGVVGLNTRLGCLRPDLAPDSEAQKLINAANFSFDAINDLEHNFPFWKFFVTPMLQKLYDAQDFLTDTTIKYISQTVEALKGS
SFDSYLSILEQLLVRGMEPSDVVTMVIDMLMAGVDTSANTS AFLLYYLARNPEKQEKLRQEILSVVGPKGSTATASALNSLPYLKACIK
ESFRLMPAANANARITDKDLVLSGYIIPKGT LVAAALHQLMGRLDENFPEAEKFIPERWIKGDLQESHHPYVTL PFGCGTRMCIGRKIA
ELEIQQLTIKMLQNFKVEYDHEDMSCFMRMTNMPDKPLLKFIDL

>Lgi_CYP10[*Lottia gigantea*; XP_009056782.1]

MSSLIPKTFAKIAVTALPEIATKRVVSTSVAHKQSARVIEVDPLTLGTCFPRSTFEKVESIVNPIEPKVEPQELTKETGIKSFEHVPGP
KGLPILGSLLDYFKKDGLRFDKMFEAFKVRSEIEFGPVYKESIGPIDTVVISDPAEYAKVIRADGKFPPNRKEMEPMAFYREQKGIGLGLV
NSQGEWHQRSAVIKKMLMLNEVQDFSQPMNVVANDFITHLSSSRDASGEIQQLDKQIFKWAMESIGTFLFEERIGCLNEKPTELAQE
FIDTLQKYFRLMQQLMYNLPMYKVFRTKKWQEFEKLSDRIMEVGREFVDKKIEKLQNADPSTSQEKGAFLTHLISQKSLSTSDVTSNAV
DLLSAAVETTSNASLWCLYNLATNPEAQQTMFNEINTVLPNKEDVTPQALSKLPYVKAVLKETFRKYPITYATSRFLPENLEVGGYNIP
AGTHVQANLYGMYSDAKIFPEPEKFKPERWLRESKMSDQTKSLSNLIWGHGARMCIGRRFAEQEMHIMLTKEIQNFKLEYHHEPVEPTL
NTVMTPDRPVQIKFVPRS

>Cvi_CYP10[*Crassostrea virginica*; XP_022312941.1]

MAPIQKPQELTNLSQTSSVKPFDSIPGPKGLPVIGTLFDYMKKDGFRFNKLFEAYRQRAQVFGPIFKENIANISTVVITDPTEYNKVVR
ADGKYPKRHQMEPWYHYREQNRGQGLVDLEGSEWHRVTVVSKKMLKLKDQDYCTDMDEVSDFTTHLSSLRNQHNEIVGIEKELFK
WSMESIGTFLFNSRIGCLRXPPEQETKDFVDHLQGGFFKLMQPLMYNIPLYKVFPPTKIWXQYVTHADNIFNIGRSLVDKEALRLEQNPPA
EGEKSSFIQYMSQKSLTENEALSTVVDMLISATETTSSGTLWALYNLAXNPEVQEKLYEDTKRVLNPKETITPEKLSELQYVKAVMKE
TFRLYPITFATTRYLAEDTEVAGYTIPAGTHVQGNLFGMFRDSKLFPEPETFKPERWLKGSQMNQEIKALSNLVWGHGARMCIGRRFAE
QEMHILLTKIVQNFRLEYNHPRWAVLNTVMTPDRPLQISFIPRN

>Mye_CYP10[*Mizuhopecten yessoensis*; XP_021376627.1]

MASTTTKALTCLVKINTPIKRVVSTSTSSRQGAQVLAVGADIAGTCFPRSTFETIDNMMSRPQQTAAIQVETPVIENKVQNYDAIPGPK
GLPLIGTLFDYLKKDGLRFNKMFEAYRTRALEFGPIYKEKIATISTVIIISDPDEYSKQVIRDEGKYPMRREMPMAYYRSKNGIGLGLVN
AQGEWHKYRTVVSKKMLKMKEVLDYCGSMDTVAEDFVQHLKDRSTTKHEVPVLEKEIFKWAMESIGTFLFEERIGCFGSPPTQAQSF
IDNLQGGFFKLMQPLMYNIPLYKVMPTKMWKQYEAAYADNVMMKIGRSFVDKKAKALEGVVPKENEKVSFLTYLMSQESLTPDDALSTAVDL
LVGATETTSNGSLWVMYCLAKNPTVQEKLFQEIQNVLPYKEAITPETLNKLPYIKAVIKETFRLYPITFATSRFVQKDIEVGGYNLPAG
THVQANLYGMFRDPEYFPDPEEFRPERWLREANMESNIKALSNLVWGHGARMCIGRRFAEQEMHIMLSKMOVNFKIEYHHEDIEPVLNT
VMTPDRPLKLSFVPRESECL

>Ovu_CYP10[*Octopus vulgaris*; XP_029640276.1]

MATFRRLTQQTYKKTVFYSNMRNISTSATGQORVAELDDTFITECPMRKTLNLVKTYASEERASSNLIGRPFEIIPGPKGLPILGTLDD
YFKKDGLSFTKMFEAYNKRALYEGPIFREQITTVKTVVISDLDEYSKVIKAEGRFPNRREMPMMYHRYQRGIDLGLINSQGEWHKYR
SVLSRKLLLSKEIQQHCSAMDAVANDFITRLDLLQQSENGEVHNLEHEIFKWSMESVGTVLFEERIGCLDPEPPKLALDFIANLVGYFK
LMQPLMYNAPIYKVFPPTKQWNQFVSFADNVMMNIGKTFVERKLNKLQKEIEDGNVNSEETSKFLSYLLTQKSLSLCEATSSAVDLLSGAV
ETTSNSIVWVLYCLAKNPQVQEEIYKEVCKIVGPGEELTPAKLTSIPLVKACLKEALRIYPITFATSRVTNKDIEVCGYHIPAGTHVQC
NVYGLGRNSDVFPQPLEFRPKRWIGNRSDNNGKALYNLTWGHGPRMCIGRRFAEQEIFILLTKI IQNFRLLEYHHEDVQPVNLNTVMTPDR
PLLLKFVPRDPENQ

>Cgi_CYP10[*Crassostrea gigas*; XP_011439055.2]

MYRSQKRVSLSSSSPQTIVTNVAPIACPLQGQDSLDSFEQNKDQQPLTPSVKAFDNI PGPKGLPIVGTLLDYMKKDGLP FNKLYKV
YRQRSLQYGPVFKEKLANFTTVVISDPAEYNKVVR AEGKYPLRRDVEPWFLYREKRKMGGQGLVNSHGPEWHKYRSAASKM LKMKEVSE
YCKSMDEVADDFIVHISCIRNQQGEVIGIEKECFKWAMESMG TFLFESRLGIFSSNPPHEAQIFIENLQGLFRLMQVLMYSLPIYKIFP
TKDWRQYVNYCDNVFRIGKSYVNKKAQA IRENPAKEGERTPFIEYMMNQESL TEQEALSTCVDLLVGATETTSSGILWALYCLAKNPVA
QEKLYKEIKLVLPNNEAITPEKLSKLQYVKAVVKETFR LYP LTF TT SRYLEEDLEIGGYNLPAGTHVQANMYAMFRNSQYYSEPEVFKP
ERWLKDSGMDNNLKAMS NLVWGHGARMCIGRRFAEQEMYILLTKIVQNYKVEYHHGSVEPLLNMVMS PDRPLQFSFI PRE

>Cte_CYP10[*Capitella teleta*; ELT96518.1]

MKGGQVVRKEKKLKPFKDIPGPKGLPVIGTLLEFTKKDGLKFNKMFEVMTSR SKEFGPVYKERIGMIESVIVSDPHEYAKVIQVDGKHP
HRIELFPMVHYRQKKKMALGTVNAQGEEWYRGRMVLSKVMLKPKEVQDYVIAQSDVGND FIRHMKSI VSSDGQLISFERE IFKWALESI
CVVLFEERIGCFPNPPT EKAQEFITNLIGFFKYMQPLMYNFPMYKIYPTKTWRQY EKHGDIVVGIGLDMVRKVKKESKSEFLTYLLAQK
SLSPVEANSHAVDLMMGAVETTANSMMWMLYCLSNFPDAQRKLQEEIDKIVPQDERITPEVLSKMKYTKAC LKETFR LFPITFATSRMI
HEEIELGGYHIPKGTHCQANLWGMGRDPDYFSDPLTFKPERWLRDIQTLEHHNPHAVLPFGHGARMCIGLRFAEQEIYIAVAKLMKHFT
VKHEGELL PVLNTVMTPDRPVNFRFLLR TKPALSGLGDTKKPIA VELK

CYP17

>Hsc_CYP17[*Holothuria scabra*]

TPTWKLHRKLTYS AFRNLATGNNDRFERLVFTMTARVAKILES KGDEEFDPKRIVSLAVYNFIAQMVF GKQYELDDPELLEWQKLSEEG
IEVVGNGLLADFFPIFSYIPTPGMRGLKDLVVRYYKLIDKELDRHKAYYNPRDEPKDFIEMLYHARQTMIDEGEEGIDQISESHIRQTV
MDIFSAGTDTSIFTMHWAIA CMVDFPEVQEKVQKEIDEVIGRDRNPRMNDRGSVPYTECALYEVFRFSSIAPIALPHATTTDVTFRGYH
IPKGTWVLPNIYSMHFDKKLWGD PENFRPEHFMDETG SVRQHPEGFLPFSTGRRVCLGESVAKAELFLIFTWLFQNFTFRKPAGKEEVM
YARVDKSELNPILKSYDII VSKR

>Hsa_CYP17[*Homo sapiens*; NP_000093.1]

MWELVALLLLTLAYLFWPKRRCPGAKYPKSLLSLPLVGS LPFLPRHGHMHNNFFKLQKKYGPIYSVRMGTKTTVIVGHHQLAKEVLIKK
GKDFSGRPQMATLDIASNNRKGIAFADSGAHWQLHRR LAMATFALFKDGDQKLEKII CQEISTLCDMLATHNGQSIDISFPVFVAVTNV
ISLICFNTSYKNGDPELNVIQNYNEGIIDNLSKDSLVDLV PWLKIFPNKTLEKLKSHVKIRNDLLNKILENYKEKFRSDSITNMLDTLM
QAKMNSDNGNAGPDQDSELLSDNHILTTIGDIFGAGVETTT SVVKWTLAFL LHNPQVKKKLYEEIDQNVGFSRTPTISDRNRLL LLEAT
IREVLRLRPVAPMLIPHKANVDSSIGEF AVDKGTEVIINLWALHHNEKEWHQPDQFM PERFLNPAGTQLISPSVS YLPFGAGPRSCIGE
ILARQELFLIMAWLLQRFDLEVPDDGQLPSLEGIPKV VFLIDSFKVKIKVRQAWREAQAEGST

>Rno_CYP17|*Rattus norvegicus*; NP_036885.1|

MWELVGLLLLILAYFFWVKSPTGAKLPRSLPVLVGSPLPFLPRRGHMHVNFFKLQEKYGPIYSLRLGTTTTVIIGHYQLAREVLIKK
GKEFSGRPQMVTQSLLSDQGKGVAFAFADAGSSWHLHRKLVFSTFSLFKDGQKLEKLCQEAKSLCDMMLAHDKESIDLSTPIFMSVTNII
CAICFNISYEKNDPKLTAIKTFTEGIVDATGDRNLVDIFPWLTFIPNKGLEVIKGYAKVRNEVLTGIFEKCREKFDSQSISSLTDILIQ
AKMNSDNNNSCEGRDPDVFSRHLATVGDIFGAGIETTTTVLKWILAFVLHNPEVKKKIQKEIDQYVGFSRTPPTFNDRSHLLMLEATI
REVLRIKRPVAPMLIPHKANVDSSIGEFTVPKDTHTVVVNLWALHHDENEWDQPDQFMPERFLDPTGSHLITPTQSYLPFGAGPRSCIGEA
LARQELFVFTALLLQRFDLVDSDDKQLPRLEGDPKVVFLIDPFKVKITVRQAWMDAQAEVST

>Ssc_CYP17|*Sus scrofa*; NP_999593.1|

MWVLLVFFLLTLTYLFWPKTKGSGAKYPRSLPVLPVVGSLPFLPRRGHQHNMFFKLQDKYGPIFSFRLGSKTTVVIGDHQLAKEVLLKK
GKEFSGRPRVMTLDILSDNQKGIAFADHGTSWQLHRKLALSTFSLFKGGNLKLENIINQEIKVLCDFLATRNGESIDLAQPLSLAMTNI
VSFICFNFSFKKGDPAQAIIVNFNDGILDVAGKEILYDMFPGIRILPSQTLENMKQCVRMRNELLREILENRKENYSRNSITNLLDIMI
QAKTNAESNTGGPDHNLKLLSDRHMLATVADIFGAGVETSASVVKWIVAFLLHYPLLRKKIQDAIDQNIGFNRAPSISDRNQVLLEAT
IREVLRFRPVSPTLIPHRAIIDSSIGEFTIDKDTDVVVNLWALHHNEKEWLRPDLFMPERFLDPTGTQLISPSLSYLPFGAGPRSCVGE
MLARQELFLFTAGLLQRFDLLELPDDGQLPCLVGNPSLVLQIDPFKVKIKERQAWKEAHTEGSTS

>Xla_CYP17|*Xenopus laevis*; AAG42003.1|

MISYVAGALLLAFLALISVWKFAGGKHGAKYPNSLPCLPFIGSLLHIGNHLPPHILFCKLQEKYGSLSYFRMGSHYIVIVNHHEHAK
EVLLKKGKTFGGRPRAVTTDILTRNAKDIAFANYSPSWKFHRKVVAALSMFGEGETVAIEKIIISREATSLCQSLISFQDNPLDMAPELT
RAVTNVVLCALCFNTRYKRCDPFEFEMLAYSXGIVDTVAKDSLVDIFPWLQIFPNKDLIDLKRSVAIRDKLLQKKLKEHKEAFCNEEVND
LLDALLKAKLSMENNNSNISQEVGLTDDHLLMTVGDIFVAGVETTTTVLKWMTMAYLLHYPEVQTKIQEELDFKVGFGRHPVLSDRRILP
YLDATISEVLRIRPVAPLLIPHVALQESSIAEYTIPOQDARVVINLWSLHHDPEWENPEEFNPERFLDENGHNHVYSPSQSYLPFGAGIR
VCLGEALAKMEVFLFLSWILQRFTLELPAGDSLPLDVGKFGVVLQVKKFRVTTKLREAWKNIDLTT

>Dre_CYP17|*Danio rerio*; NP_997971.2|

MAEALILPWLLCLSLFSAVTLAALYLKQKMNGFVPAGNRSPPSLPSLPPIIGSLMSLVSDSPPHIFFQDLQKKYGDLYSLMMGSHKLLIV
NNHHHAKEILIKKGKIFAGRPRVTDDLLTRDGKDIAFADYSSTWKFHRKMVHGALCMFGEKGSVIEKIIICREASSMCEVLTESQNSAV
DLGPELTRAVTNVLCALCFNSSYKRGDAEFESMLQYSQGIVDTVAKDSLVDIFPWLQIFPNKDLRILRQCISIRDKLLQKKYEEHKVTY
SDNVQRDILLALLRAKRSENNSSTRDVGLTEDHVLMTVGDIFGAGVETTTTVLKWSIAYLVHNPQVQRKIQEELDSKIGKERHPQLS
DRGNLPYLEATIREVLRIRPVSPLLIPHVALQDSSVGEYTVQKGRVVINLWSLHHDKEWKNPELFDPRFLNEEGDGLCCPSGSYLP
FGAGVRVCLGEALAKMELFLFLAWILQRFTLEMPGQPLPDLQKGKFGVVLQPKKFKVVAKVRADWEKSPLMQHC

>Bbe_CYP17|*Branchiostoma belcheri*; BAF61104.1|

MWLMTITVGVVTLVLVTWLRDYVRRWRMPGPFWFPIFGNLSLFAGKFYLTTFIDLAKKYGDVFSLKQGMTDVVVLNSLDAIREAFVKKG
VEFAGRPTFVSADIFTEGGKDIAFTDYSPTWKLHRKLFHTAIRGYASGENLQNKVHESLEETIAEFSKMEGQAVDLEDYIYKLVYNVIC

SAAFGVRYNMDDKDFNTLMKVSKDSAEVFGEGILADVFP SLRFLPTPGITAIQKIVRPFLDIMQHHL DQHRETFDPNNLRDITDHMIKA
QKDAEEEGMQDINSLTDTHLRQTIADIFGGGTDTTILTLRWAVLFLSAHPEIQEKVAAELDSVVGDR LPELSDREATPYTEATIHEVM
RMGSIAPSSLPHTTTTVDTTLRGHRIPQGTWIMPNLWAVHHD PDTWGD PDVFRPERFLDENGKPIPKPPALMPFSAGRRACPG EAVGKAD
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>Bfl_CYP17|*Branchiostoma floridae*; XP_002601863.1|

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VDFAGRPKILSMDIFSEGGKDIAFTDYSPTWKLHRKLFHGAIRGYALGENLQTRVHESLEDTIAEFTKMEGQAVNI EDYIYQLVYNVIC
SAAFGVRYTMDD EEFNTLMKINKDTEEIVGQGLLADVPSLRFLPSPTLTNIRKMTKQYVGIMQRHLEEHRETFDPSNLRDITDHMIKA
QKDAEEEGIQDINSLTDTHLRQTI SDIFGGGTDTTI FTLRWAILYLAVHPEIQEKVAAELDSVVGDR LPELSDREATPYTEATILEVM
RMGSIAPLSLPHATTVDTTLRGYQIPKGTWVVPNLWALHRDPDTWGD PDVFRPERFLDENGKPVKPAALMPFSAGRRACPG EAVGKAD
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>Sko_CYP17|*Saccoglossus kowalevskii*; XP_002730850.1|

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GFKDIAFSDYSPSWKLHRKIAHQAIRNYASGDKLEDMMRKDAIPLLTQILEDNEGKVIAPRPLLFLT VNNIVAQFCFGQKYTLDDPELK
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DTHLVQTVSDIFGAGIDTTTHTMDWSIIFLTRYPDVQAKVAREIHEVIGRDR LPLISDRPNLPYCDAVIHELMRIRTVPMSVPHKALV
DSSIGGYLIPKNTWVMVNLWAVQMDEKHWDN PQEFRPERFIDKDGSLKAKQDNFI PF SAGRRVCLGESLAKPEIFLMFTSLYQSFAFSQ
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>Apl_CYP17|*Acanthaster planci*; XP_022111252.1|

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IGQIVYNILASMC FGRQYEFNQPELLQWIDL NVEAQKAFGNGLLPDYFPALSFIPTQSEKKVCKIVGAMLDVFY GELKRHREQFDPDNV
RDFFD SLLL TQKQAIEAGEEEADKITDTHIVQTVSDIFGAGTETTIIITLHWAVGLMVENPDIQQKVAMEIDEVLGRDR LPSLDDRASLP
YTEATILEIFRYGT VAPTGLPHAVMEDTTLAGYDIPKGT TVMIDILALHNDTKEWNEPEKFKPERFLDDNGQLLSKLPESFLPF SAGRR
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>Spu_CYP17|*Strongylocentrotus purpuratus*; XP_789963.1|

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PKVLITLIMYNVLAQMC FGLSYELEDPNVTQWMDVNN DVNEKLGLGLAADIFSWAKYIPTSGPRMIKEITETMFGFLRSQVDEAREHYD
PENINDFYSLLLKAQEDARKEGENVDKLT DTHIFQTVADIFGAGIQTTVETLYWAMALLVTYPEIQAKIRAEID DVIGRDR LPTINDRG

NLPYTEASLYEVLRYSSIAPIAVPHATSRDTEFGGYHIPKGTVVFINTHSMHYDPQEWDQDPDKFLPEHFMDGSGTVREHPPSFLPFGAG
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>Aja_CYP17|*Apostichopus japonicus*; PIK40958.1|

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FDTRRVLASSIYNILASLCFGKQYEFDDPELTRLMYLSKEGNDIAGSGLLADYIPIFKYVPTPGQTKLKAIKDFFSLVNKEVDEHREK
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DREELVYTTATLYEVMRYSTLVPLAVPHATSADVELGGYTIPKDTWVLVNIYSMHYDEKLWDDPKKFTPEHFLDESGKVRLHPEGYMPF
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>Cgi_CYP17|*Crassostrea gigas*; XP_011454188.1|

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HQLYTICFGEKRPVDDPEVKRFIKLDNDLLEKFGSGFFEDVFPYLRHIFTTAKWKMLLLTTEEVLNVLRKNLKEHKETFPQPGVNRDFTD
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IFETMRISNSVGF GIPHMTVCDSQVGGYDIPKGTTVLINYWALHHD PKQWKDPEQFDPHRFLDENGKMKPTKPD SWLPFSVGRRVCLGE
SLAKSDILLICANLLQRF EISLPEGVKPNLECHMKGFGMEMTSDYKIVVKERSG

>Mye_CYP17|*Mizuhopecten yessoensis*; XP_021361085.1|

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DDELQEHITSFDEGNIRDFADALILARKEAENDEDTELLDQLTEAHLRQTLNDIFFAGFDTTTRFTLQWFFLYMAANPEEQKIAQKEIDT
AVGGDRLPGLGDRNAMPYTEAVLHEVMRIASVAPFGVPHAARNSKLYEYDIPKGTMMINHWALHNDPKHWKDP SKFDPKRFLDSDGN
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>Lgi_CYP17|*Lottia gigantea*; XP_009050593.1|

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NADVNDALVKKGGDFAGRMHLHSLEVISSEGYKSIA MADTTYAWKLQRKLSLQGLRQYLSGNKLEEKLHESVSRTIRLLKEKENEPVSI
LSYISLTVFNLLTGVCFSKSYEMGDKEFIELVSDFDTFSTEFGNGLWEDIVPLLKYWPTKKYNRLMKMFNSFLDVMYKNYHEHVQSFSE
DNLKDFTDFMIYAKKQAAVDDPNIENIITDTHIVQTIADIFGAGVDTSRQTIVWTLYLLAENPEIQKKVQSEIDEILDNLNQAPSVKDRS
SLPYTEAVLHESMRICPVAPLSVPHTSQCDTTLGEYEIQKGT TILINTWALHMDPETWGDPEVFRPERFLDEDEGSLAPKTMSWLPFSAG
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>Cvi_CYP17|*Crassostrea virginica*; XP_022344772.1|

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HQIYTICFGEKRPADDPEVKKLELGNDDLATFNNGLVEDIVPYLKDIYPTARWKKMVALIDQILNVFRGKLQEHKDTFKPDLNRDFID
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>Pda_CYP17|*Pocillopora damicornis*; XP_027053398.1|

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IEDLTDALLKAYHEAQEEDGKVAQLLTEDHLVMTMNDVFNAGLETSATTLRWLLAFLVTPDIQARVHAELDDVIGSGRMPCLNDRGNL
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>Ofa_CYP17|*Orbicella faveolata*; XP_020626306.1|

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MEDLTDALLKAYHEAKEEDGKVEQLLTEDHIVMTMNDVFNAGLETTATTLRWLFAYMAHYPEVQARLHAELDDVIGCGRMPCLKDRGNL
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>Spi_CYP17|*Stylophora pistillata*; XP_022798766.1|

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PYLESTIAEVLRIIRAIVPLSLPHKATCDTTLGGYDVPKDTMLISNIWAMHHDKDEWLNPEVFDPSRFLDKDGKLLGSEKFSAGVRSY
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CYP3A

>Hsc_CYP3A[*Holothuria scabra*]

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>Mmu_CYP3A[*Mus musculus*; BAB20498.1]

MNLFSA LS LDTLVLLAIILVLLYRYGTRTHGLFKKQGIPGPKPLPFLGTVLNYYTGIWKFDMECYEKYGKTWGLFDGQTPLLVITDPET
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YSMDVITSTSFQVNVDSLNNPEDPFVEEAKKFLRVDFDPLLFSVVLFPLLTPVYEMLNICMFPNDSIEFFKKFVDRMQESRLDSNQKH
RVDFLQLMNSHNNSKDKDSHKAFS NMEITVQSIIFISAGYETTSSTLSFTLYCLATHPD IQKKLQAEIDKALPNKATPTCDTVMEMEY
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>Ssc_CYP3A[*Sus scrofa*; AAL13316.1]

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RVDLLQLMINSQNSKEMDPHKSLSNEELVGPGIIFIFAGYETTSSALSLLAYELATHPDVQQKLQEEIEATFPNKAPPTYDALAQMEYL
DMVVNETLRLYPIAARLERACKKDVEIHGVFVPKGTVVVVPVFLHRDPDLWPEPEEFRPERFSKKNKDTINPYTYLPFGTGPRNCIGM
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>Mfu_CYP3A[*Macaca fuscata*; BAE45352.1]

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YSMDVITSTSFQVNIDSLNNPQDPFVENTKLLRFD FLD PFFLSITIFPFIIPILEVLNISIFPREVTSFLRKS VKRIKESRLKDTQKH
RVDFLQLMIDSQNSKETESHKALS DLELVAQSIIFIFAGYETTSSVLSFIIYELATHPDVQQKLQEEIDTVLPNKAPPTYD TVLQMEYL
DMVVNETLRIFPIAMRLERVCKKDVEINGIFIPKGVVVMIPSYALHHD PKYWPEPEKFLPERFNKKNNDNIDPYIYTPFGSGPRNCIGM
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>Ola_CYP3A|*Oryzias latipes*; AAG35209.1|

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LDSVVNESRLRYPAAARLERVAKATVEVNGLVIPKDMVVMVPTWPIQRPDELWPEPEKFKPERFSKETKETFDPTYTMPFGAGPRNCIG
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>Sko_CYP3A|*Saccoglossus kowalevskii*; XP_002731620.1|

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PETQVKLQREIDEVMRNYDDVGYEAVSKMKYLDMVSETLRIFFPPSRFNRECNQDVNINGINIPKGMTVSVSPYVIHHDPDNYPDPEK
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>Aja_CYP3A|*Apostichopus japonicus*; PIK42887.1|

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>Apl_CYP3A|*Acanthaster planci*; XP_022082383.1|

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>Spu_CYP3A|*Strongylocentrotus purpuratus*; XP_011666125.1|

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>Cvi_CYP3A|*Crassostrea virginica*; XP_022315198.1|

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>Cgi_CYP3A|*Crassostrea gigas*; XP_011456748.1|

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>Med_CYP3A|*Mytilus edulis*; BAH24057.1|

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NELGKSPPTYDSLPMNKYLEMFLAEVLRLYAAVPRINRRAKSDITVNGMFI PKD TDVTIPISALHRNPKYWPEPEKFDPERFTDENKAT
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>Mye_CYP3A|*Mizuhopecten yessoensis*; XP_021350792.1|

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MKGFIGGFTMDVIASTGFGLDVNSQNNPDNSFTKHARYFSDPTSIAVLVVIVFFLPFFWWILRLSAFLGFNLTKVRTAMNFFARVTEKA
LTERRQSPGEHFDLGLIMVKAEGDEPTEEKGDELLKENDASETLSWTRKTLTVEEITAQATLFFVAGYDTSNSLCFLMYHLVLYP

EICDNLLQEIDDKLNGQAPNYDNVAKLSYMEMCINETMRLFFAASRLDREAKNDVTIGNIRIPKGMIIINIPVGAIHMDPEYWPEPEKFD
PERFTPEAKANRDPFVFMFPGAGPRNCVGMRLALLAMKIAIVRILQNYRPVKSPKTEIPINVSKMGNIPLGLYLKFEKRT

3beta-HSD

>Hsc_3beta-HSD[*Holothuria scabra*]
MSSDWIGSRVLILGGTGFGRHMKYLLQNELTTKIRVVDKTPIEMAWMNEEHK

>Hsa_3beta-HSD[*Homo sapiens*; NP_000189.1]
MGWSCLVTGAGGLLGQRIVRLLVEEKELKEIRALDKAFRPELREEFSKLQNRKLTVLEGDILDEPFLKRACQDVSVVIHTACIIDVFG
VTHRESIMNVNVKGTQLLLEACVQASVPVFIYTSSIEVAGPNSYKEIIQNGHEEEPLENTWPTPYPSKKLAEKAVLAANGWNLKNGDT
LYTCALRPYIYEGGGPFLSASINEALNNGILSSVGKFSTVNPVYVGNVAWAHILALRALRDPKKAPSVRGQFYIISDDTPHQSYDNL
NYILSKEFGLRLDSRWSLPLTLMYWIGFLLEVVSFLLSPIYSYQPPFNRHTVTLSNSVFTFSYKKAQRDLAYKPLYSWEEAKQKTVEWV
GSLVDRHKETLKSQTQ

>Mmu_3beta-HSD[*Mus musculus*; NP_038849.2]
MPGWSCLVTGAGGFLGQRIVQLLMQEKDLLEIRVLDKFFRPETREQFFNLDTNIKVTVLEGDILDTQYLRKACQGISVVIHTAAVIDVT
GVIPRQTILDVNLKGTQNLLEACIQASVPAFIFSSSDVAGPNSYKEIILNGNEEEHHESIWSDPYPYSKKMAEKAVLAANGSMLKIGG
TLHTCALRPYIYGERSPFISNTIITALKNKNILGCTGKFSTANPVYVGNVAWAHILALRALRDPKKSPNIQGEFYIISDDTPHQSYDD
LNYTLSKEWGFCDSSWSLPVPLLYWLAFLMLETVSFLLSPIYRFIPPFNRHLVTLTGSTFTFSYKKAQRDLGYEPLVSWEEAKQKTSEW
IGTLVEQHRETLDTKSQ

>Oar_3beta-HSD[*Ovis aries*; NP_001129404.1]
MAGWSCLVTGGGGFLGRRIICLLVEEKDLQEIRVLDKVFREPEVREEFSKLQSKIKLTLLEGDILDEQCLKRAFQGISVVIHTASVIDVR
NAVPRETIMNVNVKGTQLLLEACVQASVPVFIHTSTIEVAGPNSYREIIQDGHEEEHHESAWFCPPYPYSKKLAEKAVLEANGWALKNGG
TLYTALRPYIYEGGSPFLSAYMHGALKNNGILTNYCKFSRVNPVYVGNVAWAHILALRALRDPKKVPNIQGGQFYIISDDTPHQSYDD
LNYTLSKEWGFCLDSRMSLPISLQYWLAFLLEIVSFLLSPIYKYHPCFNRLVTLTCLNSVFTFSYKKAQQDLGYEPLYTWEEAKQKTKEW
IGSLVKQHKETLKTkih

>Rno_3beta-HSD[*Rattus norvegicus*; NP_058961.4]
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GVNPRQTILDVNLKGTQNLLEACVQASVPAFIYCSTVDVAGPNSYKKIILNGHEEEHHESTWSNPYPYSKKMAEKAVLAANGSILKNGG
TLHTCALRPYIYGERSPFLSVMILAALKSKGILNVTGKFSIANPVYVGNVAWAHILALRALRDPKKSQNVQGGQFYIISDDTPHQSYDD

LNyTlSkEWGLHLDSSWSLPLPLLYWLAFLLEIVSFFLHPVYNYRPSFNRHLVTLSNSKFTFSYKKAQRDLGYKPLVSWEEAKQKTSEW
IGTLVEQHRETLDTKSQ

>Dre_3beta-HSD|*Danio rerio*; NP_956103.1|

MSNNNKSKLTyVITGGCGFLGQHLLRVLLEKKKNVKEIRLFDKNVFPsLQSESTEDVKVVI IQGDITKYEDVRNAFLGADLVFHAASLV
DVWYKIPEKVIFAVNVQGTENAIAKACVEIGIQYLvyTSSMEVVGPNVKGDEFVRGNEDTPYNI FHEMPYPKSKAAAEKIVLEANGTKVE
GGNilyTCCLRPtGIYGEQHQLMKDFYlNSVRNGGWVMRGVPPHTEHGRVYAGNVAWMHLLAARALQEHpNRLGGECYFCYDDSPYKPY
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NTFPFETSTKDK

>Ola_3beta-HSD|*Oryzias latipes*; NP_001131037.1|

MSLRGDVCVVTGACGFLGKRLVRLLLLEEEEETAEIRLLDKHVPQQVLQsLEDcRGgTKLSAFEGDIRDSDFVRKACRGATNVFHTASMid
VLESVEYSEIYGVNVKGTQLLLEAClHENVMsFIYtSTIEVVGPnPRGDPMVNGTEDTVYDSRLtLSYSKTKKEADRTLQANGQLLQn
GGRLATCSLRPAYIFGEGCRfLLGHMTDGIRKGNVLNRLSAREALVNPVYVGNVAFaHLQAARSLKEPQKRDTVGGKfYfITDDTPHLS
YADFNyCMMSPLGfSVQDKLQmPLRIFyIVIFFLEALCMLLRPFIRIVPPMNRQLLTLLNTTfTFSYQKAkRDLGYfPKYSWEEARRRT
FDWLASQLPQQRETLQSN

>Sko_3beta-HSD|*Saccoglossus kowalevskii*; XP_002738669.1|

MSSEEEGDVILVTGASGfVGQHvVKLLMERCDRVREvRAFDIRPFKwIKELRVtETyVDLVHVRGDITQLSDIRKACRGVDaVVHTAGY
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NGRKLKtCSLRPTTMYGEGDIYfLPPTLKASKQQGGVLMRIGDGKALFHaSYVGNVAWAHILALQQLKRQRSEDDISGQACfISDDTEP
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TVRYVKRLRL

>Spu_3beta-HSD|*Strongylocentrotus purpuratus*; XP_011664172.1|

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VYYRRECGLS

>Aja_3beta-HSD|*Apostichopus japonicus*; PIK61940.1|

MTNQEGVTILVTGGAGFLGQHIVKELMEQEVFPVKEIRSFDIQPFKWHHGLHPSKNSQKLYHIEGSICDPAALTQACENVdVVIHNCSC
VAFGAYPNRKSTRAVNVDGTENVVDACIEQnVECLvyTSSIEVANDLKKPSVNASETSvtVPAINPIfHVYSKSKYDAEKmVLTANNKT
LKNGKKLRtCALRPCGIYGEgDHILTTNLGYfLNAGIAFRIGEPsGKSQYAYAGNLAYSyVFAVKSLLRPDEKTDISGEAffLGDDTPi

YSIGELVSHFAKALVAETGTATPPYWLMYTIAFFLTVMCWLVSNLKYWEMPFHTNAVRYMFGEYHYSWEKLQRVLGYPKYTYKEAFDR
TITYYEHFFGLNNKSNQTKKQK

>Isc_3beta-HSD[*Ixodes scapularis*; XP_002407062.1]

MGDGDSSRKYRFLVLGGTGFGRHLVDFLLKHNLATKIRVVDKVPQMGWLNANHKVVFEDPIVEYKSANLINQASCKAAFESEEPFD
FAVNLAGE TKINLPDSVYQEGIAKLSENCAKEAIAHNIKRYIEISSGHIYAEGKKPSQEE SALDPWTAVARFKRDVEKTLEAFKDLDYV
ILRPALVYGVADKRSITPRILVGAVYKHLKETMKLLWTKDLKMNTVHVSDLCSAVWHVCLHGKAREVYNVVDPGDTTQGKITDIICEIF
GVNHGYWGTAASFLAKADMQGAVQEINEKHLAPWAEACQKDAIANTPLSPYLSQELLYDKNLCMDGSKLQSIGFTYRVPEINKDCINEI
IDDIEMNIFPKSLIK

>Aae_3beta-HSD[*Aedes aegypti*; XP_001650664.1]

MDKKADMEAKEVILITGGAGFLGQHLIRTLQERDPKVREIRVVDLKPENILGHIDTHRVS YVGDIQPSKIESAFEGVDCVFHMAAY
INFDFPPNHQELQRVNVDGTQMVIDLCRKYNVPRLVFTSDCLIHMT PYMGRANFTIVCNQTEPKTKVPAKESEFQIPGYASSKFRAENL
VLAANDTPTANGGMLKTIAIRPPVVFEGGDQRFIPSIKVALRFNGEIPKLAGPGGKQQLVYAGNVAAHLRAKDALLTKPKEISGHPV
FVTDDSGIEDTTRFCQRLSRANETLKL RPSWYQIPLFLSFFLAFLLELLIKALNP IVKIKLSFP PCGLLSYMSSILLYNRIRASIYLDY
EPIYGEEKAVSNAALWYEK WYQDYCQQHKLKKLKVK

>Dma_3beta-HSD[*Daphnia magna*; KZS12706.1]

MGSEVVLTGGQGFLGQHIIRLLQQDPKVAEIRVIDKKMFTNRIGFEEKKVVKSFVADISK PETMGNEIFDGVNCVIHTAAETGFSHP
SAKIMEEVNVNGTRHVIHKCITANVGCLIFTSTTHVVIPKKDPLFLATEHLAKAPPKDGFLFGHYGR TKHDAENLIRDANGKRLADGSG
NLATLCLRPTLLYGELDPYYVTHALKIAKDHGGCLYRIGWGGERIQV TYAGNAAWAHILAKDQLMKEPTIVGGEVIFVTDDTVIQNAFE
FLDPFLKARSMKASTFVYPATLAVIFVLFLYFVSRMLRPLVHLKNPFPHPSTLYFIVCFYCFNRLKATLRLGYKPIYSPEEAISKSLDY
YKNVPLS

>Tme_3beta-HSD[*Tropilaelaps mercedesae*; OQR69050.1]

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STCKNIRLFDVKPYKNLLNHAVQKPMKEIQGDLTNAKEVL DACEGVDCVIHCAALVDISLFPNEAALEAINVEGTRNVIDACIRQNV
PYLVFTSTTDTTVSSNHIFYGAENTTFVPKNFLMGPYAETKHRAEQVLVQANNRLLADGSTKL RSCVLRPTVFYGEQDEHFIPRIMKIAKY
YGGNKVQRVKSIDERFQV TYVGNAAHAHIVAKNRLRENSDCAGEVYYITDDTPLQELYS AIKPYVDSQ GKFRISDWSIPYLLAILGISI
LVLIVRLVRPIYQVGKYFPTPAAVTYACTSVFFNRQKATLRLKYYPHYTVEESHENSLKYKDLKV

>Nle_3beta-HSD[*Neodiprion lecontei*; XP_015514980.1]

METANFETKPGVIVLGGCGFIGRNLVEYLLDNELVSYVRVIDKVPQTAWLNKKHQ RIFEHPLLEFRSANLINSASCDNAFAGEQRIDI
VFNCAGETKYGTDPVYKDG IHKLSMNCAQKAAELGVQRYIEISSGHLSSSEKVP HKEDDEVDPWTFIAKHKVQVENDLKNIPGLKFTI
FRPAIIYGP GDRNSLAPRLVVGAVYKHLGEMMKLLWGPNLRMNTVHV RDVVRAMWHVTRHPNTIGQIYNVVD ESDSTQGSISALVSELF

NINHDIYWGAAALSMLAKVDMTTIVEEVNDKHMSPWAEACSKDGVENSPLSPYINRELLYNKNLYLQPGKLSSTNFTYLYPKLMKESLKE
VVDDYVEMKIFPHSLVL

>Can_3beta-HSD[*Crassostrea angulata*; AFK26304.1]

MCTVTVTGGAGFLGQHVIQHLQLSAPWVTEIRVFDLIPFSRSLDYTPRLDVITYTGNLGDTESLRKAFHNASAVLHLASAI DARFQDPK
KLLQE NVNKG TANVIAACVEEGVPIL IYCSSIGTVQGYFNCQGGSETELKDVRPLLFRDYGGTERVAEQQVLKADQTPLANGKKLRTMS
LLPPTMYGEGDKLIAMMLQYAEDNNGSFIRMGNGENLEAYAYAGNVAWG FVCCLKTMYNNPSFGNERMFIMDDTPPQSIQALSRPYLES
RGFQMTSYYVPLSIVFFICFLVETVCLLISPFKRFSFPLSLSGIIFSARKFYVRYDKAKTLIGYVPPFSVEGARERSLPYYNNVKLRKN

>Ovu_3beta-HSD[*Octopus vulgaris*; XP_029645198.1]

MFL LQQHRRHHLNVKALRYSSNMAPERRAKQVCVVTGGSGFLGQHIVHLLQTKCDDVREVRTFDIRPIKKFLEYEDNFSSRHIIGDVTN
YTDIMQALDGVDDVYHVAGVVSYGTRPDTELMQKVNVS GTENVIHACIEMSVPR LIFCSTVDVVVGDKNIVDGTEDTAITPSHFLFPGY
PQTKHEAEDLVCRANGSHLANGGRLYTVSLRPNVMYGEDPFLIP SALQSAYSAGGWSVCVGN GKAI FQVSYAGNVAWAFLMANRTLLD
NKLTNVEGQYFFVPDDTPATSIYTTLEPYLHDRGFKHMPVYIPYWLIHG LLSIRD LFLWLISPLVKINAQPPICSIKYINMTLTFKNDK
ARTYLGFRPLFNPEEALQRSRKYYKKIKLN

>Mye_3beta-HSD[*Mizuhopecten yessoensis*; XP_021363944.1]

MRNGLTFWTRRGKYHSHLSRSLSKGRKLPANNFAMTTTKDFNQSAAGEVVMVTGGAGFLGQHIIGHLQEKASHVSEIRVLDIRPYSNKL
GHRESKPLTSTLGDICDQQTVQQACQGVTTVIHVAGLVSYGTFPDINGMQRINVQGTRNIVESCLNTGVERLIFCSTVDVVVGFDIRE
GMETTTTCVPKQFLFPGYPATKYEAEC LVLNANGQKSVNGNPLWTMSLRANVMYGEEDPFYVTSGLRSAASN RGLVQVGNQSKFQQVY
VGNTAWAFVCADRALRLNYNLGGEIFYIPDYTPVQNSFLFMQPYLES RNYGLSQYRLPCGLVYYSLYLMELVLHLLAPLIRINLPTASC
SVRYINMDLYFNGSKGRLLGYQPLYSPQEA EKRSLEYKHKV KL

>Cgi_3beta-HSD[*Crassostrea gigas*; XP_011438773.1]

MPCTVLVTGASGFLGQHVVKTLHEKAADFVTYLVLFDKDTFVQKLDYKPKIPIECITGSITDPEVVRKAVQKVDCVIHLAAVISVSTFP
NVKAMQDVNVKG TALLLDACVGANVGIVITCSTQDTAVDLTDQTMVDETYKVEPRNLAFGDYARTKLEAEKIVLAKHGSRLKNGDRLRT
VVL RPGVLYGELDAIFVTEVIRNAKKQGGVLYHFGSPQAVSQYAYVGNVAWG FVCALRKLSQDTSIGGEAYFIGDETPLMQLFKFSELF
IKLYGGRLSSRPIPYTLILVIVL LLEWIVWLISPIKQINLPISSTVRYANKKWSFSYNKAKTELNYSPLFDWEESYSRSCEYYKTAVT

17beta-HSD

>Hsc_17beta-HSD[*Holothuria scabra*]

LSREGKVDILINNAGYGQSGSFEHVSLEKCRALFETNFFGAVHLTQQFIPSMKKRKSGHILFISSTVSTFGI PFCEIYTASKCAVDGVA
EALAPSLALFNIKVTLICPGPVETNFAPNIIMFGQDENDEETMDIKNQYLKNLQQIIIGENLQKRDEVA AVIKEAIEAEKPNLRYYTSEK
DLQDAKNKLVDTTGNCAIEFLNNSYFKGVKLNSQ

>Mna_17beta-HSD[*Miniopterus natalensis*; XP_016057672.1]

MDRTVVLLITGCSSGIGLHLALRLASDPSQSFKVYATLRDLSTQDQLWEAARSQGCPPGSLETLQLDVQDADSVAAARARVTEGRVDVLV
CNAGRGLHGPLEAHSADAVGSVLDVNLVGMVQMLQAFPLPMKRRRSGRILVTGSMGGLMGLPFNAVYCASKFAVEGLCESLAVLLPPFG
IHVSLIECGPVRTAFPEKVQDGLDVVLEGADAQTRDLFSQYQRHFEQVFREGAQDPEEVTEVFLRALRSSQPALRYFTSERILPLVRLR
LADPSGCSYVAAMHRAVFS DKPAAGSDGAQTEAGGGELGGPELSASPAALK

>Npa_17beta-HSD[*Nanorana parkeri*; XP_018426360.1]

MEKRVVLLITGCSSGIGLGLAVLLASDSHQRFKVYATMRDLSKKEQLLECVRDCHVDTFEILQMDVTDQQSMIGTIEKIKEQRVDILVCN
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VSLIECGPVNTNFMNKLQNGEPSNSQLQNVDS DTRSLYAQYLQHCQAIFQDVAQDTEILQVFLEAIEAQVPSLRYFTTQFFMPLTKLK
LSCASGSEYIHAMHKFVFSEAKPKE

>Xla_17beta-HSD[*Xenopus laevis*; XP_018107456.1]

MEKRVVLLITGCSSGIGLGLAVLLASDTCQRFKVYATMRDLSKKENLMECVKDCHADTFEILQMDVTDQQSVVSTTKKIKEQRVDILVCN
AGVGLMGPLECHSYESMKKLFDVNLFGTISTIQAFPLPGMKQRKSGRVIISSSVGGLQGIPFNDIYCASKFAVEGLCESLAIALQHFNH
VSLIECGPVSTNFMNNLHSDVTS DCLQEVDSDTRLLYDQYLQHCQSIFQDVAQDTEEILQVFLEAIEAPTPSLRYFTTQFFMPLIKLK
LSCAGGSEYVRAMHKFVFSGTKQKEEEK

>Cau_17beta-HSD[*Carassius auratus*; XP_026063884.1]

MEQKVVLITGCSSGIGLSLAVHLASNLKAYKVYATMRNLDDKKQRLMESVRGLHKDTMAILQMDVTDQQSILDAKRNITEGRIDILVCN
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VSLIECGPVNTDFLMNLKRTEPSEEAL EVDPHTRSLYDQFLQHCQTVFQNAAQD TDDIIQVYME AIEAQTPFLRYYTNRALLPMSSLKL
TSM DGSQYIRAMSKLIFSAPDTPQI

>Dre_17beta-HSD[*Danio rerio*; AAP74564.1]

MEQKVVLITGCSSGIGLSLAVHLASNPAYKVYATMRNLDDKKQRLLESVRGLHKDTLDILQMDVTDQQSILDAQRNVSEGRIDILVCN
AGVGLMGPLETHSLDTIRAIMDVNLLGTIRTIQTFLPDMKKKRHGRILVTGSMGGLQGLPFNEVYCASKFAIEGACESLA ILLQHFNH

ISLIECGPVNTDFLMNLKRTETGDKELEVEVDAHTRS LYDQYLQHCQSVFQNAAQDTEDIIQVYLEAMEAQTPFLRYYTNRALLPMSSL
KLTSMDGSQYIRAMSKLIFSSPGTDAQK

>Bbe_17beta-HSD|*Branchiostoma belcheri*; XP_019619357.1|

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KELAKFGIRCNAILPGFIETPMTDAVPQKVLDKFRDFIPIGRLGKPSDIADVCVFLASDESSYITGASIEVAGGLHM

>Bfl_17beta-HSD|*Branchiostoma floridae*; XP_002609475.1|

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>Aja_17beta-HSD|*Apostichopus japonicus*; PIK53404.1|

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VKVSIVCPGPVGTKFAPNMAIIDDAESDTETKAVREKYMKTLTETEFISGNLQTGEEVAADVQEAIIQAEKPDFRYYTSPKDLQSASTKYSD
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>Apl_17beta-HSD|*Acanthaster planci*; XP_022080934.1|

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RMSLVEPGPVQTPMVTKFGSVSPAERTKDYPDPLRDEYMNFIKLAGPMMNTAVSADEVANLILEAIVSENPFLRYQIHEVYKKAACK
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>Spu_17beta-HSD|*Strongylocentrotus purpuratus*; XP_780174.1|

MAPRVAIITGCSSGIGLSTAVMMAKDPSKGYIVYATMRNLAKKGDLEKAAGATLNKTLFITQLDVTRGDSIKRAVKDVFTKHKRIDILV
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I WVSSCQPGPVKTAFIANMGSANNQPEFLKLTEEKNIDKESKEVCCKIFKLLINSPTHDEEQQTPEEIASVIKGALEDEKPHLRYATSK
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>Mye_17beta-HSD[*Mizuhopecten yessoensis*; AXY92159.1]

MASAVGLLAGRLALVTGAGSGIGKAVCQVFAKEGATVAVVDLHADTANSTLETLPKGDHQAFGADVSCSASVNDLIGQLKDKFSAPVPTV
TVNSAGITRDKLMLKMSEEDFDEVIRVNLKGTLYVNQAVGRALVESKAKSGSIINISSISGKVGNVGQTNYAASKAGVVGLTKTVAKEM
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>Cgi_17beta-HSD[*Crassostrea gigas*; XP_011430925.1]

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GITRDRMTMMKLTEEDFDKVVNVNLKGTWLLNKAVGKAMLTNKVQGSIVNISSLVGKTGNIGQTNYAASKAGVIGITKSMAKEMGKFNIR
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>Pva_17beta-HSD[*Penaeus vannamei*; ROT63560.1]

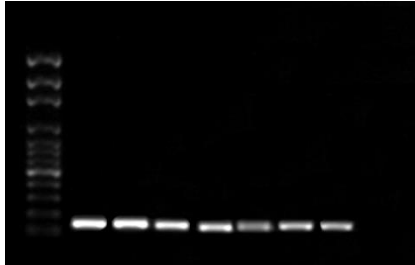
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>Obi_17beta-HSD[*Ooceraea biroii*; EZA54209.1]

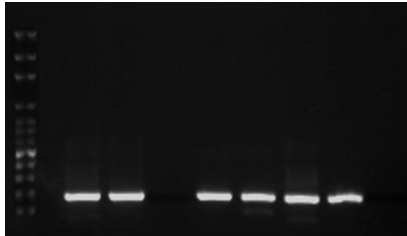
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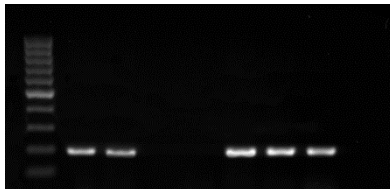
HscStAR



HscCYP10



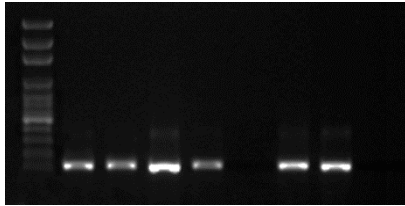
HscCYP17



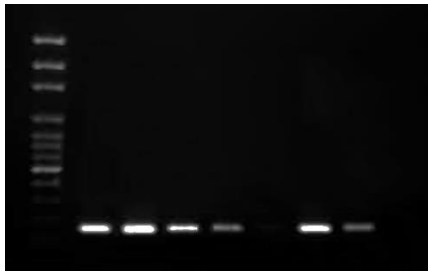
HscCYP3A



Hsc3 β -HSD



Hsc17 β -HSD



16S rRNA

